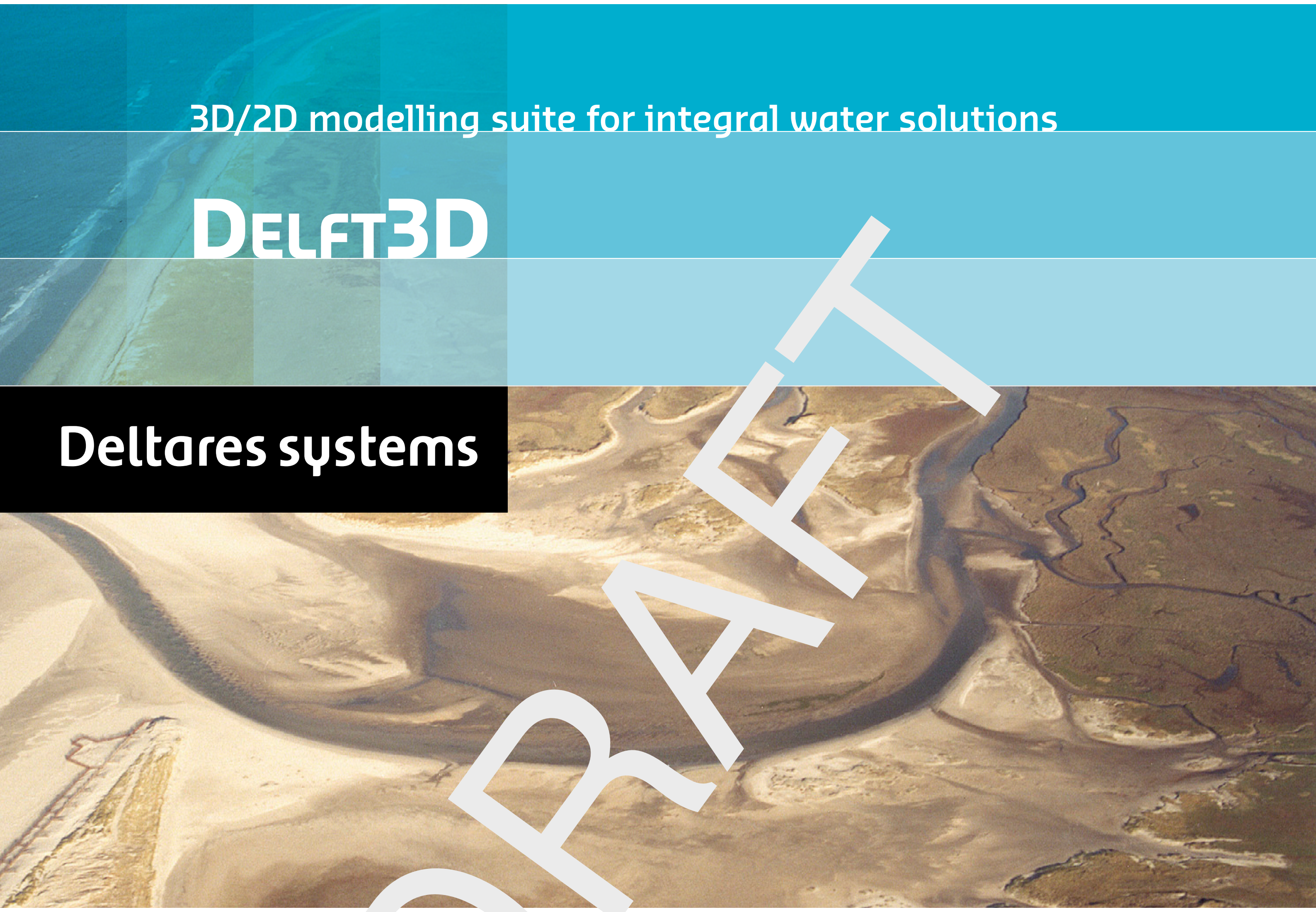
3D/2D modelling suite for integral water solutions

Delft3D

Deltares systems



GPP

Deltares

Enabling Delta Life

User Manual

GPP

Visualisation of Delft3D simulation results and measurement data

User Manual

Hydro-Morphodynamics & Water Quality

Version: 4.00
SVN Revision: 52614

April 18, 2018

GPP, User Manual

Published and printed by:

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1 Guide to this manual

1.1 Introduction

The name GPP has been derived from "general postprocessing program". It is meant for applications developed by Deltares. It can read most of the result files produced by the Delft3D modules and handles various other types as well.

Key terms for GPP are:

data sets	collections of data to be visualised, recognised by a unique name
presentations	ways of presenting the data, such as contour maps or xy-graphs
models	the source of the data files, this identifies what types of files can be used
file types	the structure of a data file is important when selecting the data set and reading the actual data. The interface to the file is, however, uniform.
layouts	before presenting the data, you specify the general set-up of the picture by selecting the appropriate *layout*: size of the graph or graphs (called *plot areas*), their position, additional text etc.
plots	a *plot* contains one or more *plot areas*; data sets are presented within a *plot area* according to some plotting method. One or more data sets may be added. Together with the axes and additional text, they make up the plot.

This manual describes the use of GPP. It is divided into two parts, the first will give you a short introduction and moves on to a detailed description of the user-interface:

chapter 2: Getting started, describes how to get started with the program.

chapter 3: Graphical User Interface, explains most of the menus and dialogues contained in GPP.

The second part explains the concepts and documents what external files are used, how you can customise the program and so on. It is intended for the experienced users:

chapter 4: Data sets and presentations, describes the concepts of data sets and presentations in more detail.

chapter 5: Files and filetypes, presents some details on the currently supported file types.

chapter 6: Layouts and plots, describes the function of layouts and plots.

chapter 7: Customising GPP, discusses customising the program.

chapter 8: Advanced features, presents advanced options within GPP, such as animations.

chapter 9: Installation, describes how to install GPP.

chapter 10: Glossary, is a glossary of the most important terms in GPP.

More details can be found in the appendices:

Appendix A: Command-line arguments, lists the command-line options and the environment variables that may be used.

Appendix B: ODS error codes, lists the possible errors that can be unconnected and their codes.

Appendix C: Description of files used by GPP, presents the contents of the configuration files in detail.

Appendix D: Creating animations, describes how to use the auxiliary script *gpp_anim* for creating and displaying animations.

Appendix E: Example of using AWK to edit the state/session file, gives an example of *batch editing* facilities that can be added to GPP.

Appendix F: Printers, plotters and pictures, contains information about supported printers, plotters and storing pictures under Linux and MS Windows.

Appendix G: Frequently asked questions, has the frequently asked questions and their answers.

Appendix H: Trouble shooting, describes the known problems and their work arounds. Should you experience problems.

Appendix I: Overview of data sets, provides an overview of the data set types supported by GPP.

Appendix J: Models and filetypes, gives an overview of the file types that are supported by GPP.

Appendix K: Plot routines, contains an overview of the plot routines and other routines.

1.2 Changes with respect to previous versions

Version	Description
2.14	section 8.4, in description Separator should be ‘Separator’. section K.4, new operations $f(A,B)$ and $f(A)$ described. In the Tutorial folder files $<$trih-k05.$*>$ replaced by $<$trih-f44-tutorial.$*>$. Headers in Appendices D, I and K corrected.
2.12	section 8.3, Facilities for making animations, inserted. section 8.4, Automatically exporting data sets, inserted. Old Section 8.3 is now section 8.5, old Section 8.4 is now section 8.6. Section 1.3 What’s new added.
2.11	Updated terminology in some places Added the new features concerning the scripting interface (Sections 8.3 and 8.4) Appendix I added: an overview of data set types Appendix K: updated the list of available plot routines and other action routines Name changed to “GPP”
2.10	Enhancements to the user-interface: The *Edit* menu in the main window, which allows the user to replace data files and text strings The *Quick Scan* button in the plot window The *Show*button in the Assign data window The *Interpolate* button in the Plot options window The changes to the printing facility under Windows documented Several details updated and corrected

1.3 What’s new?

This chapter intends to give a concise overview of new features and changes in GPP and the manual.

Enhancements dd. november 2005 (version 2.11.07):

◇ Replacement of the old reading routines for certain NEFIS files. The new ones have a different approach, making it much easier to extend the supported parameters.
◇ Replacement of the underlying plot library. As a consequence you can send pictures directly to PostScript files for further use.
◇ Introduced a scripting language, Tcl, enabling you to create your own plot routines and export routines. Also useful to automate certain tasks.
◇ Documentation of the export functionality via the session file.
◇ Facilities for making animations.

2 Getting started

If you are anxious to start working with GPP and loath reading fat manuals, like most of us, then read at least this chapter: we describe a simple recipe for getting pictures from your data files. As GPP is fully window-oriented with a graphical user-interface, it should not be difficult to get around in the program. But, nevertheless, it is good to have some guideline.

We will concentrate on a few files from the tutorial directory, but please note that GPP can use all kinds of data files. As long as you have files in one of the supported formats, you have no need to convert your files (the supported formats are described in a separate appendix).

GPP is normally installed as part of the Delft3D system (*cf.* WL | Delft Hydraulics, 1999), but it can be used independently as well.

To start GPP on:

Linux	type `gpp` or `delft3d-menu` on the command line. If you use the Delft3D menu program (via `delft3d-menu`) then select the *Utilities* → *GPP* option.
PC	start the program Delft3D from its icon and select the *Utilities* → *GPP* option.

You will get the main window, which initially shows the description (Figure 2.1). It has a simple menubar with the menus *Session, Edit, Print job* and *Help*, three push buttons (*Description, Datasets* and *Plots*) and a status bar, showing the current version of GPP.

Description allows you to type or edit several lines of text that are meant to describe the set of data sets and plots you will create. The combination of data sets and plots is called a *session*and it can be saved in a so-called *session file.* You can save such files, open existing ones and create new session files via the *Session*menu.[1]

The other buttons in the main window bring up the subwindows for defining and manipulating data sets and plots.

The basic steps toward pictures are:

◇ prepare a sub-set of all data sets you might have and from which you are going to make graphs
◇ select or define the layout of the pictures you want to make
◇ combine layout and data.

First we need to select the data we want to present.

◇ Click *Datasets* (see Figure 2.2).

The list box will show the already defined data sets and will be empty if you start a new. The buttons to handle data sets are shown on the right hand side.

◇ Click *Add.*

A dialogue appears, which shows from top to bottom (Figure 2.3):

◇ a button *Select File*
◇ two additional buttons which are greyed out
◇ an empty list box

[1]The menu has not been called *File*, because this might give confusion with the data files you will use.

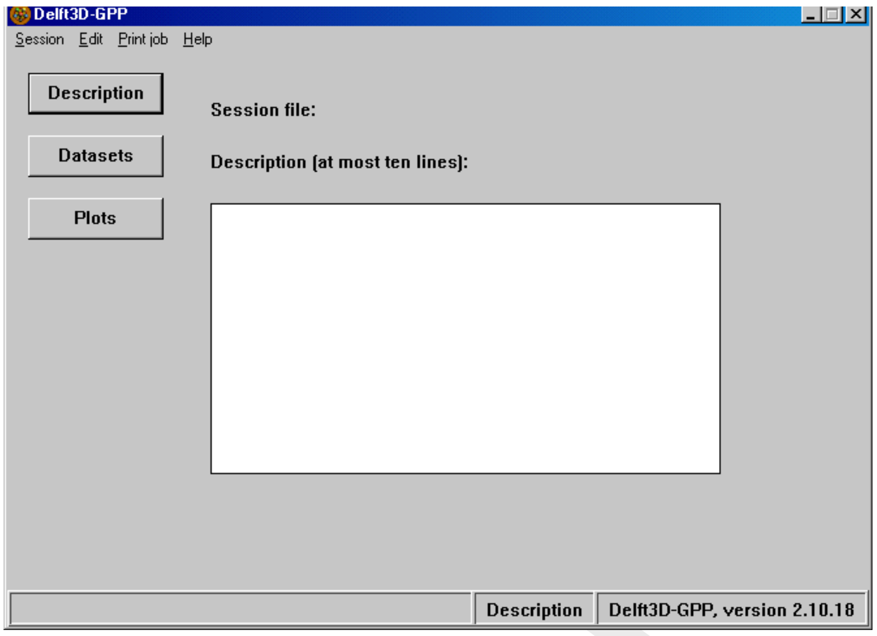

Delft3D-GPP
Session Edit Print job Help
Description
Datasets
Plots
Session file:
Description (at most ten lines):
Description
Delft3D-GPP, version 2.10.18

Figure 2.1: *GPP main window*

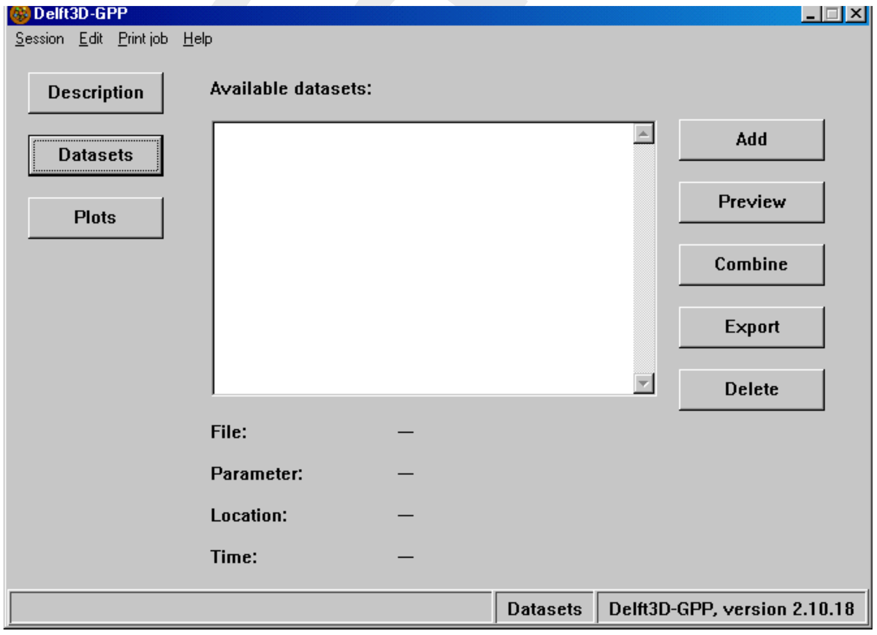


Figure 2.2: *Data Group Datasets*

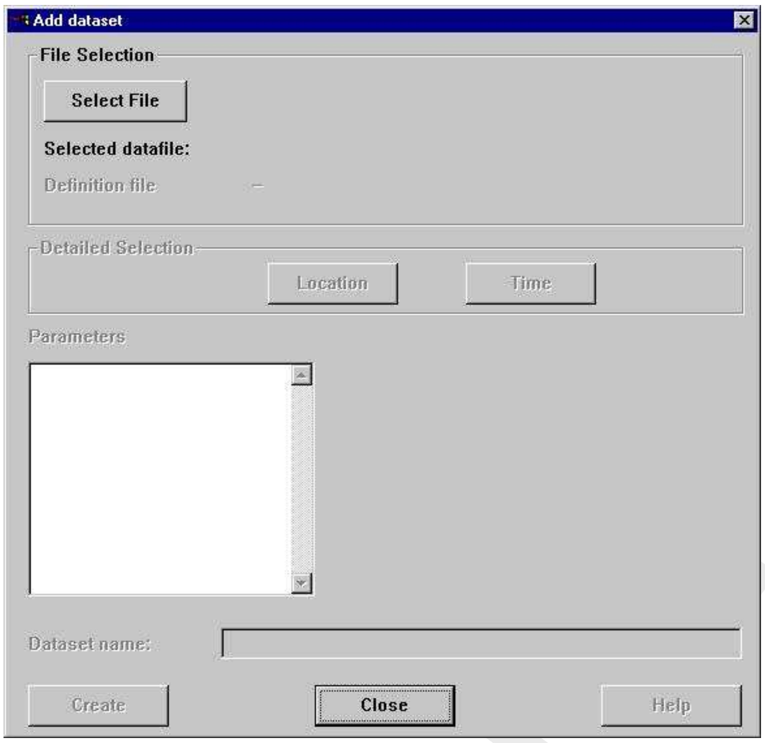


***Figure 2.3: Add dataset** window*

◇ a text entry field (greyed)
◇ three buttons, *Create* (greyed), *Close* and *Help*

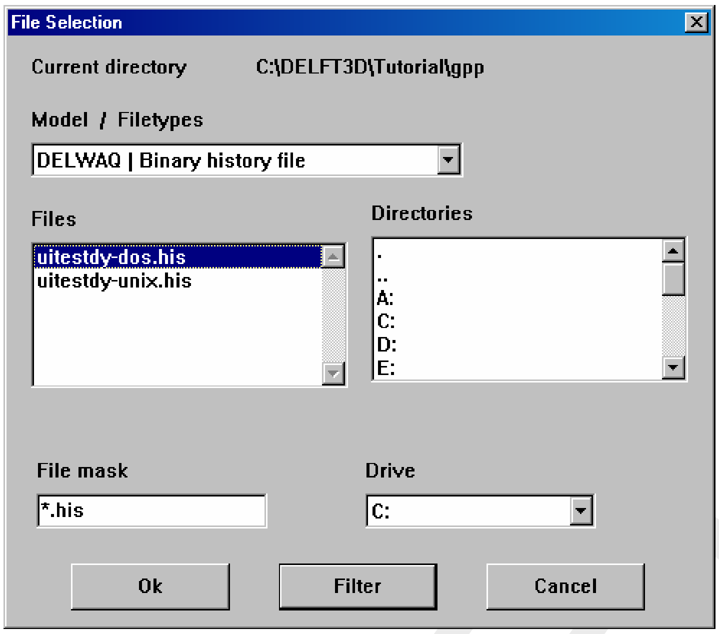
We need to get the data from some file. So:

◇ Click *Select File*.

Again a dialogue appears (Figure 2.4). This time a list button, to select the type of data file, two list boxes (left for files of the selected type, right for the sub-directories under the current), an input field for setting the mask for matching filenames and three buttons (*OK*, *Filter* and *Cancel*):

◇ The list boxes are filled with the subdirectories and files in the current directory that match the first file type.
◇ You will need to select the correct type of file, say a history file from D-Water Quality. This will bring up the appropriate filter, in this case "∗.his" and a list of files that match this filter.
◇ Select a different directory if necessary by double-clicking on the directories (".." is the parent directory).
◇ Select the file you want: click once and press *OK* (or double-click).

In this tutorial we will use the file <uitestdy-dos.his>, a DELWAQ (binary) history to illustrate the use of GPP. We have supplied several other files in the tutorial directory:


File Selection

Current directory C:\DELFT3D\Tutorial\gpp

Model / Filetypes

DELWAQ | Binary history file

Files

uitestdy-dos.his
uitestdy-unix.his

Directories

.
..
A:
C:
D:
E:

File mask

*.his

Drive

C:

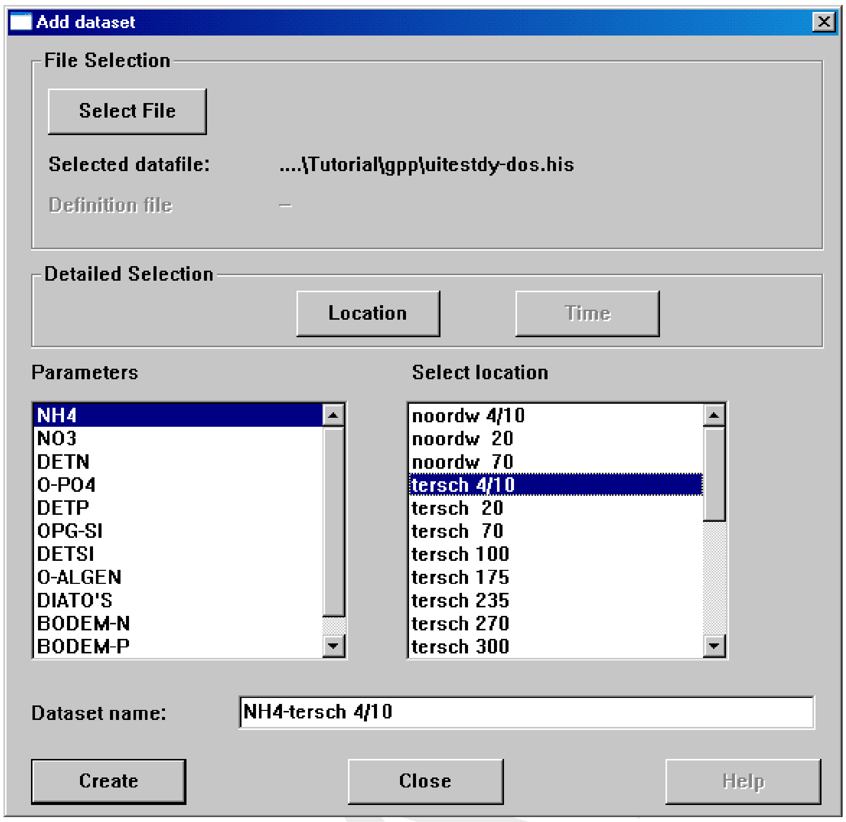
***Figure 2.4: File Selection** window*

File	**Type**	**Remarks**
<table31.tek>	TEKAL time-series file	Used to generate the picture in chapter 4 of the manual
<trim-edw.dat> <trim-edw.def>	Delft3D-FLOW map file	The calculation has to do with current-wave interaction.
<trih-f44-tutorial.dat> <trih-f44-tutorial.def>	Delft3D-FLOW history file	The area of interest is a small inlet in the Dutch Wadden sea.
<del011.hda> <del011.hdf>	D-Water Quality history file	No particular area, just some eutrophication calculation.
<manukau.ldb>	TEKAL landboundary file (GIS)	Land contours of Manukau harbour in New Zealand
<texts.ann>	TEKAL annotation file	File, showing how to include geographic text
<samples.obs>	Samples observations file	Example of defining measurement data

The file selection dialogue disappears and the list of parameters is shown (see Figure 2.5). Then you can select a data set from this file. To do that:

◇ Select the parameter NH4 (ammonia).
◇ As a consequence the right-hand list box is filled with either locations or times (depending on the type of data file)
◇ Select one of the possible locations or times, in this case: *tersch 4/10*.
◇ Click *Create* (otherwise it will not create the data set).
◇ Click *Close* to close the dialogue (or go to the first step to define other data sets).

These actions have created the data set containing one parameter, NH4, one location, ter-



Selected datafile: ....\Tutorial\gpp\uitestdy-dos.his

Parameters	Select location
NH4	noordw 4/10
NO3	noordw 20
DETN	noordw 70
O-PO4	tersch 4/10
DETP	tersch 20
OPG-SI	tersch 70
DETSI	tersch 100
O-ALGEN	tersch 175
DIATO'S	tersch 235
BODEM-N	tersch 270
BODEM-P	tersch 300

Dataset name: NH4-tersch 4/10

***Figure 2.5:** List of parameters and locations, after selecting a file and a parameter from that file*

sch 4/10 and a series of times. The data set is therefore a time-series and we can make a graph of the parameter versus time at that location.

The next step is to plot the data set. To do this,

◇ Select the data set and click *Preview*. This action has the following result.

A graphical window comes up (Figure 2.6). This displays the chosen data set, using:

◇ the *first* layout
◇ the *first* suitable presentation form for this type of data set

Remarks:

◇ Presentation forms and layouts are described in the chapter 4 and chapter 6.
◇ It may be that you selected a data set that has no (direct) presentation forms, such as a three-dimensional data set. In that case the **Assign data** window is shown and you first have to create a subset (for instance select a layer) which can be plotted.
◇ You may postpone the choice of a location or a time. That way the data set will contain more information and when you try to display it, you can select the location or time you want to see.

The plot window allows all kinds of manipulations, as described below.

Remark:

◇ The quick-and-dirty approach offered by the *Preview* button is not the only way to make a picture, it is simply the quickest. If you change to the *Plots* Data Group, the procedure

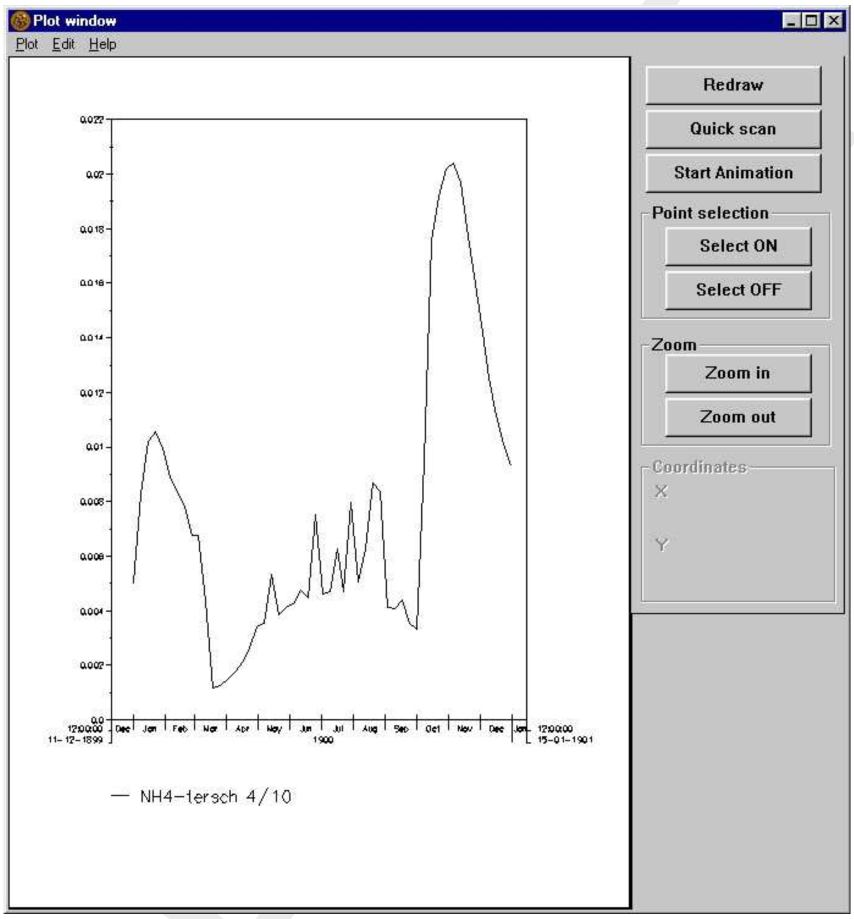


Figure 2.6: *Graphical window with a time series plot*

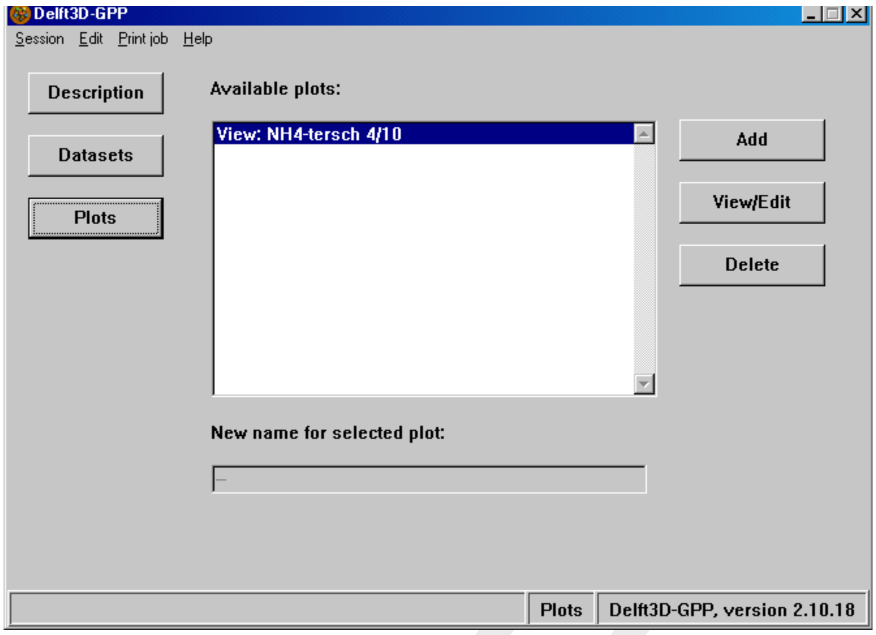


Figure 2.7: *Data Group Plots*

will be somewhat more elaborate but it offers quite a bit of flexibility.

◇ To do this, click *Plots* on the left.[2] (see Figure 2.7):

The main window is now filled in with a list box containing the names of any plots you may have defined, including the ones creating via the *Preview* button. Again there is a series of buttons on the right-hand side:

Add	Add a new plot
View/Edit	View or edit the *first selected* plot
Delete	Delete *all selected* plots

◇ Now click *Add*. This action has the following result, see Figure 2.8:

◇ A selection dialogue appears which allows you to select a layout for the new plot.
◇ Select the first layout (actually, any one will do).

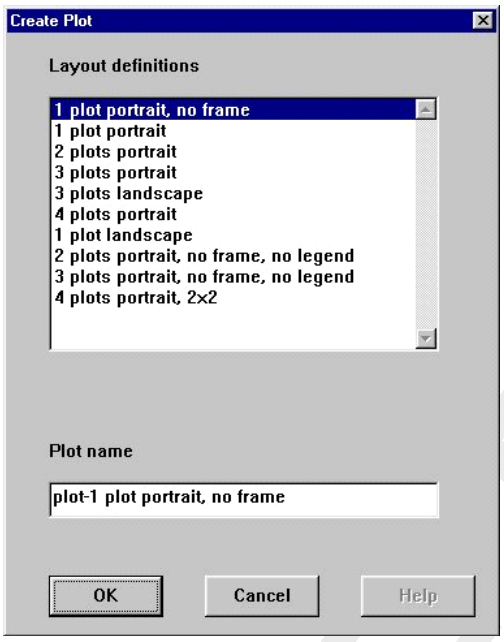
Normally you will change the name of the plot to a meaningful name reflecting the contents of the plot. In this tutorial we will use the default name “plot-1 plot portrait, no frame”.

◇ Click *OK* to enter the Assign data dialogue.

The dialogue **Assign data sets** lets you assign one or more data sets with their presentations to the plot (Figure 2.9). Now:

◇ Select a plot area from the list box *Plot areas.*
◇ Select a data set from the *Datasets* list box. (The program will then fill in the right-hand list box: names of possible presentation methods for the selected data set or selection procedures to derive a sub-set. For this: see the next chapters.)

[2]On Windows (in all its guises) you will need to click Plots twice if the focus is currently within the visible data group. This is no design of ours, but apparently part of the window management system. It makes it necessary to be a bit careful, when switching between data groups.



Layout definitions

1 plot portrait, no frame
1 plot portrait
2 plots portrait
3 plots portrait
3 plots landscape
4 plots portrait
1 plot landscape
2 plots portrait, no frame, no legend
3 plots portrait, no frame, no legend
4 plots portrait, 2x2

Plot name

plot-1 plot portrait, no frame

***Figure 2.8: Create Plot** window*

If we use the previous data set, *NH4 - tersch 4/10*, the possibilities include:

- Plot time series
- Plot balances
- Plot pie chart
- Add text to drawing

- ◇ Select a presentation method, f.i. "Plot Timeseries", from the right-hand list.
- ◇ Click *Add*.
- ◇ Click *OK* (or go to the first step to add more data sets).

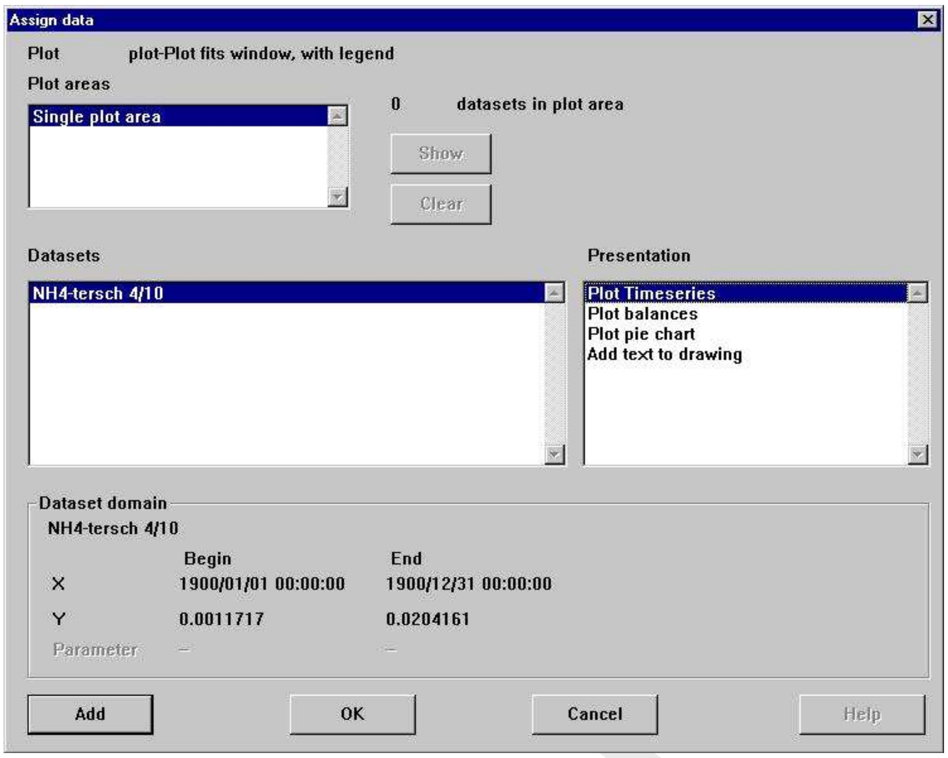
If you simply click *OK* without assigning a data set, the graphical window will be filled in with the chosen layout (see Figure 2.10): possibly a frame with some text, one or more so-called plot areas: rectangles in the picture to which data sets can be assigned.

The graphical window has a menu, like the main window, and a sub-window on the right-hand side with buttons. You can use the menu item *Edit* → *Assign data*, to invoke the dialogue *Assign Data* for an existing plot.

You can also double-click on different parts of the graphical window: legend frame, axes of each graph, or graph itself. Then a dialogue appears that enables you to modify either the presentation of legend, axes or graphs.

Perhaps this last action requires some explanation. The dialogue box concerning a graph, named *Area Attributes* (see Figure 2.11) contains four parts:

- ◇ *Line settings:*
  Select the line settings per data set in the plot area. If your graph contains a number of time series, then each set of data is drawn in a different way: the first line may be solid and black, the second a red dotted line, the third green crosses etc.
- ◇ *Colour ramp:*
  Select the sequence of colours to be used in a contour map or a histogram or, in fact, any graph consisting of filled areas.


Assign data

Plot plot-Plot fits window, with legend

Plot areas: Single plot area

0 datasets in plot area

Datasets: NH4-tersch 4/10

Presentation: Plot Timeseries, Plot balances, Plot pie chart, Add text to drawing

Dataset domain: NH4-tersch 4/10

	Begin	End
X	1900/01/01 00:00:00	1900/12/31 00:00:00
Y	0.0011717	0.0204161
Parameter	–	–

Figure 2.9: *Assigning data sets to the plot areas*

◇ *Symbols:*
Adjust the size and mutual distance of the symbols (plusses, circles, crosses etc.) in xy graphs.

◇ The following *buttons:*

OK, Cancel	end the dialogue
Data sets	invoke the *Assign data sets* dialogue for the selected plot area.
Plot options	edit the options for the plot routines
Text	features of text used in the graph (other than text near the axis)

You may want to print the graph.

◇ Select *Plot* → *Print* from the window's menu.

On Linux, a dialogue will appear to select the printer. You can also specify whether you want to save the print file. The default printer is the printer defined in the environment variable PRINTER or LPDEST (unless this printer is not known to GPP).

Also on MS Windows, a dialogue will appear to select the printer, but there is one special printer: the default printer. You can set that printer via the menu item *Plot/Printer set-up*. *Only this printer will actually print, all others create a print file with the picture.* This is especially useful if you want to save the pictures in, say, a PostScript file for incorporating them in a document.

◇ Close the graphical window by selecting *Plot* → *Close* when you are done.

The definitions of the data sets and the plots you made will be saved in a so-called state file, when you leave the program. This file is read the next time you start GPP, so that you can

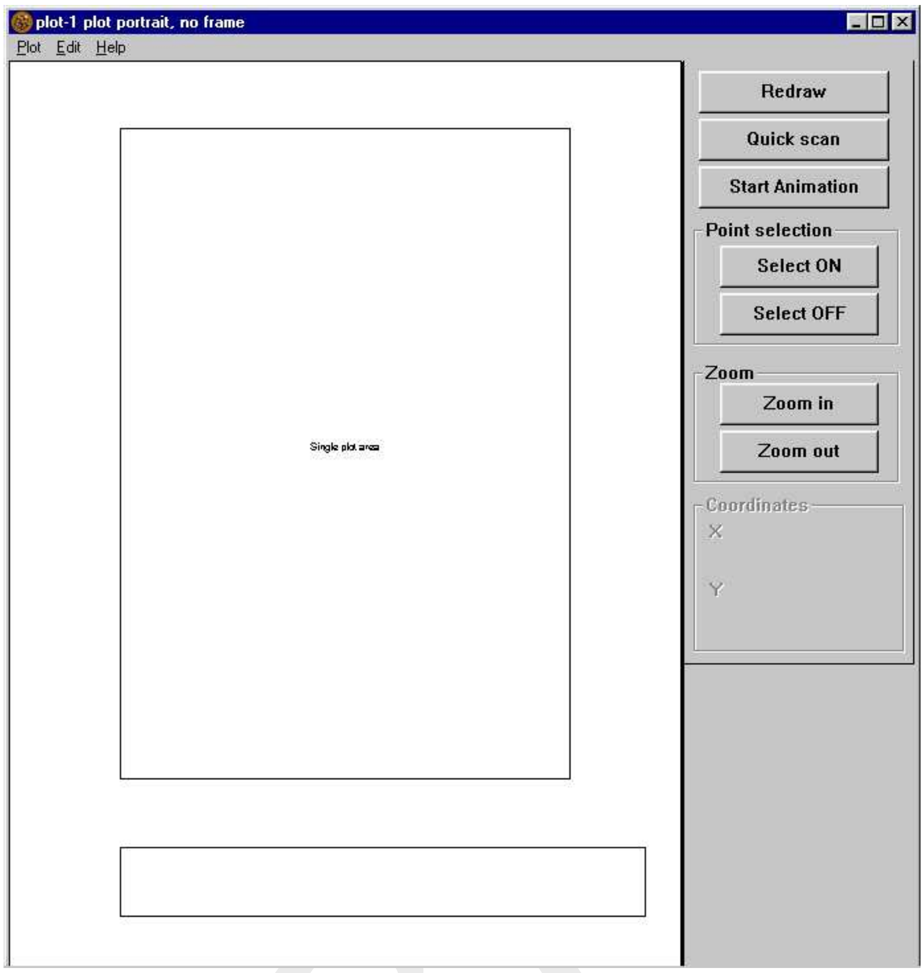
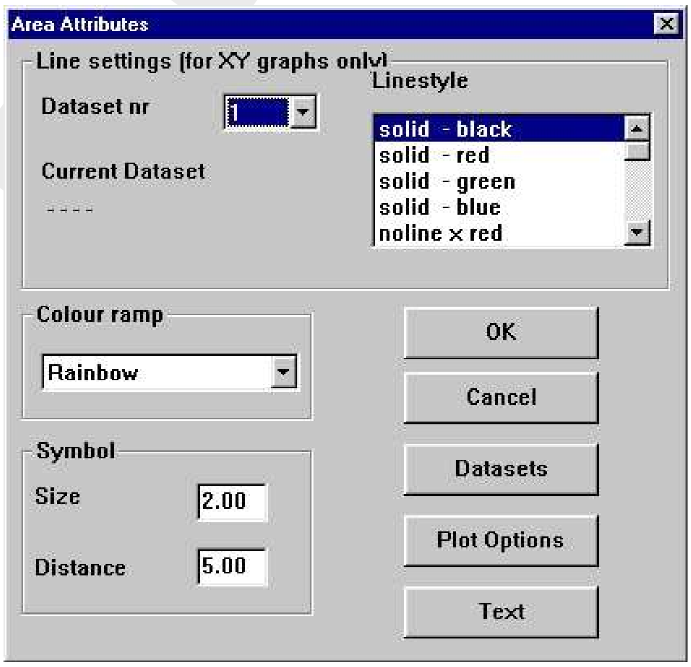


Figure 2.10: *Graphical window with empty plot*



Dataset nr: 1

Current Dataset: - - - -

Linestyle:
- solid - black
- solid - red
- solid - green
- solid - blue
- noline x red

Colour ramp: Rainbow

Symbol

Size: 2.00

Distance: 5.00

Figure 2.11: Area Attributes *dialogue window*

continue your previous session. The definitions can also be saved in a *session* file, this is essentially the same type of file, but it allows more explicit manipulation (see chapter 6 for more details).

Many settings of GPP are defined in external files (default layouts, properties of the plot routines, file types, graphical settings and printers). These files can be edited to suit your own preferences. We refer to chapter 7 and the appendices for a detailed description.

3 Graphical User Interface

3.1 Starting the program

We need to distinguish between a workstation running X Window and a PC running some version of Microsoft Windows. Also, as GPP is part of the Delft3D system, you may prefer to use it from within Delft3D:

◇ On a Linux workstation:
After installation (see chapter 9), the program can be started standalone by typing:
```
> gpp
```
or from the Delft3D user-interface:
```
> delft3d-menu
```
(and selecting a *module* or the *Utilities* option, and next *GPP*).
As the installation procedure has added the home directory for GPP to the PATH variable, this command can be issued from any directory.

◇ On a PC:
Double-click on the GPP (or Delft3D) icon in the desktop or start the program via the Start menu (this depends on how the installation was done and how you have organised your PC).
To start GPP, go either to the *Utilities* or to one of the *modules*; next select *GPP*.

When starting, GPP will bring up the main window (see Figure 3.1). It will also read a number of configuration files and the so-called state file (if it exists), which contains the definitions of data sets and plots from a previous session (see Appendix C).

Read section 7.5, *Working environment*, for more information on which files from which directory are used.

GPP may be passed a sequence of command-line arguments as well. Such arguments are used to:

◇ Determine a session file to read instead of the default state file, so that you can continue previous work.
◇ Let GPP work in *batch mode*, which means that any pictures defined in the given session file are printed without interaction from the user.
◇ Specify the so-called system directory (see chapter 7) which determines where the configuration files are coming from.

In Appendix A these command-line arguments are explained in detail.

3.2 Main window

The main window initially shows three buttons on the left-hand side, a simple menubar and the description of the session file. When you click on any of these buttons, the main window changes to present a list box of existing data sets or plots and push buttons that allow you to create new data sets or to view the plots and other functions. The buttons on the left represent *data groups* and clicking them brings up the corresponding dedicated subwindow.

The status bar is used to display various messages, but only those that do not require immediate attention from the user.

The buttons are:

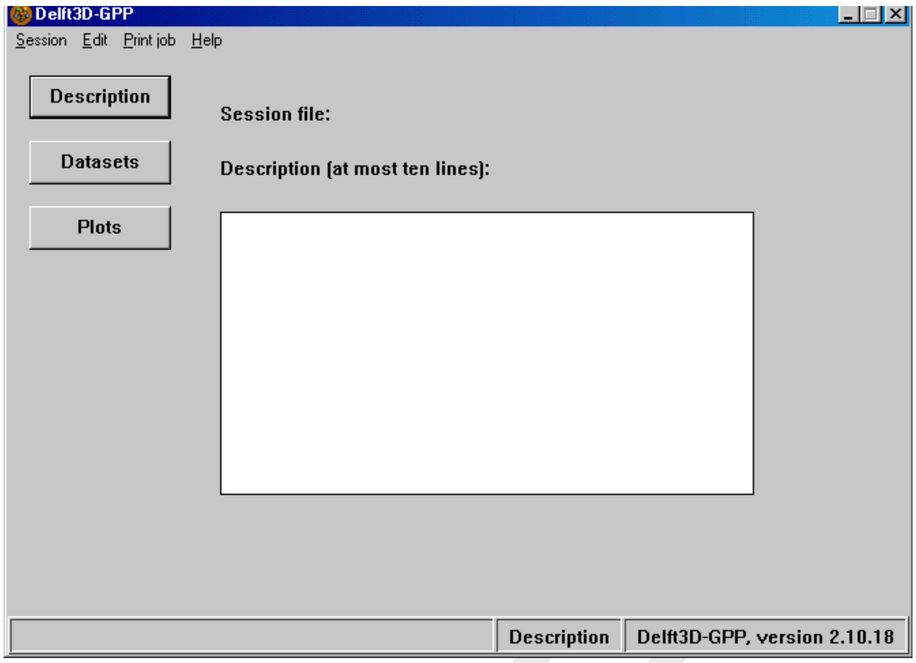


Figure 3.1: *Main window of GPP*

◇ *Description*, see Figure 3.1
This allows you to document the session file with a few lines of text. Rather than simply relying on file names or the actual data sets and plots in the session file, you can use this facility to document its purpose and contents.

◇ *Datasets*, see Figure 3.2
When you select this data group, the main window displays a list of the data sets. The buttons on the right-hand side allow manipulation of the data sets:

Add	Add one or more new data sets
Preview	Create a simple plot to show the selected data set
Combine	Combine two data sets via an arithmetic calculation
Export	Export the contents of data sets to an external file
Delete	Delete the selected data set or data sets

The button *Preview* is a function that allows you to view a selected data set. It will create a plot containing that data set based on:

◇ the first layout in the list of layouts
◇ the first plot routine in the list of plot routines for that type of data sets.

Remark:

◇ If the data set is a 3D data set or some other type that has no direct plot routine, then the Assign data dialogue appears and you have to do the necessary selections first.

◇ *Plots*, see Figure 3.3
Selecting the *Plots* Data Group brings up the list of existing plots and a set of three buttons:

Add	Add a new plot
View/Edit	View and/or edit the selected plot
Delete	Delete the selected plot or plots

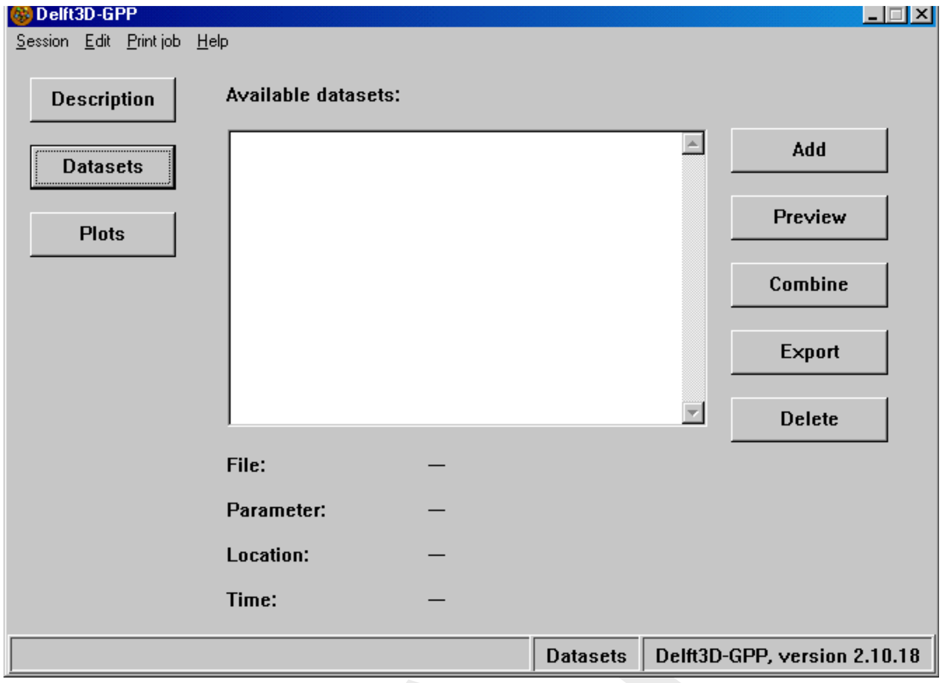


Figure 3.2: *Data Group Datasets window*

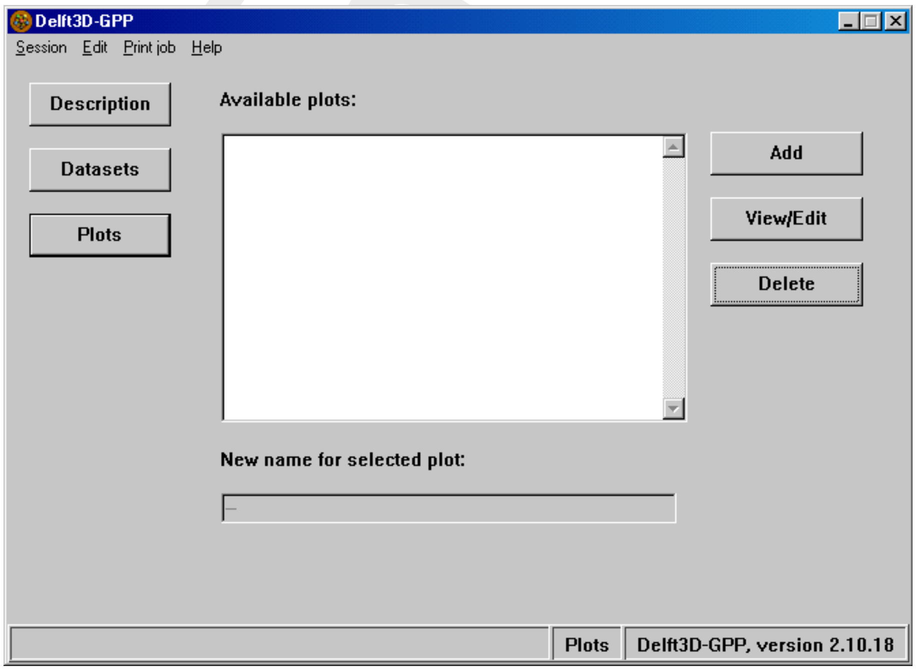

Delft3D-GPP
Session Edit Print job Help
Description
Datasets
Plots
Available plots:
Add
View/Edit
Delete
New name for selected plot:
Plots
Delft3D-GPP, version 2.10.18

Figure 3.3: *Data Group Plots window*

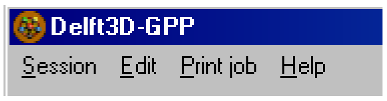


***Figure 3.4:** Main window menu options*

The intention is that the next release will allow you to rename the plot. This facility is visible in the user-interface but not fully implemented yet.

The main window has a simple menubar with the following menus:

◇ *Session*
  This menu allows you to manipulate the current session, such as:
  - Start from scratch
  - Open an existing session file
  - Leave the program

◇ *Edit*
  This menu allows you to manipulate filenames and texts in a global way:
  - Edit links to data files
  - Replace text in a frame
  - Replace text near axes

◇ *Print job*
  This menu allows you to create a so-called print job and to set the characteristics of the (default) printer.

◇ *Help*
  This menu can be used to bring up the online help information. Pressing function key F1 has a similar effect.

The functions associated with the data groups and the menubar will be explained in more detail below.

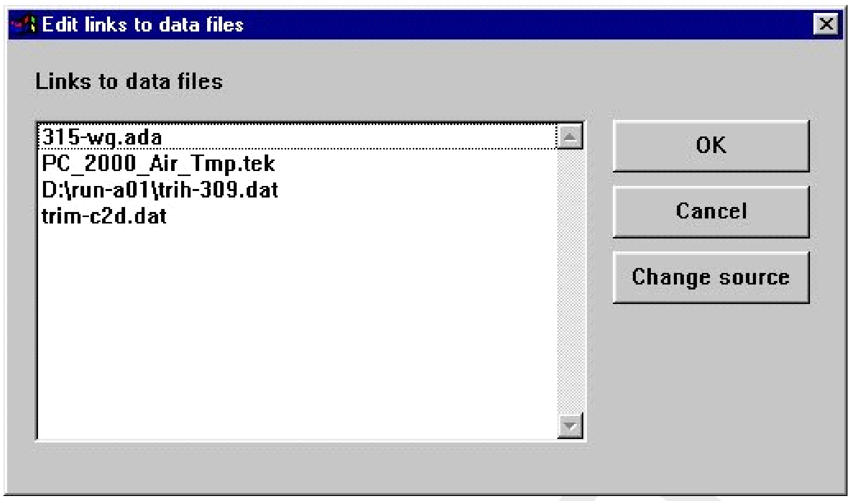
3.2.1 Menubar

The main window has a menubar with three menus, see Figure 3.4.

◇ The *Session* menu has the following items, which are equivalent in function to the more usual *File* menu (the name however refers to *session* files, and was chosen to avoid confusion with the data files that you will use):

New	Remove all data sets and plots from the current session and start a new
Open	Read an existing session file
Save	Save the data sets and plots in the current session file (if any)
Save as . . .	Save the data sets and plots in a new session file
Exit	Exit the program (save the state file, while doing this)

◇ The *Edit* menu contains three items:
  - *Links*
    A dialogue will appear that presents all selected data files (see Figure 3.5). By selecting a data file and next *Change source*, the data file can be replaced by another (but similar) data file.
  - *Frame texts*
    This option allows you to replace texts in the frames of a plot.
  - *Axis texts*



```
315-wg.ada
PC_2000_Air_Tmp.tek
D:\run-a01\trih-309.dat
trim-c2d.dat
```

Figure 3.5: *Sub-menu option Edit links to data files*

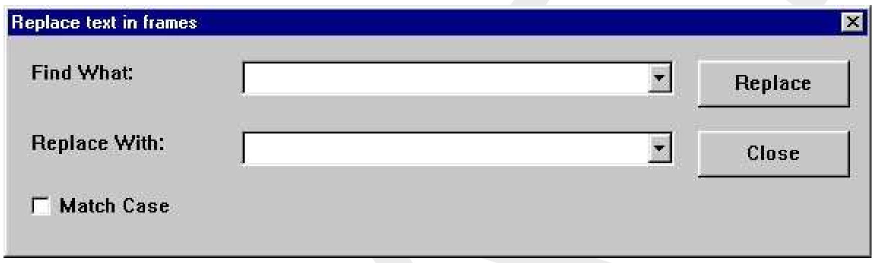


Figure 3.6: *Sub-menu option Replace text in frames*

This option allows you to replace texts near axes in a plot.

◇ The *Print Job* menu contains two items:

- *Make job*
  A dialogue will appear that presents all existing plots (see Figure 3.8). By selecting one or more plots you indicate that these plots should be sent to the printer *without showing them on the screen or any actions from you.*
- *Printer setup*
  Select the printer and set its properties.

◇ The *Help* menu should require no specific explanation: it will bring up the online help information. The text is an abbreviated version of this manual, so the manual is the most comprehensive reference to GPP.

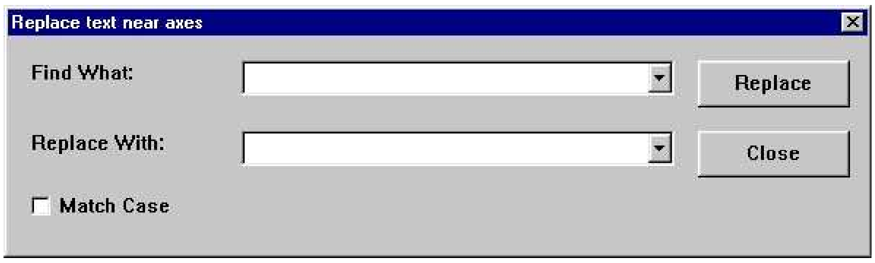
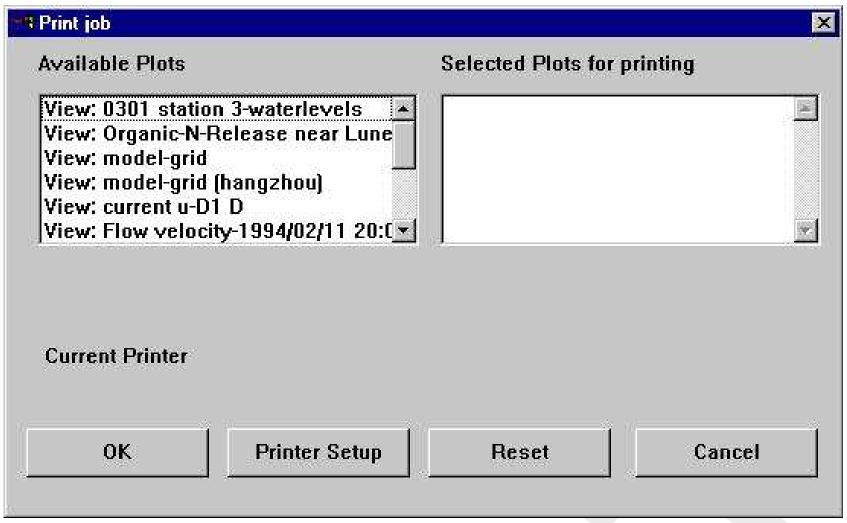


Figure 3.7: *Sub-menu option Replace text near axes*



View: 0301 station 3-waterlevels
View: Organic-N-Release near Lune
View: model-grid
View: model-grid (hangzhou)
View: current u-D1 D
View: Flow velocity-1994/02/11 20:0

***Figure 3.8: Make Job** dialogue*

3.2.2 Data group Description

We can be short about this data group (see Figure 3.9):

◇ It shows the name of the session file that was imported (if any) and which will be written again if you select the *Save* item from the *Session* menu.
◇ It also displays a short description of the session, which consists maximally of some ten lines. You can edit this description and it will be stored in the session file. Whether you want to use this facility or not, is entirely up to you, but it is quite convenient if you have a lot of such files.

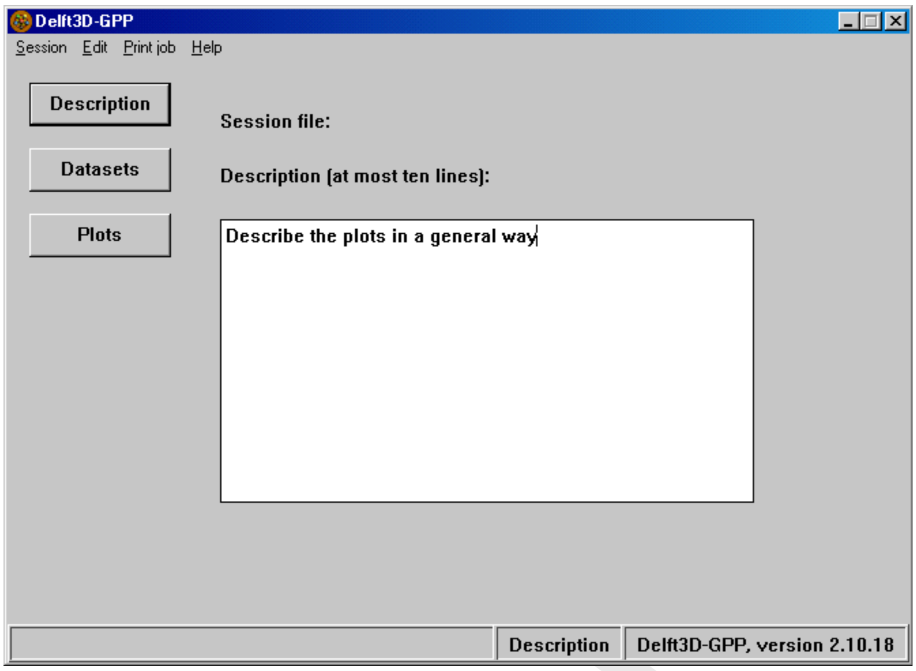
3.2.3 Data group Datasets

The data group *Datasets* presents a list of existing data sets and a set of push buttons to manipulate the data sets (see Figure 3.10). Its functions as follows:

◇ When you select a data set, several properties will be shown below the list box.
◇ Click *Add* to bring up a dialogue to add new data sets (see the explanation in chapter 3).
◇ When you click *Preview*, the data set will be put in a new plot and this plot is then shown in a new plot window (see section 3.3). This fails, if there is no presentation available for that particular type of data set and you will have to use other means in stead (see the description of the Data Group *Plots*).
◇ Click *Combine* to bring up a dialogue to combine two data sets via arithmetic operations (addition, maximisation etc.) This should be fairly straightforward (see Figure 3.11):

  ◻ The list box labelled *Dataset A* only contains data sets for which one or more operations (like addition) are available.
  ◻ The list box labelled *Dataset B* is filled with the same list.
  ◻ Selecting a data set from both list boxes brings up the list of possible operations (the first operation is chosen by default).
  ◻ By clicking *Create* you create the new data set. If you type a string in the *Suffix* field, this string will be appended to the name of the new data set. This makes it easier to distinguish it.

◇ Click *Export* to bring up yet another dialogue (see Figure 3.12). This one allows you to export the data contained in the data set to an external file. (Not all data sets can be exported, because currently only a limited number of methods is available).

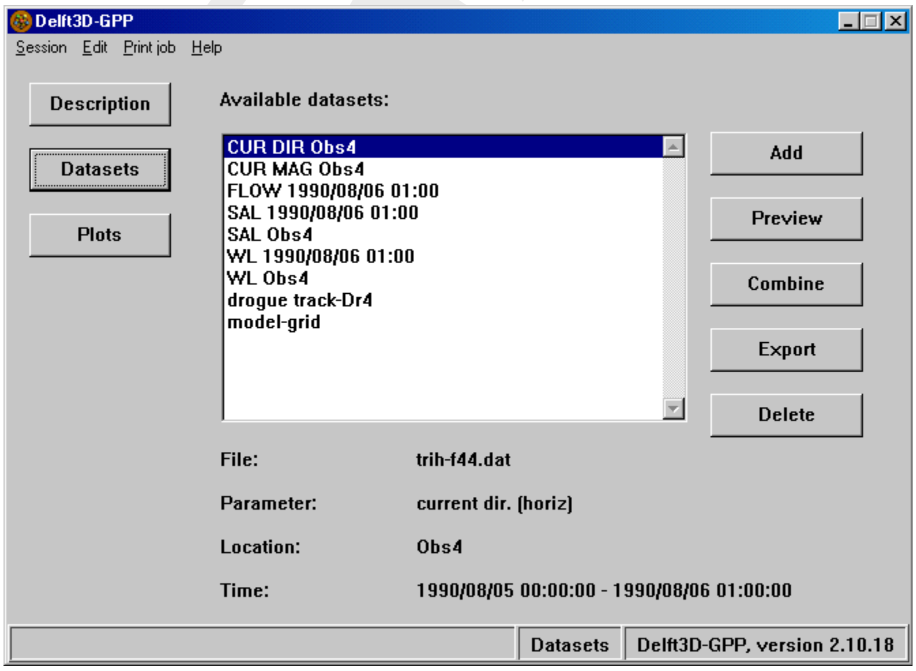


Session file:

Description (at most ten lines):

Describe the plots in a general way

Figure 3.9: *Data Group* Description



Available datasets:

CUR DIR Obs4
CUR MAG Obs4
FLOW 1990/08/06 01:00
SAL 1990/08/06 01:00
SAL Obs4
WL 1990/08/06 01:00
WL Obs4
drogue track-Dr4
model-grid

File:	trih-f44.dat
Parameter:	current dir. (horiz)
Location:	Obs4
Time:	1990/08/05 00:00:00 - 1990/08/06 01:00:00

Figure 3.10: *Data Group* Datasets

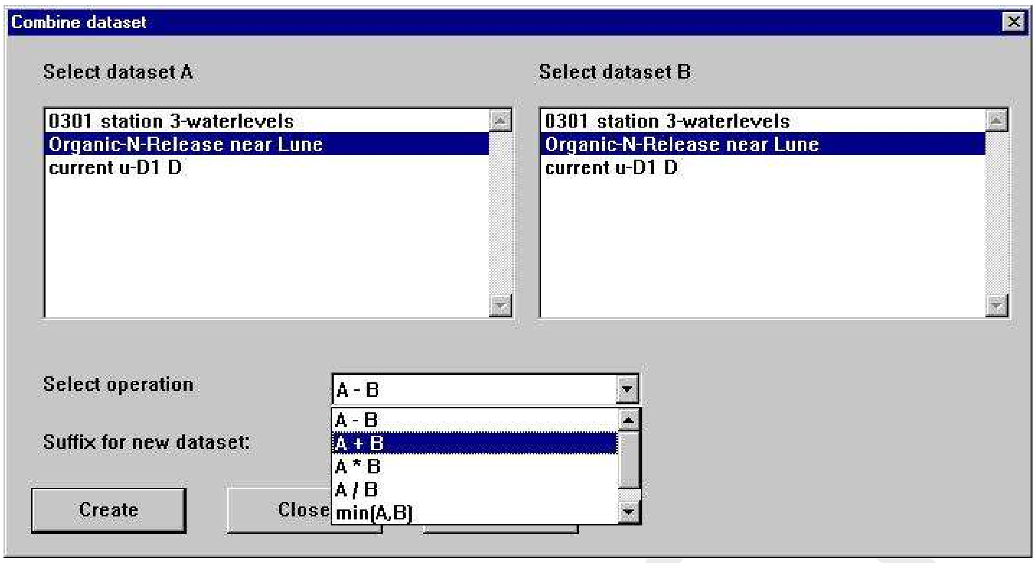


***Figure 3.11:** **Combine datasets** dialogue*

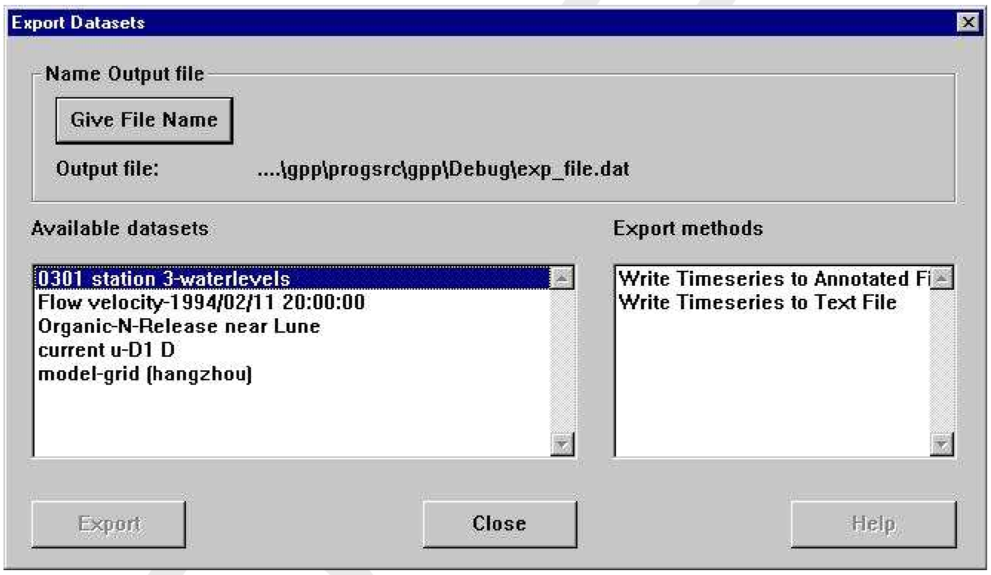

Export Datasets
Name Output file
Give File Name
Output file:
....\gpp\progsrc\gpp\Debug\exp_file.dat
Available datasets
0301 station 3-waterlevels
Flow velocity-1994/02/11 20:00:00
Organic-N-Release near Lune
current u-D1 D
model-grid (hangzhou)
Export methods
Write Timeseries to Annotated Fi
Write Timeseries to Text File
Export
Close
Help

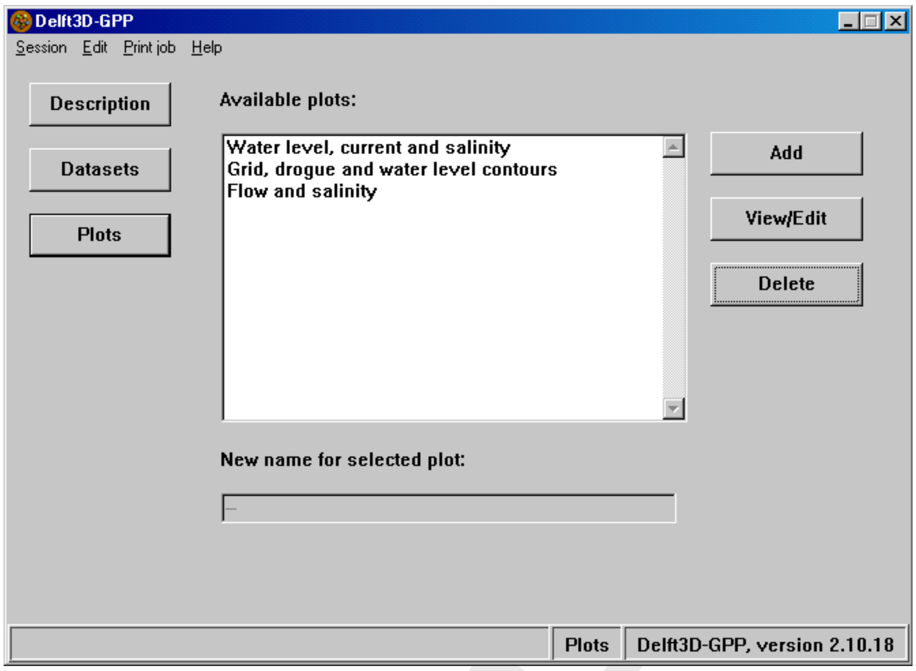
***Figure 3.12:** **Export datasets** dialogue*

Most methods export to a text file of some kind as these are best suited for the purpose.

◇ When you have selected one or more data sets and click *Delete*, the selected data sets will be removed from the session (which includes removing them from the plots as well). In some cases, data sets are required by other data sets and because of this relationship, such data sets will *not* be removed (but you get a message about that).

Remark:

◇ The x,y co-ordinates in exported 2D map data sets refer to the grid cell corners. The x,y co-ordinates of the grid cell centre are also added.


Delft3D-GPP
Session Edit Print job Help
Description
Datasets
Plots
Available plots:
Add
View/Edit
Delete
New name for selected plot:
Plots
Delft3D-GPP, version 2.10.18

Water level, current and salinity
Grid, drogue and water level contours
Flow and salinity

Figure 3.13: *Data Group* Plots

3.2.4 Data group Plots

The data group *Plots* allows you to define new plots or to view and edit existing plots (see Figure 3.13). The window contains a list of all existing plots and a set of three buttons:

◇ Select a plot and click *View/edit*, the plot is shown in a (new) graphical window.
◇ When you have selected one or more plots and click *Delete*, the selected plots will be removed from the session. *This has no effect on the data sets that were used in the plots.*
◇ Click *Add* to bring up:

 - A new graphical window
 - A list of available layouts from which you should select one
 - A dialogue allowing you to assign data sets to the various plot areas within the new plot

 This procedure is explained in section 3.3.2.

Remark:

◇ In a next release, the data group will allow you to rename the plot, as it is often difficult to think of a good name beforehand. In version 2.10 this has not been implemented yet.

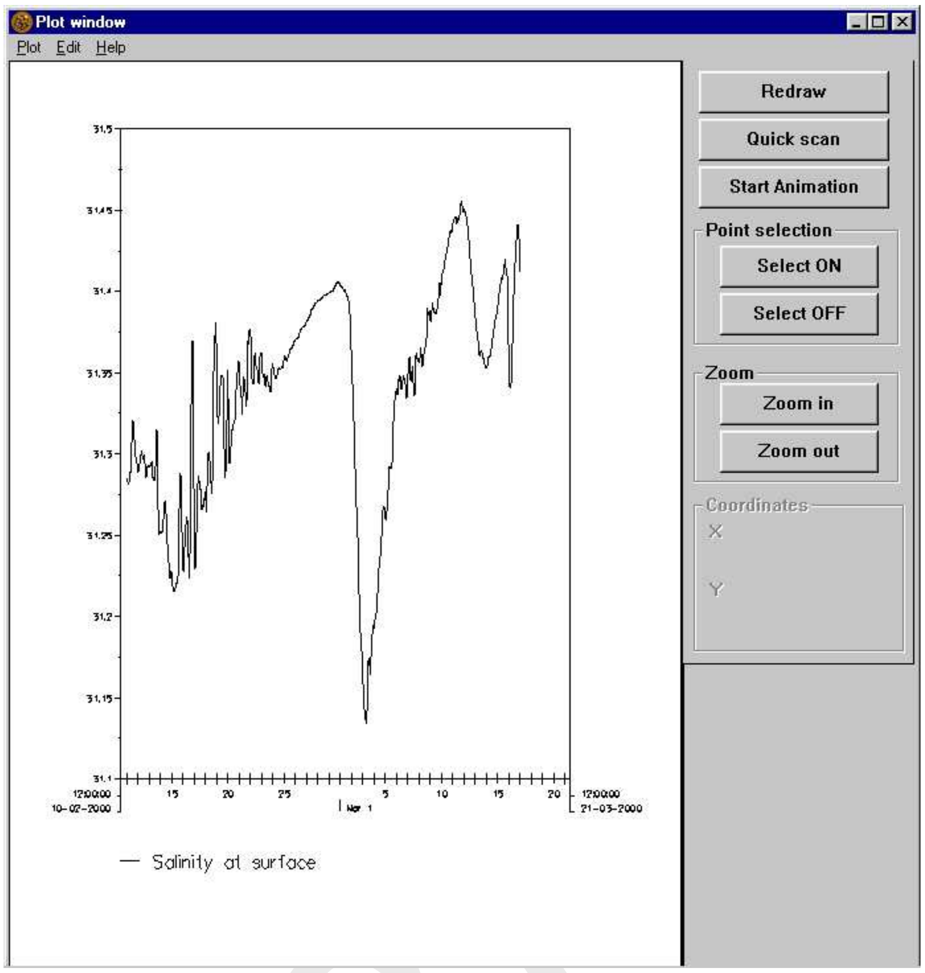


Figure 3.14: *Layout of the graphical* ***Plot window***

3.3 Graphical windows

When you use the *Preview* button in the *Datasets* data group or the *Add* or *View/Edit* buttons in the *Plots* data group, you get a new window, called a graphical window. This window has a separate menubar and a number of buttons and other functions that will be explained in this section (see Figure 3.14).

Remark:

◇ If you select the *Preview* option, the data set will be displayed in the graphical window directly only if the data set needs no further selections. If the data set needs further user selections (layer, time point, etc.) the *Assign data* dialogue (Figure 3.15) comes up.

3.3.1 Usage of the menubar

The menubar consists of the following menus:

◇ *Plot*
This menu takes care of several overall functions. It has five items:

Create	Create a new plot, by selecting a layout and setting a unique name for the plot
Select	Select a plot from the list of existing plots
Printer setup	Select the printer and set its properties
Print	Print the plot that is shown
Close	Close the graphical plot window

◇ *Edit*
This menu may be used to change the contents of the plot or to copy it to the clipboard:

Assign data	Open the dialogue to assign the data sets to the plot areas or to clean up the plot.
Attributes	(not implemented)
Add text	Open the dialogue to add or modify text in the plot.
Copy to clipboard	Copy the plot as a *bitmap* to the clipboard.

Copying the picture to the clipboard is useful, if you want to include it in some document. Be aware though that the resolution is that of the screen and this can be too coarse for a printed document. A better alternative might be to print it in a PostScript file, as this will preserve the resolution much better.

◇ *Help*
You can get the online information via this menu.

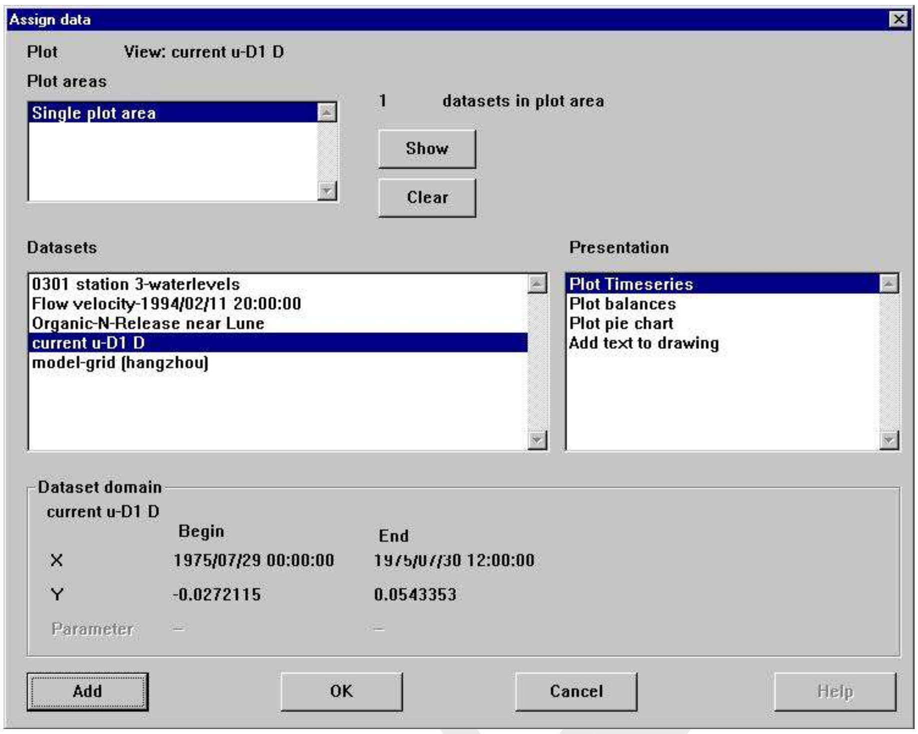
3.3.2 Composing a plot

When you want to fill the plot with data sets, you can do so by selecting the item *Assign data* from the *Edit* menu (see Figure 3.14 and Figure 3.15). The procedure is fairly simple:

◇ First select the plot area.
◇ Then select the data set you want to visualise. The third list, the possible presentations, is then filled. Sometimes you can use a so-called *selection procedure* to make a subset out of the data set, for instance to display a single layer from a three-dimensional data set.
◇ Select the appropriate presentation or selection procedure (if the latter, a new list appears, allowing you to select a layer or a location and thus to create a subset. This new data set will be automatically highlighted and a list of available presentations will appear).
◇ Then click *Add* to add the data set and its presentation to the list for that one plot area.
◇ You can repeat this procedure as often as you want. After clicking *OK*, the plot will be drawn.

To delete 1 or more data sets from a plotarea:

◇ First select the plotarea then select *Show* in the **Assign data** window. Figure 3.16 will appear and you can view and delete separate data sets.



Plot View: current u-D1 D

Single plot area

1 datasets in plot area

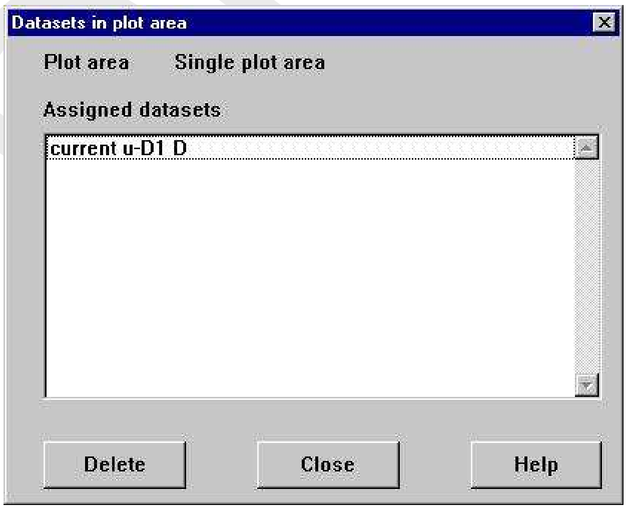
Datasets:
0301 station 3-waterlevels
Flow velocity-1994/02/11 20:00:00
Organic-N-Release near Lune
current u-D1 D
model-grid (hangzhou)

Presentation:
Plot Timeseries
Plot balances
Plot pie chart
Add text to drawing

Dataset domain
current u-D1 D

	Begin	End
X	1975/07/29 00:00:00	1975/07/30 12:00:00
Y	-0.0272115	0.0543353
Parameter	–	–

Figure 3.15: ***Assign data*** *dialogue*



Plot area Single plot area

Assigned datasets
current u-D1 D

Figure 3.16: *Data sets currently assigned to a plot area*

3.3.3 Buttons in the graphical window

The buttons on the right in the graphical window have the following meaning:

◇ *Redraw*:
Redraws the graph. Use this if parts remain blank. (This might happen in some weird circumstances when the screen is not properly refreshed.)

◇ *Quick scan:*
If the plot contains but one data set, this button brings up a list of locations or times that are contained in the same data file, so that you can have a quick look at these other locations or times *without having to define new data sets* (see Figure 3.17). To keep the facility easy to use, this works only if there is a single data set.

◇ *Start animation*:
Start a simple animation. Its use is a bit complicated: you must create a data set with a spatial distribution and one or more time steps (typically one parameter from a so-called map file). Create a subset by selecting one time step and present it in the plot. If you then click this button, GPP will draw all time steps in the *original* data set one by one. Then its saves the picture in a bitmap file.[1]

◇ Point selection: *Select ON, Select OFF*
You can choose a point in one of the plot areas. It will show the value at that point or other relevant information (such as the grid cell indices; see Figure 3.18).
The co-ordinates are shown in the two text fields below the buttons.

◇ Zoom: *Zoom in, Zoom out*
Zoom in on a smaller area:

  ◻ First select *Zoom in*
  ◻ Click the left mouse button at one of the corners of the area you want to select
  ◻ Keep it pressed and move the mouse. If you release the button, the area will have been selected and the graph will zoom in.

  You can repeat this again and again. By clicking *Zoom out* you will return to the original area (for *all* plot areas).
  Note: Depending on the kind of axis type, the zoom size is adapted in that way the aspect ratio is not changed.

3.3.4 Using double-clicks

You can use a *double-click* of the left mouse button:

◇ Double-click on or near an *axis* brings up a dialogue in which you can change the attributes to the axis, colour text, font, number of tickmarks, scaling (see Figure 3.19, Figure 3.20 and Figure 3.21).

◇ Double-click in the *frame* (if a frame is visible); this allows you to fill in the text that appears in the frame (see Figure 3.22, Figure 3.23 and Figure 3.24). The buttons *Text Attributes* and *Frame Attributes* are used to change the detailed appearance of the text and the frame.

Double-click in a *plot area* to give you the opportunity to change (see Figure 3.25, Figure 3.26 and Figure 3.28):

series settings	appearance of individual time-series in line graphs.
colour ramp	which sequence of colours to use for a contour map or pie-chart

[1]On the UNIX workstation it will save each picture in an XWD file, on PC it will save each picture as a BMP file. See also chapter 8 for more information.

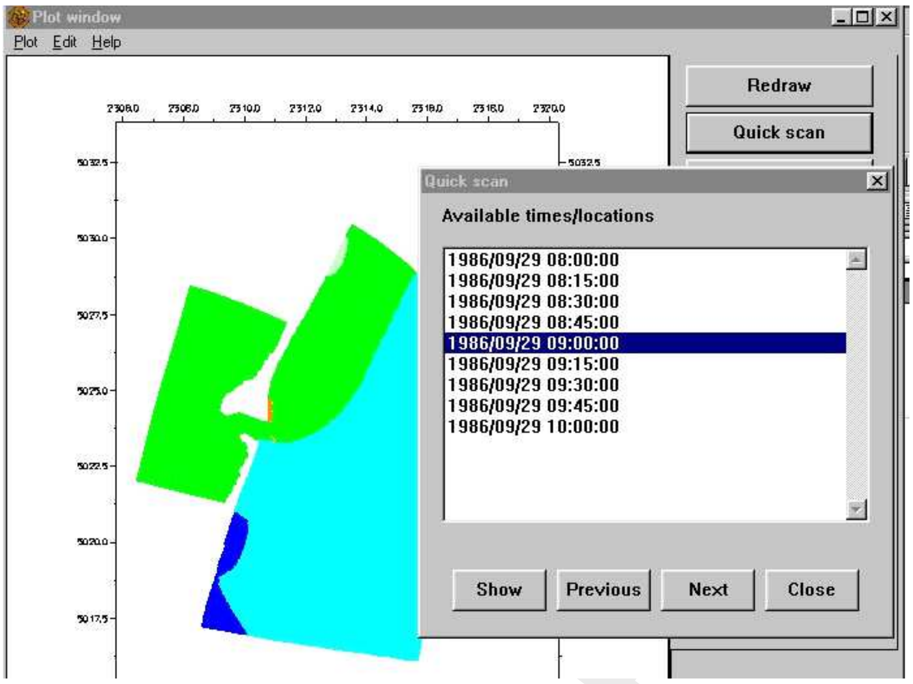
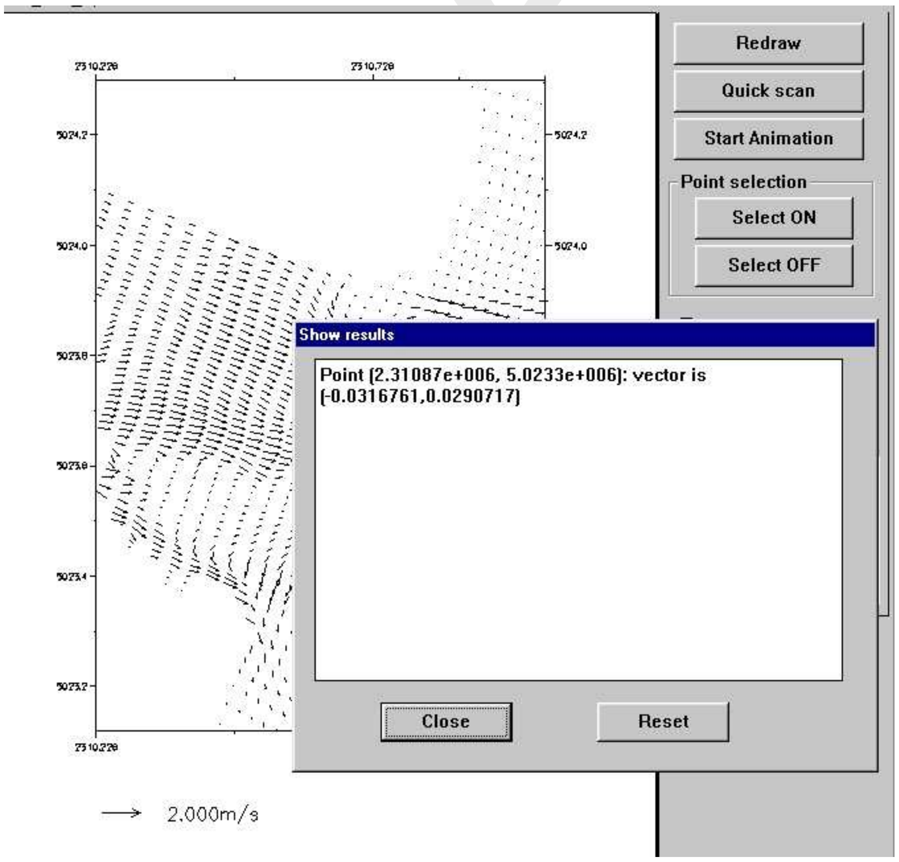
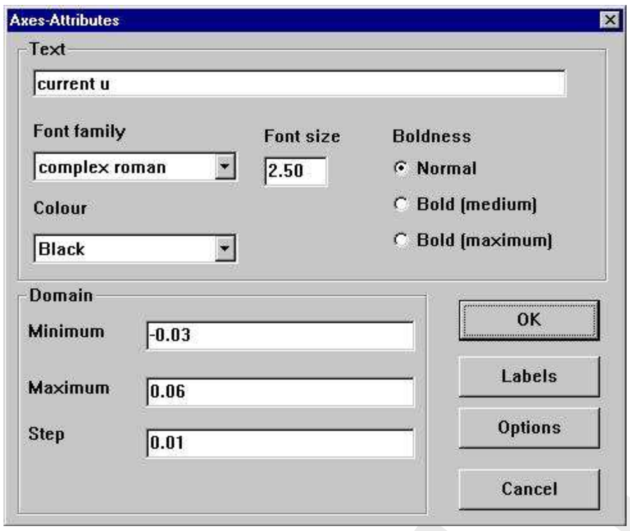


Figure 3.17: *Quickscan facility allows for temporary selection of other locations or times*



Point (2.31087e+006, 5.0233e+006): vector is (-0.0316761,0.0290717)

Figure 3.18: *Point selection*



Axes-Attributes

Text: current u

Font family: complex roman

Font size: 2.50

Boldness: [✓ Normal] Bold (medium) Bold (maximum)

Colour: Black

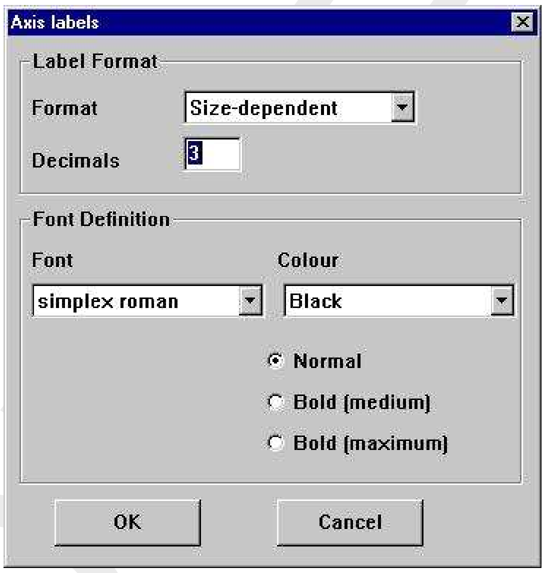
Domain

Minimum: -0.03

Maximum: 0.06

Step: 0.01

***Figure 3.19: Axes Attributes** dialogue*



Axis labels

Label Format

Format: Size-dependent

Decimals: 3

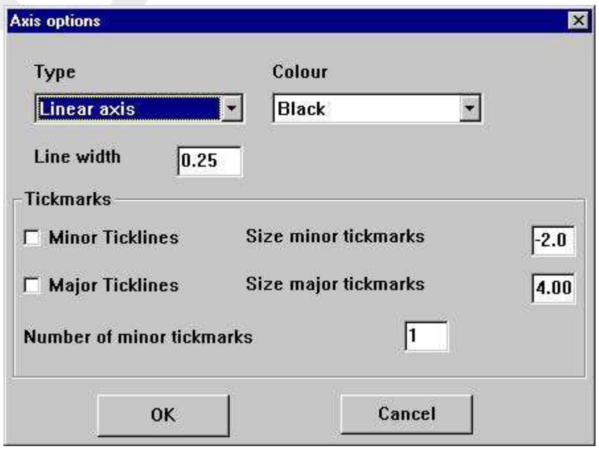
Font Definition

Font: simplex roman

Colour: Black

[✓ Normal] Bold (medium) Bold (maximum)

***Figure 3.20: Axis Labels** dialogue*



Axis options

Type: Linear axis

Colour: Black

Line width: 0.25

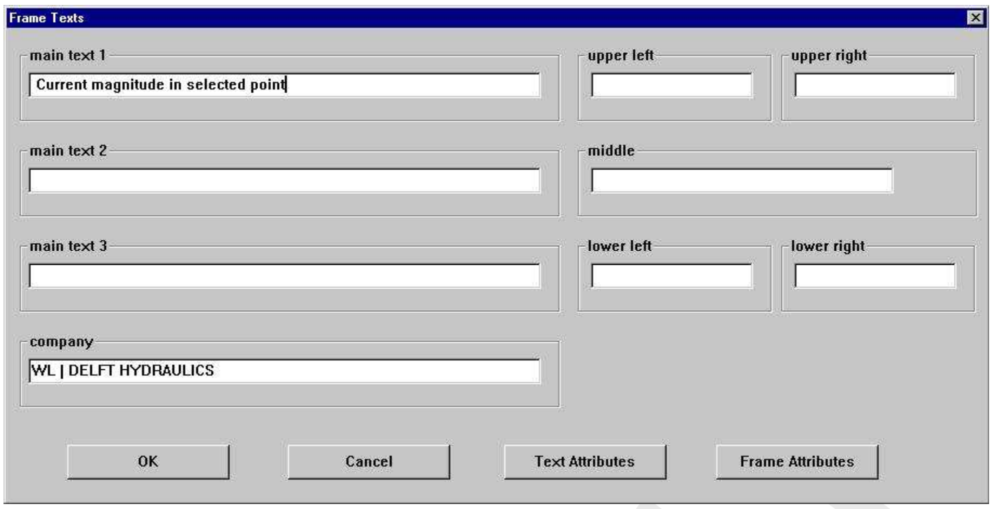
Tickmarks

Minor Ticklines [ ] Size minor tickmarks: -2.0

Major Ticklines [ ] Size major tickmarks: 4.00

Number of minor tickmarks: 1

***Figure 3.21: Axis options** dialogue*


Frame Texts

main text 1: Current magnitude in selected point

main text 2:

main text 3:

company: WL | DELFT HYDRAULICS

upper left:

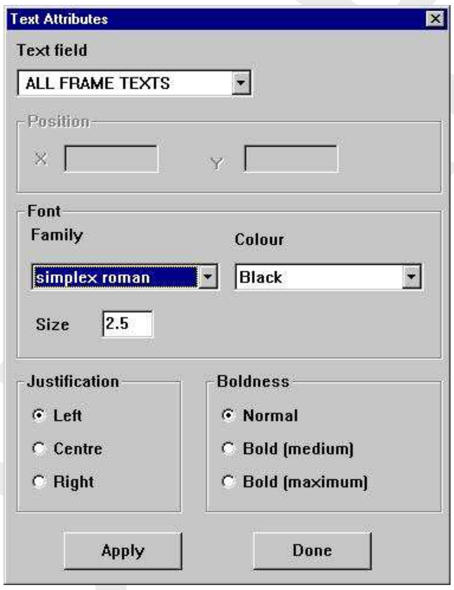
upper right:

middle:

lower left:

lower right:

***Figure 3.22: Frame Texts** dialogue*


Text Attributes

Text field: ALL FRAME TEXTS

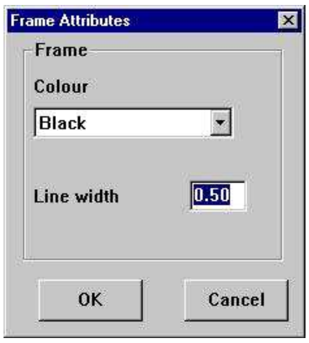
Position: X Y

Font
Family: simplex roman
Colour: Black
Size: 2.5

Justification: [✓ Left] Centre Right

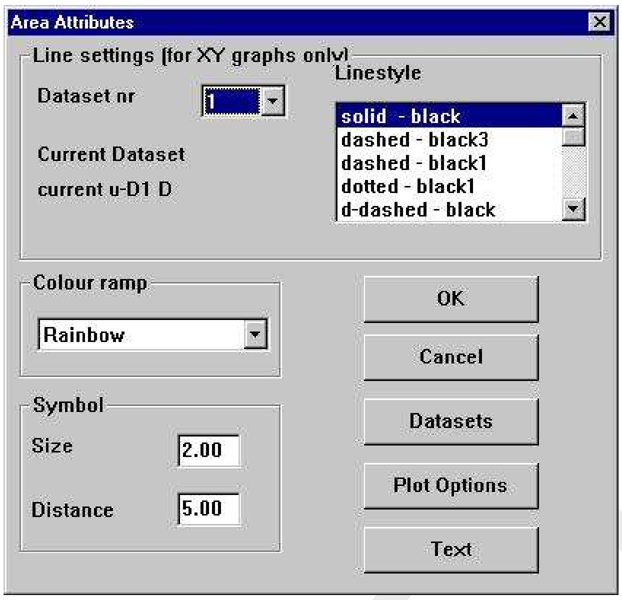
Boldness: [✓ Normal] Bold (medium) Bold (maximum)

***Figure 3.23: Text Attributes** dialogue*


Frame Attributes

Frame
Colour: Black
Line width: 0.50

***Figure 3.24: Frame attributes** dialogue*



Line settings (for XY graphs only)

Dataset nr: 1

Linestyle:
- solid - black
- dashed - black3
- dashed - black1
- dotted - black1
- d-dashed - black

Current Dataset: current u-D1 D

Colour ramp: Rainbow

Symbol
- Size: 2.00
- Distance: 5.00

***Figure 3.25:** Change **Plot area attributes** window*

datasets	which data sets are shown in the area
plot options	the options used in drawing the data sets.

The dialogue for changing the plot options requires some further explanation. Each presentation form can have one or more specific options. These are for instance whether to use a right vertical axis or a left axis or a list of concentration levels for making a contour map.

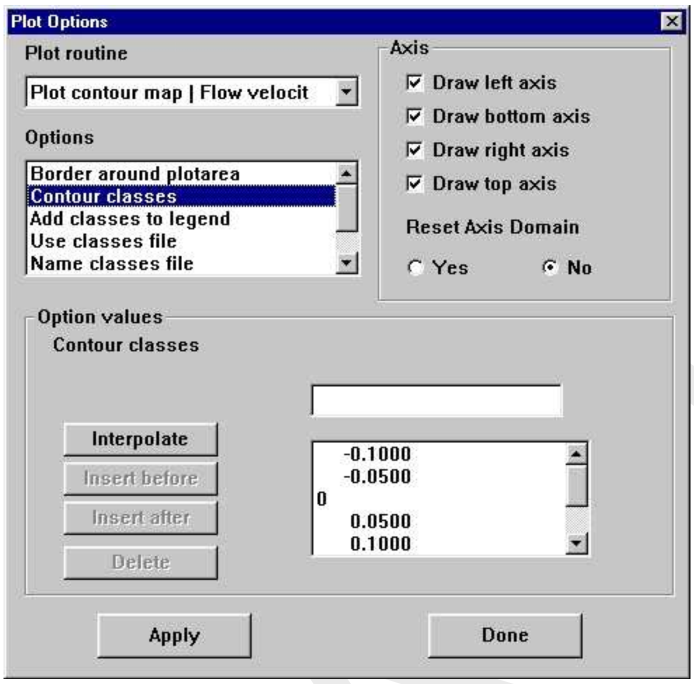
The idea is that each combination of a data set and a presentation form can have its own values for these options. This way you are very flexible in making the plot. Defaults for these options are read from the configuration files.

A second purpose of the dialogue is that you control whether the axes are visible or that the axes have to be determined again. This may be necessary if the plot options involve a change in axis type or if you have added new data sets for which the previous scaling is not effective.

For *Contour classes* you can either modify the classes or *Use classes file*. Via *Interpolate* you get a dialogue that allows easy manipulation of the contour classes (see Figure 3.27):

◇ Enter a *minimum* and a *maximum* value for the class limits as well as the *number of intervals*.
◇ Select the method of interpolation:
  - *Linear spacing* gives equal steps
  - *Logarithmic spacing* gives steps that are small near the maximum and large near the minimum
  - *Anti-logarithmic spacing* gives steps that are small near the minimum and large near the maximum (so the reverse)

Depending on the character of the quantity to be shown, any of these methods may be useful. For instance, if you show the salinity in open sea, then you probably want to emphasize slight deviations from the maximum (i.e. fine scales in the range 33–35 promilles), whereas below 33 promilles the steps can be larger. With logarithmic spacing you can achieve this effect.



Plot routine: Plot contour map | Flow velocit

Options:
- Border around plotarea
- Contour classes
- Add classes to legend
- Use classes file
- Name classes file

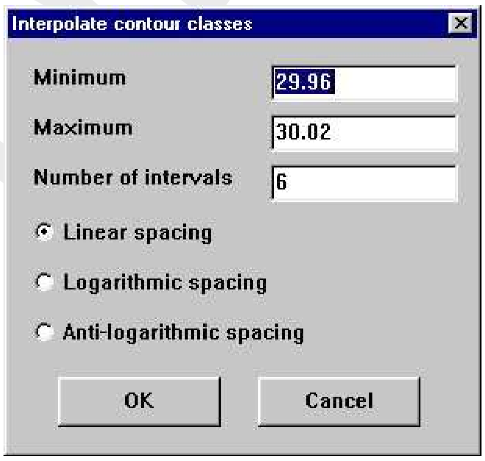
Axis:
- ☑ Draw left axis
- ☑ Draw bottom axis
- ☑ Draw right axis
- ☑ Draw top axis

Reset Axis Domain: Yes [✓ No]

Contour classes

```
  -0.1000
  -0.0500
0
   0.0500
   0.1000
```

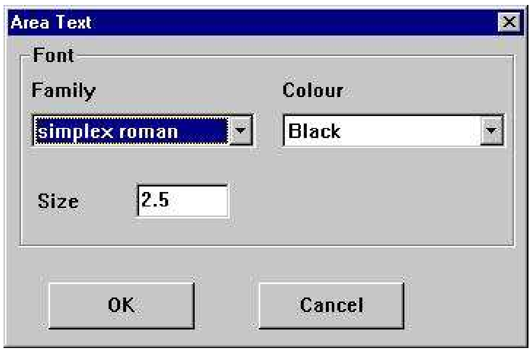
__Figure 3.26:__ Change __Plot Options__ window



Minimum: 29.96
Maximum: 30.02
Number of intervals: 6

[✓ Linear spacing] Logarithmic spacing Anti-logarithmic spacing

__Figure 3.27: Interpolate contour classes__ dialogue



Family: simplex roman
Colour: Black
Size: 2.5

Figure 3.28: *Change* ***Area Text*** *window*

To import a user-defined classes file:

◇ Set the option *Use classes file* to true.
◇ Set the option *Name classes file* to the name of your classes file.

A classes file has a very simple format: any line may contain one single number, the numbers must be in ascending order and for documentation purposes you can add comments by using a hash (#) or an asterisk (∗) in the first column.

Example of a classes file:

```
*
* Water levels: fixed contour classes
*
  -2.0
  -1.5
  -1.0
  -0.5
   0.0
   0.5
   1.0
   1.5
   2.0
```

3.4 Error handling

If an error occurs while reading any of these files, you will see a message box with a description of this error. Three types of errors are possible:

◇ The program cannot find the file, which is a serious error for all but the session state file, as things are not defined then.
◇ The program can not read the file because of some syntax error. The reading routines will indicate the line on which the syntax error occurred and the offending word or character.
◇ The program complains about the version number in the configuration files. As these files are extended and adjusted with new releases it is important to use the correct versions. We try to keep them compatible, so that some things are simply not available, but occasionally major changes do happen.

The message is therefore: if an error occurs with any of the configuration files, please find out what is the matter before continuing. If an error occurs with the state file, you may ignore it, though some data sets or plots from the previous session are not available.

4 Data sets and presentations

4.1 Data sets in general

Sets of data, the results of a numerical model or of a measurement campaign, are commonly characterised by some quantity or quantities (a hydraulic parameter, an ecological parameter or whatever), by locations (we are dealing with the real world and models of that world) and by a range of times. This summarises the idea of the Open Data Structure (or ODS for short): these three things are characteristic for all data sets we usually deal with. Within this *data model* you can have many variations: time-series, scalar data on a 2D grid, a three-dimensional flow field and so on.

To elaborate on this: a data set can be a time-series of water quality data - measurements of the concentration of BOD at a fixed location in time. The most natural form of presentation of such a data set is, of course, a plot of the concentration versus time. This is certainly one of the presentation forms contained in GPP. But what if the data set contains the data for two or more locations (see Table 4.1 and Figure 4.1)? Or for two or more parameters (temperature, salinity and oxygen concentration, for instance, as measured by a probe)?

Although we try to abstract from the actual format of the data file via this general data model, there remains a relationship between the data set and the file it comes from. In general, the files you import in GPP can be considered to contain one or a limited number of such data sets. In some cases, such as map files from D-Water Quality, all the information in the file can be arranged into one single data set according to the ODS data model. In other cases more than one data set can be distinguished: a history file from Delft3D-FLOW is an example. It contains results for monitoring stations (single points) and for cross-sections. For the stations different parameters are available than for cross-sections. So, we may say that the data in such files constitute two disjoint data sets.

Some files actually require a second or even a third file to be read. If this is the case, the primary file will be selected and the names of the others are derived from that, if possible.

It is not necessary to import the whole data set at once. In fact, GPP suggests that you select at least a *parameter* from the list of available quantities.

So, GPP is a framework which allows you to import certain data sets (from external files) or to create data sets from others, and to present them in any way possible and suitable.[1] To keep track of these data sets, they are given unique names. The user-interface constructs a default

[1] We refer to the detailed documentation on GPP for the algorithms used, how to extend the set of presentations etc.

Table 4.1: *Measured data of BOD5 (mg/l) in two locations. (Note: these data are fictional)*

Time of measurement	Station K4	Station QU2
21 July 1985, 8:00	5.0	3.5
22 July 1985, 10:35	6.5	21.5
23 July 1985, 8:10	2.0	2.0
25 July 1985, 13:43	3.4	1.0
1 August 1985, 12:20	4.0	< 1.0
2 August 1985, 11:55	(not measured)	3.0
5 August 1985, 7:22	11.2	4.5

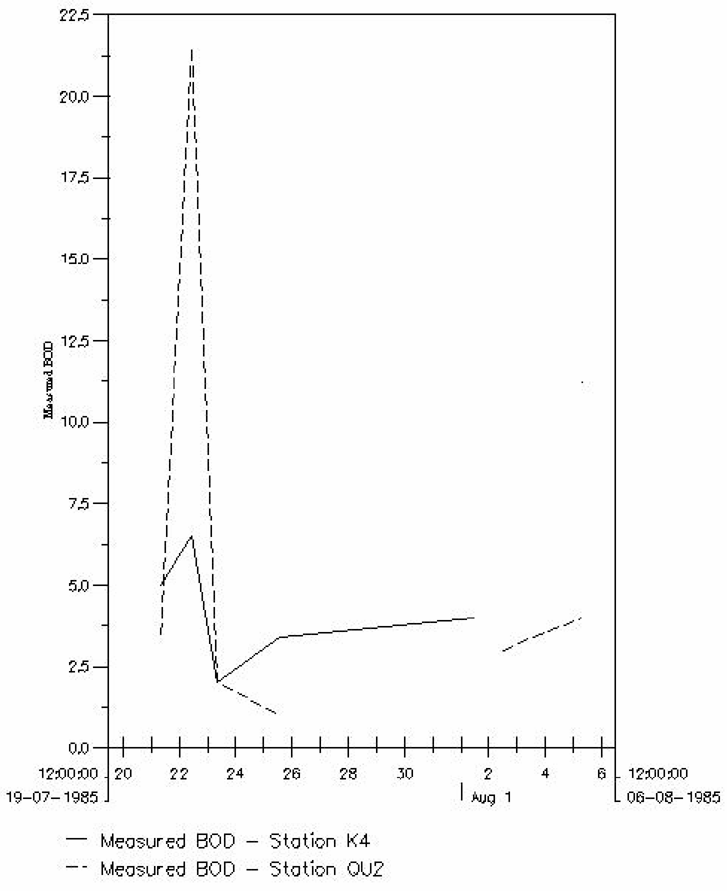


Figure 4.1: *Example of particular data set. Missing values are represented by discontinuities in the line*

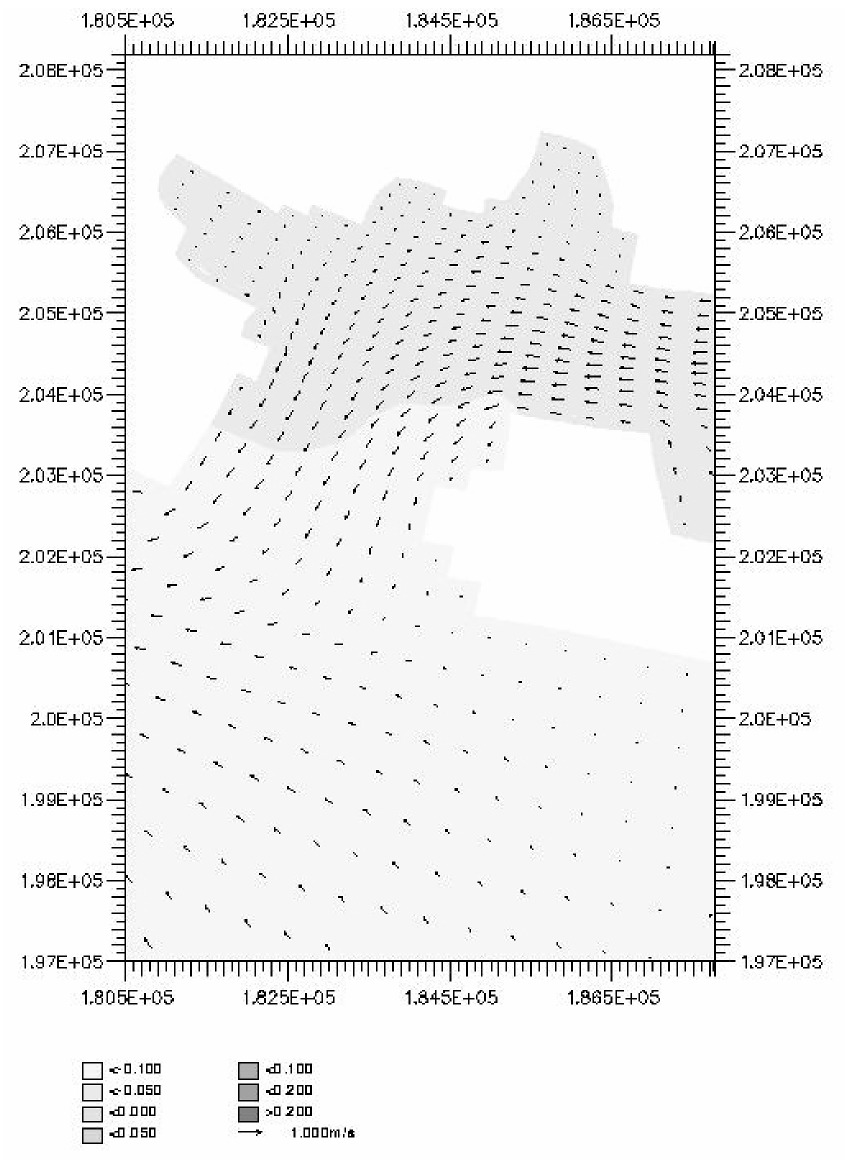


Figure 4.2: *Plot of water level (filled contours) and flow velocity (vectors)*

name, but you are free to select a different name.

4.2 Presentations and selections

Internally, the data sets have a type and a subtype. These two properties among others allow GPP to construct a list of suitable presentation forms and selection methods. They are set automatically from all available information. The type indicates the dimensions of the data set: time-series, two-dimensional data sets, three-dimensional data sets etc. The subtype is usually 'SINGLE', indicating a single component. In some cases, the subtype is 'VECTOR', indicating two components (a vector quantity), others are used as well. Both the type and the subtype determine which subroutines for plotting a data set are suitable (see Figure 3.15).

Sometimes, selecting the file from which the data set should come and selecting parameter, location or time is enough. An example: selecting the water level at a single monitoring station from a result file from Delft3D-FLOW. In other cases, we need the underlying grid as well. This may mean that another file has to be selected which contains information about the grid. As an example we may look at D-Water Quality map files. D-Water Quality does not know anything about the grid (the underlying computational program, called DELWAQ, does not use the co-ordinates of the grid points, but only derived quantities), hence its output files do not possess any information about the geographical layout. You need to import an extra file (two actually). At present, only curvilinear grids can be imported. The order in which you do that is not important, but it is important to get the right files, as otherwise the data set can not be plotted: its proper type is not recognised.

4.3 Importing the data set

The basic procedure to create a data set from a file has been described in chapter 2. But there are in fact several possibilities after you have selected the parameter:

- If the file contains *named* locations, it is known as a history file. You can:
  - select a single location. The result is a time-series (or possibly a set of time-series, if the location has more than one layer).
  - select several locations, in which case the data set is a combination of several time-series.
  - postpone the choice. GPP automatically selects *all* locations into the data set.
- If the file does not contain named locations, it is considered a map file or a grid file. In the first case, you can:
  - select a single time to get a data set that is defined on some grid.
  - postpone the choice. GPP automatically selects *all* times into the data set. (It is not possible to select several times for technical reasons.)

  In the second case, there is no time to select. The parameter has uniquely identified the data that should be imported from the file.

The data set will be known by a unique name: it is up to you to accept the name constructed by default or to type in one yourself. The name is important because whenever you need to chose a data set, this name is presented.

4.4 Available presentations

Depending on the type of data several presentation forms will be available. Table 4.2 provides some examples (a more elaborate overview is given in Appendix K):

During the creation of the data set you may want to postpone the choice of, say, a location. When you select such a data set in the plot dialogue, one of the possible "presentations" will be: *Select a location*.

Besides selections you can also do some operations on data sets. Examples of selections and operations are:

Select a single parameter (if the data set contains more than one parameter).
Select a single time (used when creating animations, see chapter 7).
Select a single layer (if the data set is three-dimensional).
Select a fixed M or N grid line.
Select an arbitrary transect.
Select a vertical profile.

Instead of a picture, a dialogue appears which shows the possible choices for the selection or details for the operation. By selecting an item you create a new data set, which is actually

Table 4.2: *Presentation forms for various types of data sets*

Data set	**Presentation form**
Time-series	Plot of values versus time Cumulative histogram of values (so-called balances) Plot limiting factors
XY series	Plot of y-value versus x-value
Scalar data on a two-dimensional grid[2]	Plot contour map Plot iso-lines Plot thin dams Plot time bar
Scalar data on a three-dimensional grid	No direct presentation possible, reduce to some form of 2D data first
Vector data on a two-dimensional grid	Vector plot Plot time bar
Grid itself	Plot of the grid layout

a subset of the original one. This new data set is automatically selected and the possible presentation forms are presented.

Besides the above mentioned selections you can do also some operations on appropriate data sets:

Calculate the magnitude of a vector parameter.
Average over a fixed layer (from the surface) (3D data sets only).
Averaged squared vector (m^2/s^2) over a fixed layer (3D data sets only).
RMS vector (m/s) over a fixed layer (3D data sets only).

4.4.1 Types of presentations

Presentation forms may roughly be divided in three categories:

line graphs (like a time-series)
surface graphs (like a contour map)
all others (like a grid).

This is not to be taken too strict: drawing a grid as a collection of short lines outlining the grid cells could be called a line graph and iso-lines belong to the category of contour maps. The main reason for this distinction is that the *resources* used by the two categories are different. In the first category we are dealing with one or more series of data points in a graph. Each series needs to be distinguished from the others. This can be achieved with:

◇ different line styles and line thicknesses
◇ different colours
◇ different symbols

Symbols are especially useful if you want to show the individual data, whereas colours and line styles are very handy to distinguish more or less continuous series. In order to make the presentation routines work together, they take these settings from a common source.

Presentations which belong to the second category are different altogether: there different colours will be used to indicate a continuous distribution. For example: the colours used in a contour map will follow a rainbow-like sequence or perhaps a range of blue shades, not only to please the eye, but also to better present this continuity. To aid the presentation routines in achieving this aim GPP uses so-called colour ramps and contour classes:

- ◇ Colour ramps are sequences of colours which can be selected by selecting the name of that colour ramp.
- ◇ Contour classes are sequences of numbers which can be edited in a dialogue box (see chapter 3) and are used in the order they are given.

The third category consists of various unrelated presentation forms which do not use either type of resources. They are independent from other presentations.

5 Files and filetypes

This chapter focuses on some general features of the data files. For specific information on the models and filetypes that are supported and what special considerations may apply, we refer to the appendices.

5.1 Data files in the user-interface

To read the data from the data files GPP uses a simple concept, such that the details of the file structure are irrelevant to you. To be able to read the files properly, it does have to know the structure, or put in another way, the filetype. In the user-interface, this is characterised by the *model* and by the *filetype* within such a model.

To facilitate the selection of files, GPP uses a *file mask*. This is a pattern like "∗.hda" that is used to select only those file names that are likely to be of the right type. The asterisk (∗) matches any sequence of characters. You may change this mask when selecting a file or you may supply a different default mask for files of a certain type.

To summarise the properties of a data file that are important to the user-interface:

model	The numerical model or other source that created the file
filetype	Indication of the file's structure
file mask	A pattern to be used to pre-select the file names, usually fixed by the conventions used by the model.

These properties are defined in the file <filetype.gpp>. Only filetypes listed in this file are available in GPP (see Appendix C.2).

5.2 Representing date and time

Time in GPP is always a date and time of day. The routines that read the files are supposed to retrieve such a date and time. Some models do not use an *absolute* time. Instead, the routines may use the following convention (check the addendum on filetypes):

◇ A reference date and time may be given via comments. This will be used to reconstruct the actual date and time for the model results. The layout of such a line is:

```
 t0= 1993.12.31 12:59:59 (scu=       1 )
 ....+....1....+....2....+....3....+....4 (column numbers)
```

The first part is the date and time to which the relative time 0 in the calculation refers, the second is the unit of the system clock in seconds.
Note:
It is important that the time units are given consistently, otherwise a distorted picture will be drawn!

◇ If the files do not contain a reference date (or the date is not of the correct format), the reference date is set to January 1, 1900.

5.3 Formatted data files

Measurement data are often stored in text files or databases of various kinds. GPP offers several filetypes to import such data: the so-called TEKAL and Samples files.

5.3.1 TEKAL files (general)

Essentially, all TEKAL filetypes share that structure:

- ◇ The file may contain one or more tables of data, which are independent. They are sometimes referred to as *blocks*.
- ◇ A short string (the *block name*) identifies the "block" or table of data.
- ◇ A line should follow to indicate the number of rows and columns. In the case of data on a two-dimensional grid, a third number indicates the number of cells in the first direction.
- ◇ Each line after that contains the data for one row.
- ◇ Comments can be added before the block name, via an asterisk ($*$) in the first column.

(Examples appear in the various subsections.)

Thus, the structure is (almost) always as described briefly above. It is a very flexible and easy-to-handle format. This is partly because it lacks additional information, such as the quantities that are given in these columns, the meaning of the table and so on. *This information must be added by the program or the user.*

Within GPP, this lacking information is added in three different ways:

- ◇ By selecting the filetype from the list defined in the <filetype.gpp> file.
- ◇ By using the comments to supply names to the columns.
- ◇ For the one-dimensional variant, an extra dialogue will appear.

The files can be used for the following purposes:

- ◇ *Time-series or data as function of an arbitrary co-ordinate*
  This is a one-dimensional TEKAL file (meaning that the line after the block name has only two numbers, the number of rows and the number of columns. This type of file is handled in a special way in the user-interface (see section 5.3.3).
- ◇ *Co-ordinates for land boundaries:*
  This is also a one-dimensional TEKAL file, but it should have two columns, the first for the x-co-ordinate, the second for the y-co-ordinate. All blocks are read at once, though they define individual poly-lines or polygons. Furthermore:
  - ◻ The missing value 999.999 for a co-ordinate indicates a break in the line.
  - ◻ Polygons are recognised by the fact that the first pair of co-ordinates is identical to the last pair.
- ◇ *Scalar quantities on a curvilinear grid:*
  Files that are used for this purpose require at least three columns, the first two being the x- and y-co-ordinates of the vertex of the grid cell, the others quantities that are given *on these vertices*. Special features:
  - ◻ To make the subtype correspond to values defined on the vertex (*VALUE_AT_VERTEX*), the quantities are called "value 1", "value 2" etc. and they are read as extra parameters.
  - ◻ You can associate a particular *date and time* to a block of data by using a comment line before the block:

```
* Use the keyword to set the time to
* 1 January 1990, 10:00:
*
* time : 19900101 100000
*
BLOCK (will be ignored)
...
```

The time string must be given exactly as above, with a space before and after the colon. If no such comment is present or recognised, then a default time is used (starting at 1 January 1900, to make clear that actual date time information are missing).

- The grid information, that is, which cells are active, is defined implicitly, by the value of the first quantity. If this value is equal to the missing value, then the grid cell is considered inactive. Otherwise it is active. A consequence of this is: all quantities in all tables (blocks) must be defined on this same grid. In general, this condition will be satisfied, but it does mean that you can not combine such files arbitrarily.

◇ *Vector quantities on a curvilinear grid:*
The same format can be used to import *vector* quantities, such as the transport of matter or flow velocity. The difference is only, that the columns appearing after the co-ordinates are grouped in pairs and the vectors are called "vector 1", "vector 2" and so on. All other remarks hold just as in the case of scalar quantities.

◇ *Text at geographic locations:*
It is also possible to apply the TEKAL file format, if you want to read in text strings that should appear at a particular geographic location. The current implementation expects three columns, the first two the geographic co-ordinates, the last a string:

```
*
* Just some text to appear in the plot
*
BLOCK (will be ignored)
3   5
  1000.0   2000.0 "   Text 1"
   999.999  999.999   " is continued"
  2200.0   3000.0     Somewhere in the plot
   700.0   1000.0     Text 3
  3300.0   2020.0     /  Text 4    /
```

This type of data is called *geographic text* (by lack of a more suitable name) and it will be drawn at the location indicated. The plot routine that does this has several options for positioning the strings relative to the location and selecting the angle and text height.
We must make a number of remarks about this filetype:

- Lines can be up to 80 characters long.
- The strings are read without leading blanks, unless a delimiting character is used: any character that is not a letter or a digit and is repeated within the string (in the example above: the quotation marks (") and the slashes (/)).
- Only the first block is read from the file.
- The co-ordinates are grouped together and appear as one parameter, *texts*, whereas the strings appear as location names.
- Because of ODS conventions, the location names can be up to 19 characters long. If the string is longer, then it will be split into two, three or more locations. The co-ordinates associated with these extra locations are so-called missing values (the value 999.999). You may use this internal convention to join text strings (it might come in handy, in special cases).

Some caution must be observed: if the file contains empty lines or uncommented lines outside the tables, the reading routines may recognise extra blocks and give somewhat strange lists. So: whenever possible, follow the above format exactly.

5.3.2 Samples files

Yet two other filetypes are supported that share some of the characteristics of TEKAL files, in that the structure is very simple and you can edit them manually: the so-called *samples* files. Samples files are available in two types:

- ◇ *Observation points in a geographical area*
  These file have the following format:
  - ◻ Lines can be up to 80 characters long
  - ◻ Comments can be added at the beginning of the file by starting a line with an asterisk (∗) or a pound sign (#)
  - ◻ After the comments a line with the names of the columns may appear (they should be enclosed in quotation marks ("). Names for the first two columns will be ignored though, for technical reasons.
  - ◻ Unfortunately, no time information can be given yet.
  - ◻ Each line after these should have at least three numbers. The first two are the co-ordinates of the observation point, the rest are the values that were observed.
  - ◻ Values are separated by spaces, tabs or commas. Missing values can not be indicated by two consecutive tabs or commas though, a dot (.) or a question mark (?) is called for, to make the missing value visible.
    A small example:

```
<------- up to 1000 columns ------->
* Lines with * in the first column are comments
* Observation points: X,Y, Salinity, Temperature
*
    ''X''     ''Y''   ''Salinity''   ''Temperature''
  1000.   1000.      30.0          14.3
  1200.   1540.      31.2          14.5
  5210.    522.      25.62         17.5
  3111.    354.      22.62         18.9
```

  Remarks:
  - ◇ Lines that contain one single value, before the lines with actual data (always at least two numbers) are treated specially: the number on the last line is regarded as a scale value for the third column (this was introduced for the SHIPMA model).
  - ◇ A line with the names of the columns may appear only once in the file.
- ◇ *Data as function of some independent variable:*
  This filetype is very similar to the corresponding one-dimensional TEKAL file, except that it has no header stating the number of columns and rows and the first column is by convention the independent variable. This makes it unnecessary to pose another question to the user.
  All remarks for the observations points hold for this filetype as well, except that now, only the first column is special.
  If you want to represent a missing value, use a period (.) or a question mark (?) to indicate that an actual value is missing.
  The following is an example of such a file:

```
 <------- up to 1000 columns ------->
* Lines with * in the first column are comments
* Data as function of distance
* A question mark is a missing value
"Distance"  "Oxygen" "pH"    "Ammonia (mg/l)"
    21.         8.8     7.1       0.01
    54.         8.0     7.8       0.21
    77.         6.8     6.4       0.4
   113.          ?      6.4       0.4
    202.        4.5     6.0       1.2
```

- ◇ *Data as function of date/time:*

For this filetype the first two columns are interpreted as date and time, all others are interpreted as the value of some parameter at that date/time. You can use two different formats for the date and time columns, as shown in the example:

```
"DATE"       "TIME"     "salinity"  "temperature"
19990101     200000      30.0          12.0
20010201     210000      31.0          12.3
1991/03/02   21:20:00    29.0            ?
1998/02/01   11:12:11    29.1          11.32
```

Remark:

◇ To enable a smooth transition between the “old” TEKAL format and the “new” observations files, you can include the two lines that distinguish old-style TEKAL formats (without comments for identifying the columns), that is, the block name and the number of rows and columns. These lines are simply ignored. There is one condition though: in order to detect these extra lines, the program assumes that such a line starts with a letter in the first column. As this is typically true for the majority of such files, this was a simple criterion.

5.3.3 TEKAL time-series files

As stated above, TEKAL time-series files are treated somewhat special by the user-interface.

As this format does not include information about what these numbers are, the ODS routines that read these files use the following conventions:

◇ The blocks are supposed to refer to one parameter. The various columns refer to different locations.
◇ In case of a "time block" the first column contains the date in the so-called *yyyymmdd* format and the second column in the *hhmmss* format (see example).
◇ The block name may be up to 19 characters. The block name serves as the name of the parameter.
◇ Each block may be described by lines starting with an asterisk ($*$). If they contain the keyword "column" and a column number in the right position, the text on these lines is used for the names of the locations. (Important: this information is read with a fixed format, see next example.)

The user-interface of GPP will ask for the two columns that contain the date and time or it asks for the start time and the increment, depending on the actual type that was chosen (see Figure 5.1).

As an example, Table 4.1 has been converted to a TEKAL file:

```
 ....+....1....+....2....+....3....+....4 (column numbers)
*
* column    1 : Date and time
* column    3 : Station\_K4
* column    4 : Station\_QU2
*
b001 Measurements of bod
   7     4\]
19850721   80000     5.0       3.5
19850722  103500     6.5      21.5
19850723   81000     2.0       2.0
19850725  134300     3.4       1.0
19850801  122000     4.0     999.999
19850802  115500   999.999     3.0
```

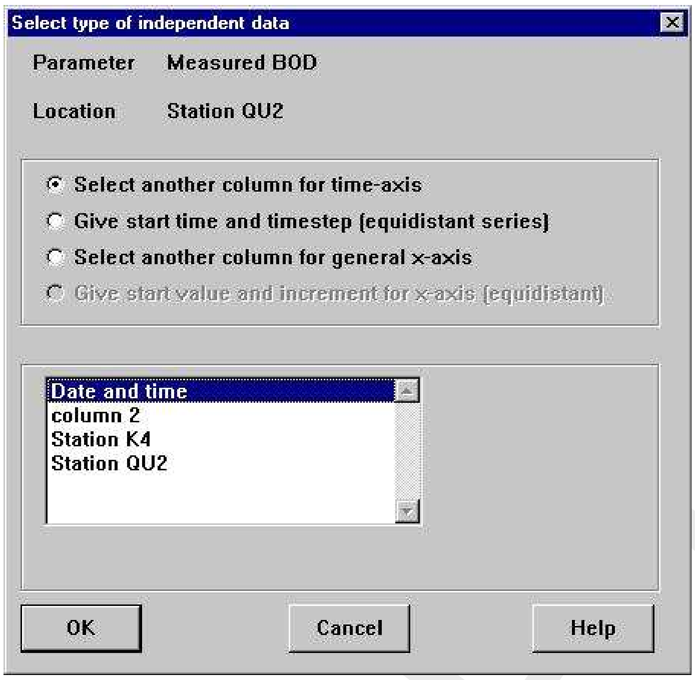

Select type of independent data
Parameter
Measured BOD
Location
Station QU2
Select another column for time-axis
Give start time and timestep (equidistant series)
Select another column for general x-axis
Give start value and increment for x-axis (equidistant)
Date and time
column 2
Station K4
Station QU2
OK
Cancel
Help

Figure 5.1: *Specifying time column of a TEKAL file*

```
19850805    72200     11.2        4.0
```

The table has seven rows and four columns. The date (given as `yyyymmdd`) and time (`hhmmss`) are distributed over two consecutive columns. The third and fourth columns contain the BOD concentration at stations K4 and QU2 respectively. The two entries in Table 4.1 that do not contain valid data are replaced by the special value 999.999, the so-called missing value. This value is skipped in all drawing routines. The graph is shown in Figure 4.1.

5.4 Other properties of the filetypes

As mentioned GPP uses the file <filetype.gpp> for defining the properties of the filetypes. Each filetype is defined by three sets of properties:

◇ *Presentation options*
This set of properties has to do with the way data sets read from these files are plotted. If a database contains measurement data only, it is likely that you want these data to be drawn as symbols, rather than as connected lines, or, on the other hand you may prefer model data always to be represented as lines without symbols. For this a separate section may be included which sets these properties.

◇ *Properties for the user-interface*
This set has been explained in the first section. It is the most "visible" one.

◇ *Special parameters*
This set of properties has to do with the meaning of the parameters in the file. For instance, vector quantities are defined in this way. The technical documentation contains more details. In general, it is enough to know that this can be done arbitrarily.

If you want to change this configuration file, you are free to do so. We suggest that you change things like the description of the filetype or the order in which the filetypes appear, so that they suit your system better: if you never use a model like *PHAROS*, why have the filetypes associated with that model appear in the list?

6 Layouts and plots

6.1 Layouts

In GPP you must select a layout to create a plot. By selecting a layout the following items are defined:

◇ the size and position of a graph
◇ the size and position of a legend to the graph
◇ an optional frame around the whole plot
◇ the orientation (portrait or landscape) of the plot

These items can not be changed from within the user-interface. They can be changed by editing the session file, though.

All layouts are defined in the file <layouts.gpp> which can be adapted to include user-defined layouts. Note that existing plots are not affected by such changes.

A layout is empty: it only defines where items will appear and what size they have (see Figure 6.1).

To show a data set you need to define a plot. A plot, you might say, is a filled-in layout (see Figure 6.2).

Because a layout may contain more than one area designated for graphical presentations, so-called *plot areas*, a data set must be assigned to a plot area, together with the appropriate presentation type. It is quite possible to combine more than one presentation type in a single plot area, to show, for instance, a model grid, a contour map and a vector field. What is important, however, is that the order in which the data sets are shown, is the order in which they were assigned to the plot area. So, if you select a contour map after a model grid, you will not see the grid, as the (filled) colour map is drawn on top.

There is currently no way to change the layout of a plot interactively and layouts that you define may not always be suitable for all types of plots, for instance because the legend and the text to a time axis overlap.

chapter 7, Customising GPP, describes what the layouts are made up of and how to make new layouts yourself.

6.2 How presentation routines co-operate

As explained in the introduction, you have to assign data sets together with the appropriate presentation forms to a plot area. You can combine all kinds of data sets in one single plot area, but there are certain restrictions. The routines responsible for the actual plotting are assumed to co-operate:

◇ The colours, symbols and so on they use for line graphs are chosen in a consistent way: the user must be able to influence these settings.
◇ If two or more data sets are drawn, they are drawn using the same type of axes with the same scaling.
◇ If a legend should be drawn, the legend area is used, as determined by the layout.

You might say, that the plot routines share the somewhat limited resources (see Figure 6.2):

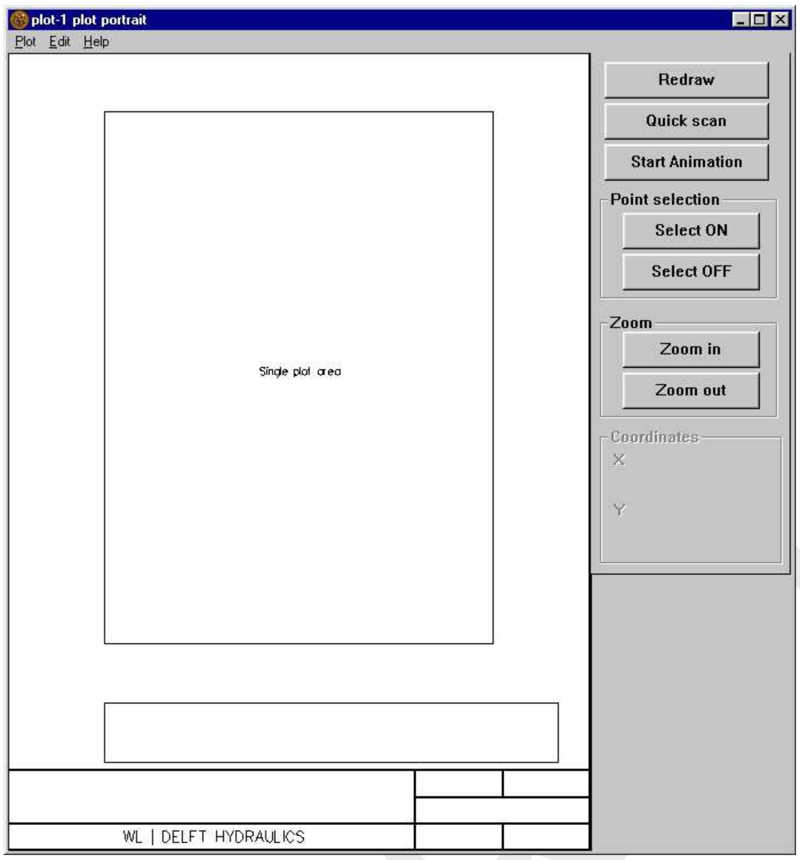


Figure 6.1: *Empty layout*

- ◇ four axes, one on each side of the plot area
- ◇ a legend area (if there is one)
- ◇ one single colour ramp
- ◇ one single set of line-styles, line colours and so on

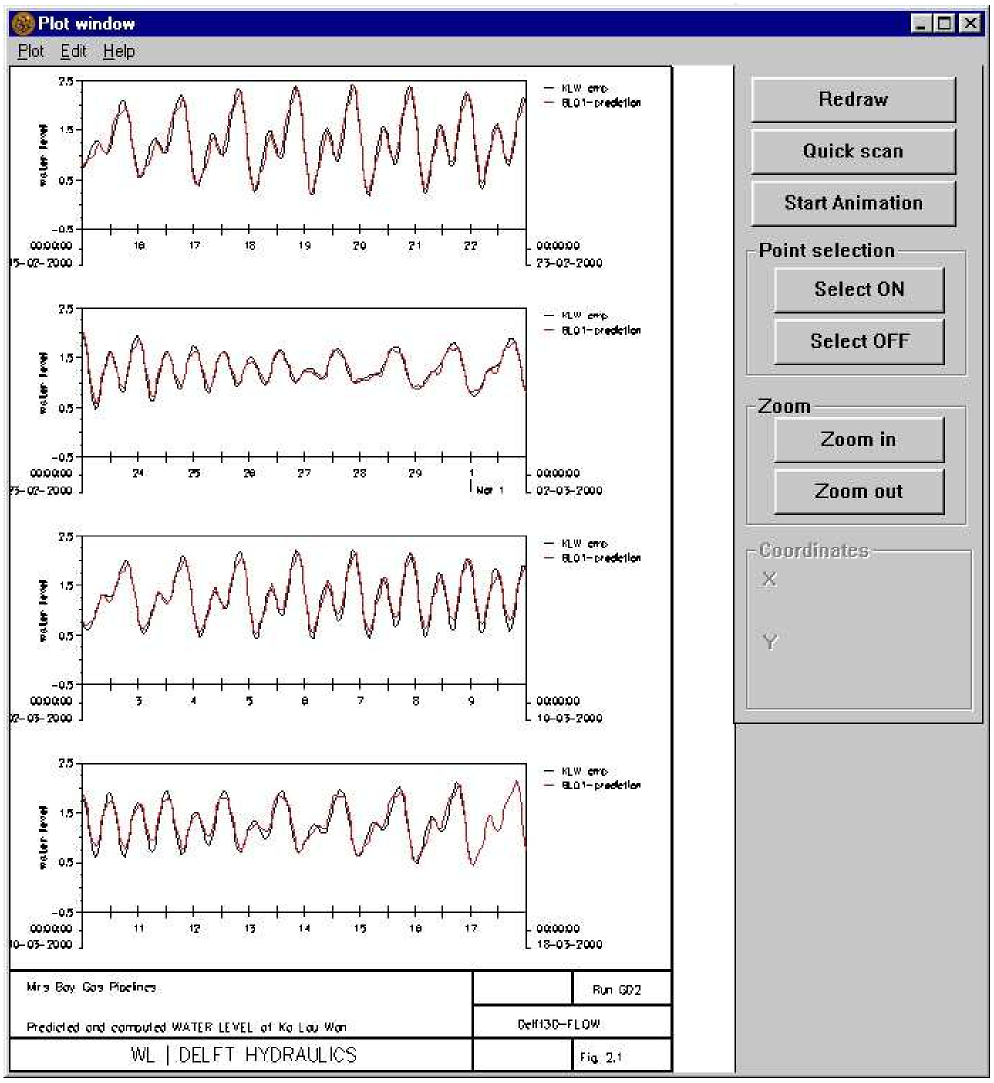
The implementation is as follows:

- ◇ First, each plot routine will specify the axes (which axes, what type and the scaling) on the basis of the associated data set. This information is combined into a common specification for all axes.
- ◇ Then each plot routine draws the data set:
  - ◻ it uses the set of line settings (as defined for that plot area!)
  - ◻ it uses the colour ramp (as chosen for that plotarea)
  - ◻ it specifies the legend entries
- ◇ When all this is completed, the general routines in GPP plot the axes and plot the legend (if there is one).

The actual plotting may be influenced by specific options other than the ones mentioned above. For instance: the routine to plot time-series has an option to use the right axis instead the left. The options to each routine are described in the separate appendices.

Note that GPP distinguishes the following types of axes:

- ◇ *Linear and logarithmic axis*



Mira Bay Gas Pipelines

Predicted and computed WATER LEVEL at Ko Lau Wan

WL | DELFT HYDRAULICS

Run G02

Delft3D-FLOW

Fig. 2.1

Figure 6.2: *Filled-in layout: the plot*

These types are used in xy-graphs and for the vertical axis in time-series plots.

◇ *Time axis*
This type of axis is used in time-series plots (it can only be horizontal, at the bottom of the plot area).

◇ *Geographic axes*
If a plot routine uses this type of axis, then a vertical and a horizontal axis have the same aspect ratio as the plot area. Specifying co-ordinates yourself (after double-clicking on an axis) will lead to unexpected results. Instead use the zoom functionally to achieve this.

◇ *Polar axes*
Some plot routines will use a polar co-ordinate system instead of a Cartesian (for instance to draw a spectrum of directions and frequencies).

◇ *Special axes*
For instance for plotting so-called limiting factors, a numerical axis is combined with an axis with textual labels.

Which type of axis is used is determined by the first plot routine in the plot area. As the axes are very characteristic of the plot, they should be properly taken care of. Some plot routines provide an option to set the type of axis, others always use the same type.

A plot routine like the one for plotting time-series, defines the bottom and left axis or the bottom and right axis, depending on an option. Therefore you can combine left and right vertical axes with different scaling (but with the same bottom axis).

The final scaling is the result of a combination of all data sets in the plot that use this particular axis.

7 Customising GPP

This chapter describes the use of the GPP configuration files and some other points:

◇ How to define printers and plotters (including some platform-dependent details).
◇ How to define layouts.
◇ How to set the default options for plot routines.
◇ How to change colours, line styles and so on.
◇ How to use GPP in an integrated environment and fine-tuning by command-line arguments.

7.1 Printing and plotting

7.1.1 Defining printers and plotters

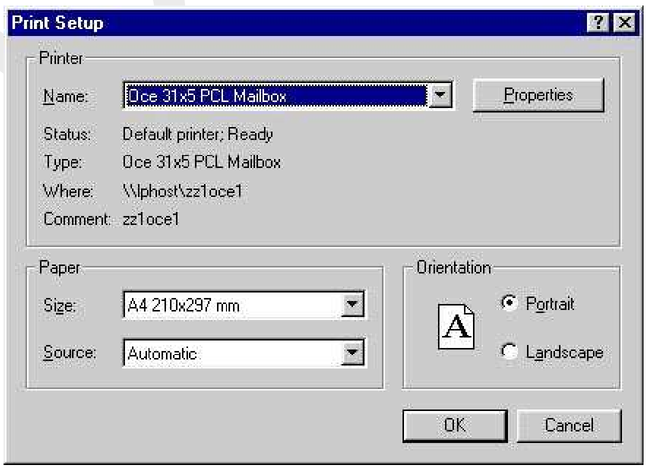
Under MS Windows the selection and definition of printers is handled directly by the operating system. You can define new printers via MS Windows utilities.

Linux workstations on the other hand do not provide such utilities, at least not for ordinary users. Such workstations have no way of knowing what the capabilities are of the printers that are attached and therefore the programs that use the printers or plotters are to a certain extent themselves responsible.

For this reason the set-up dialogue for the printers and plotters differs on both platforms. For MS Windows, you can set the standard or default printer via Windows' *standard* dialogue. For Linux workstations the default printer is identified via the environment variables LPDEST and PRINTER (see Appendix A).

When actually printing, the following dialogue comes up (Figure 7.1):

The list of printers and plotters in this dialogue, is taken from the configuration file <devices.gpp> (see section C.1 for details). It contains a list of printers and plotters and their properties. Important, but somewhat awkward properties are the paper size and the margins (see the example below). They differ for each printer type, unfortunately, and for the printer/plotter driver as well. To get correct values for a printer type not included in the installed list, you will have to experiment.



Name: Oce 31x5 PCL Mailbox
Status: Default printer; Ready
Type: Oce 31x5 PCL Mailbox
Where: \\lphost\zz1oce1
Comment: zz1oce1
Size: A4 210x297 mm
Source: Automatic
Orientation: [✓ Portrait] Landscape

Figure 7.1: Print setup dialogue

```
#
# \DGPP: definition of printers and plotters (what are their
# properties)
#
# Note: the margins depend on the device driver used. The margins
# in this file have been set correctly for the following drivers:
# - HP LaserJet III (HP/GL):    GHPL300
# - PostScript (A paper size):  HPOSTA
#
device 'print1 (HP LaserJet III (300dpi) )'
    type black-white                  # alternative: colour
    uniras-driver 'GHPL300'
    orientation portrait              # alternative: landscape
    hardcopy-size  270.0  180.0       # long, short side (in mm)
    left-margin      5.0
    right-margin     2.0
    top-margin      26.0
    bottom-margin    1.0
    print-command 'lp -dprint1 -oraw -onb' # option: -onb = no banner
end-device
#
# PostScript printer
#
device 'ps2 (Postscript HP laserjet III)'
    type black-white                  # alternative: colour
    uniras-driver 'HPOSTA'
    orientation portrait              # alternative: landscape
    hardcopy-size  297.0  210.0       # width, height in mm
    left-margin      0.0
    right-margin     0.0
    top-margin       0.0
    bottom-margin    0.0
    print-command 'lp -dps2 -opostscript -onb'
end-device
```

For both workstations and PCs you can save the plot in an external file by using the right “printer”. (Note that the “Delete” option for the print file is inoperative under Windows - if you select another printer than the default one, the print file is always saved whereas for the default printer there is ordinarily no print file.

Using this mechanism, you can create PostScript files containing the drawing and use them in reports later on.

7.1.2 Configuring printers for GPP

GPP uses a configuration file, called <devices.gpp>, that describes the properties of the printers and plotters that are available to GPP. This file is used under Windows, mainly to define output to PostScript files.

The reason for using such a file is simple: Linux systems provide no way, or at least no simple way, for an application to find out which printers and plotters are available and what their properties are. Thus, the configuration file contains the following information per printer:

- ◇ a descriptive string for the user
- ◇ the type of printer or plotter, colour or black-white
- ◇ the UNIRAS driver, which is a string identifying the software driver to be used, e.g. HPOSTA4 for black-white printers using A4-sized paper with postscript.
- ◇ the orientation of the paper (portrait or landscape)
- ◇ the size of the paper
- ◇ the margins to be respected

◇ the actual print command

All this information is necessary:

◇ The descriptive string should contain the logical name of the printer, so that GPP can link the printer to the default printer (LPDEST or PRINTER variable).
◇ The software driver creates the print file. If there is a mismatch between the printer's capability and the print file, this will result in a large stack of useless paper.
◇ The orientation of the paper is important as this is sometimes an option in the print command. *This must match the orientation of the layout. Hence make two descriptions for the printer: one for each orientation.*
◇ The actual print command and its options differs from system to system. Sometimes, a small correction to the print file is needed, because the offset is wrong.

7.1.3 Procedure for configuring a new printer or plotter

To configure a new printer or plotter:

◇ Find the description of a printer or plotter that resembles this new device.
◇ Copy the set of lines describing it and change the descriptive string so that the logical name (the one used in the environment variable LPDEST or PRINTER is contained in it).
◇ Change the print command so that the correct device is used. You can use "%s" to substitute the name of the print file (otherwise it is simply appended to the command string).
◇ If the printer is of the same type, you are done. Otherwise it is necessary to experiment with the margins (they correct for the bizarre and completely obscure relation between the printer's logical co-ordinate system and the actual position on paper).

If there is no matching description, try the most reliable printer command languages, PostScript and HPGL (the print files are ordinary text files). If your printer or plotter do not support either of these, then *filters* like GhostScript might be used.

Remark:

◇ The easiest way to get the margins right is to print an empty plot with a standard frame via GPP: on an A4 paper the frame lines should be positioned 2 cm from the left and 1 cm from the other sides. Then measuring the actual position of the lines on paper and calculating the diference should give you a fair indication of the correct margins.

Sometimes however, the useable area simply is not large enough. Then you will have set the margins to whatever values will make the lines visible.

Some PostScript printers, especially those that use the HTPIIA4S driver, require a correction of the origin. Check the script files "slpl" and others in the ./gpp directory on how this is done.

7.2 Anatomy of a layout

This section describes in some detail what a layout is made up of. Together with the description in Appendix C, you should be able to make new layouts yourself. (In future releases it may be possible to interactively make layouts.)

In the frame below a simple example is given of one particular layout. The details are explained afterwards.

Layouts have four general attributes:

◇ The units in which all positions and sizes are given: *centimetres, inches or "stretch"*.
The latter unit requires some explanation. Layouts with this attribute always fit the window or the paper in which they appear. Layouts with centimetres or inches as the unit attribute will keep the same form and thus are not always able to fill the region.

◇ *Whether or not a frame is present*:
If there is a standard frame it can be used to add descriptive text to the plot. The frame has a fixed layout which can not be changed (see Figure 7.1). An alternative is the simple frame that consists of a rectangle only.

◇ *The size*:
All layouts have a width and height, given in the appropriate units. These are used mainly to determine the aspect ratio. The actual size depends on the medium. For stretch units the width and height determine the scale of the co-ordinates and sizes (the relative measure).

◇ The orientation: *portrait or landscape*
The orientation on the screen, that is what is the long side and what is the short side is determined by this parameter. Complications arise because this is unfortunately independent of the actual orientation when printing or plotting on paper (that is determined by the printer or plotter driver). Be careful to choose a consistent combination.

```
#
#  GPP configuration: layouts
#
layout 'portrait-legend' 'One plot area with legend'
    units stretch
    size  18 27
    orientation portrait
    standard frame
    frame
       'company' 'DELFT HYDRAULICS' font 'simplex roman' 3.5 medium
                 'Black'
       'main text 1' ' '  default-font
       'main text 2' ' '  default-font
       'main text 3' ' '  default-font
       'upper left'  ' '  default-font
       'upper right' ' '  default-font
       'middle'      ' '  default-font
       'lower left'  ' '  default-font
       'lower right' ' '  default-font
    end-frame
    plot-area 'single-area' 'Single plot area'
       position  3  7
       size     12 19
       legend
          use datasetname
          position  2  3
          size     14  2
       end-legend
    end-plot area
 end-layout
```

Within a layout you may define plot areas, text areas and groups, these being convenient collections of other elements:

- ◇ *Plot areas:*
  These determine rectangles in the layout that can be used for plotting. The definition may contain a rectangle reserved for the legend as well. Note that legends are logically associated with a plot area, but they may be positioned anywhere.
- ◇ *Text areas:*
  Rectangles for putting extra text in the plot.
- ◇ *Groups:*
  Collections of layout elements that have the purpose of defining a new origin. All elements belonging to a group are positioned relative to the origin of the group. This allows you to move elements in the layout by changing the position of the group only.

There is no limit to the number of layout elements or the layouts (except memory), but in practice the available space becomes limiting quite fast. As a consequence, certain layouts are more suited for xy-graphs than others. Some are more suited for printing and others are more suited for display on the screen.

7.3 Default options for plot routines

All plot routines use one or more options that influence the appearance of the actual plot. These options can be set for each instance independently. Moreover the defaults can be set for your personal preferences as well. You can not define new options, but you can define "new" plot routines.

Suppose you often need plots of time-series with a right vertical axis. You can copy the definition of the plot routine in the file <routines.gpp>, edit the default value of the "new" plot routine and give it a unique description (see frame below). The *name* of the plot routine must remain the same, because this is the link to the actual subroutine that does the work.

You are quite free to do this, just as with the defaults. Note that you should not change the types of data sets that can be handled, as GPP might crash because of this. The routines expect certain types of data sets and are not always capable of determine whether a data set of the correct type has been supplied.

```
#
# Original plot routine "Plot Time series" has been copied
# - use right axis by default
#
#             (name is the same) (description is unique)
plot-routine 'PlotTimeseries'   'Plot Time series (right)'
    no-topography
    accepts-data sets
       'TIMESERIES' 'SINGLE'
       'TIMESERIES' 'MULTIPLE'
    end-data sets
    options                               \# Changed default
       logical 'UseAxisRight'  'Use right axis'   TRUE
       .... (other options)
    end-options
end-routine
```

7.4 Graphical settings

The file <setting.gpp>, which is explained in detail in Appendix C.5, contains the graphical settings. As with all the other configuration files, you can adjust it according to your wishes. It contains quite some information, but the following items may be of most interest:

◇ *Colours:*
  The *colours* section contains the name and the definition (for instance in RGB values from 0 to 255) of the colours to be used. You should not define too many colours, say more than 50, as the internal colour table has only 220 free entries and you need space for the colour ramps as well.
◇ *Colour ramps:*
  Colour ramps are sequences of colours used by any plot routine that needs such sequences. You can define any number of colour ramps, but the total number of colours in the colour ramps plus the colours from the *colours* section must not exceed 220 say. If there are too many, the list is truncated.
◇ *Line-styles:*
  Line-styles are used when a time-series or a similar interconnected series of points is drawn. Each line style can have:
  - a line type (one of the predefined types)
  - a thickness (in mm)
  - a colour (one of the colours defined in the *colours* section)
  - a symbol (one of the symbols defined in the *symbols* section)
◇ *Global parameters:*
  There is a collection of "global" parameters that allow you to set values for such things as:
  - the colour-ramp to be used with contour maps and isolines
  - the unit for geographic axes (either meters or kilometers)
  - the orientation of polar axes (either clockwise or counter-clockwise, or a nautical versus mathematical orientation)
  - the language for month names
  - what "escape" characters to use for superscripts and subscripts in text
  - the relative sizes for a customised frame
◇ Some can be changed via the user-interface, some can not

You are free to define or change any of these, but you must be aware that changing the settings may affect the existing plots in the state file.

An example of the above mentioned sections is shown below. Apart from these settings themselves, you can control the occurrence of lines, colours and symbols in two other ways:

◇ for each type of device (screen, black-white printer or plotter, colour printer or plotter)
◇ for each set of filetypes (the presentation section in the definition of the models and their filetypes)

The first is meant to help optimise the appearance of the picture on any output device. The latter is meant to help distinguish, for instance, data sets from measurements (typically presented as symbols) and data sets from numerical models (typically presented as lines).

```
#
# Colours section - the names are used in the other sections!
#
colours
     'Black'            0   0   0
     ’Red’             255   0   0
     ’Darkred’         127   0   0
     ’Green’             0 255   0
     ’Lightgreen’      200 255 200
     ’Darkblue’          0   0 127
     ’Blue’              0   0 255
     ’Cyan’              0 255 255
     ’Magenta’         255   0 211
     ’White’           255 255 255
     ...
end-colours
... (sections for fonts, linetypes)
colour-ramps
    colour-ramp ’Rainbow’
       ’Darkblue’
       ’Blue’
       ’Cyan’
       ’Green’
       ’Lightgreen’
       ’Yellow’
       ’Orange’
       ’Red’
       ’Magenta’
    end-colour-ramp
    ...
end-colour-ramps
 ... (several sections left out)
default-settings
 ... (several options left out)
    colour-ramp            ’Rainbow’
    #
    # Unit for geographical axes:
    # either meters or kilometers
    #
    geographic-axis-unit kilometers   # Alternatives:
                                      # kilometers or meters
    #
    # Orientation for polar axes:
    # either clockwise or counter-clockwise
    #
    orientation-polar-axis   clockwise
                   # Alternatives: clock-wise or counter-clockwise
    #
    # Language for months on the time axis
    # either dutch or english
    #
    language-for-months      english
                                # Alternatives: dutch or english
    #
    # Escape characters:
    # When used in a text string, the next character
    # will be subscripted or superscripted.
    # Choose the characters with care - they can
    # not be used in the text
    #
    subscript-escape   ’`’
    superscript-escape ’\^{}’
    #
    # Custom frames (text boxes):
    # Modelled after the standard frame,
    # but with variable width and height
    #
    custom-frame-width      10.0 # <cm>
    custom-frame-height      3.0 # <cm>
    custom-frame-side      right # Alternatives: left, right
    custom-frame-part1      70   # Percentage of total
    custom-frame-part2      30   # Percentage of total
    custom-frame-part3       0   # Percentage of total
    #
    # For MS Windows we offer a crude method to influence the
    # margins used for printing plots with a frame
    # (as "devices.gpp" is not used for the system printer)
    #
    mswindows-margin-left    0.0  # mm
    mswindows-margin-right   0.0  # mm
    mswindows-margin-top     0.0  # mm
    mswindows-margin-bottom  0.0  # mm
end-default-settings

series                               # line thickness (mm)
    'solid  - black' 'Black' 'no symbol' 'solid'    0.1
    'solid  - red'   'Red'   'no symbol' 'solid'    0.1
    'noline x black' 'Black' 'cross'     'no line'  0.1
    'noline + black' 'Black' 'plus'      'no line'  0.1
    'dotted - black' 'Black' 'no symbol' 'dotted'   0.1
    'dashed - green' 'Green' 'no symbol' 'dashed'   0.1
end-series
```

7.5 Working environment

7.5.1 Directories and files for GPP

GPP uses a number of so-called configuration files and they have to be located in some known directory. GPP reads data files and stores the session files. Quite often you can just rely on the defaults. But if you want to use specific configuration files, then you can do so by starting GPP with one or more command line arguments like *-workdir <directory>* (see Appendix A). The idea is:

◇ The configuration files are found in some fixed directory: the directory where you installed the program. It is called the system directory.
◇ You start the program in some arbitrary directory and you want to use the files in that directory.
◇ This directory may not be a directory where you can write files (because you are not the owner). So GPP distinguishes a working directory as well.

Thus:

◇ At start-up the configuration files are read from the *system directory*.
◇ The state file is read from and written to the *work directory*.
◇ Files that you import are found in the current directory, which may change as you move through the directory structure.

The *current directory* is not well-defined under MS Windows or else it is always the Windows system directory, unless you explicitly specify a different location. So you need to specify it yourself, for instance by setting it in the properties of an item in the Start menu.

7.5.2 File types and file names

The files that GPP can read come in roughly three categories:

◇ Ordinary “text” files, that is, files that you can read and write using an ordinary editor like *notepad* on Windows or *vi* on Linux.
◇ Binary files with a platform-independent structure or
◇ a structure that in practice is platform-independent.

This means that in practice GPP on Linux can read all files produced on Windows and vice versa.[1]

File names and their exact location are a different matter:

◇ Linux uses case-sensitive names for both files and directories. The full directory name starts with /
◇ Windows uses case-preserving names and the full directory name starts with “c:\” (or some other drive).
◇ To make sure that the proper files are read, GPP stores the full name (file name and the directory that contains it) internally and in the session files. If you move the files to a different location (a different computer for instance), you may have to edit the session file – GPP does, however, accept relative names, like “..\..\data\myresult.dat”.

7.5.3 Description files

Apart from a stand-alone program, GPP offers the facility to work in a so-called integrated environment. In such an environment, you are not confronted with the peculiarities of the underlying operating system, but is shown a user-interface from which you operate the programs without having to know precisely which files to edit and which programs to run. In such an environment, you do not know the names of the files or their location.

The assumption made by GPP is that the integrated environment organises the files in some sort of hierarchy. For example: the environment supports a simple scenario or case management, keeping track of data files for different models and different cases. One possible classification can be:

◇ Files from different models, but belonging to the same case, are recognised by a short description of the case.
◇ Files should also be grouped for the different models as not everybody is interested in all model output all of the time.

Hence, some hierarchy is used, which appears "natural" to the user of the system. This hierarchy can be made clear to GPP by passing it the name of a so-called description file:

```
gpp -descfile exmpl.dsc
```

Instead of showing the raw file names, it will show you the files listed in the description file only. A simple example is shown below.

```
#
# Example description file
#
```

[1]Currently, the Solaris and SGI platforms ares not supported anymore. On these platforms it is possible to produce files with an incompatible internal structure, due to the different byte ordering. The different line endings in Linux and Windows do not matter however

```
begin 'Water quality results'
"del01.his" 'case 1: basic situation'
"del02.his" 'case 2: 10\% growth of waste loads'
"del03.his" 'case 3: realisation of all policies'
end
begin 'Waste loads'
"../waste/inp01.tek" 'case 1: basic situation'
"../waste/inp5a.tek" 'case 3: realisation of all policies'
"../data/meas\_r2.tek" 'measured waste loads (1993)'
end
...
```

8 Advanced features

This chapter describes a number of features that are useful when you want to:

◇ standardise the pictures or use batch editing, in general, create large numbers of pictures with as little actions as possible
◇ create animation files that are useful for presentations

8.1 Standardising pictures

In many cases, certainly when evaluating the results of several model calculations, or preparing a report with a large number of plots, you will want to minimise the effort to produce these pictures. Another requirement is that they be uniform - use the same plot layout, graphical settings etc. GPP has several features that can be employed. We will discuss them one by one.

8.1.1 Batch processing

Within GPP, *batch processing* is loosely defined as printing without you having to select the plots manually. This can be achieved by the command-line option *-batch*, followed by the name of a session file. If this is specified, GPP will read the session file, print all pictures it contains to the default printer and terminate when this is done. You need do nothing, except wait for it finish.

We must make some remarks about the usage of this option:

◇ On Linux the printer or plotter can be specified by a second option: *-printer*, followed by a printer name defined in the <devices.gpp> file. Unfortunately, this can not be done on PC: the printer that will be used is the default printer.
◇ Though you can not do anything, for technical reasons, the program will still come up with the start-up screen and the main window.
◇ If, under Linux, the window manager asks you to place windows interactively, then the appearance of the main window necessitates at least this action from you. The cause is the policy of the window manager. If you want to use this facility, make sure the windows appear on screen without interaction. (Under the Motif window manager, this is the *InteractivePlacement* property which should be false.)

8.1.2 Editing the session file

A second step in reducing the effort to produce pictures is editing a state/session file *outside* the user-interface of GPP. To understand this, note the following:

◇ The state/session file is a text file which is divided in blocks. Each block contains other blocks defining parts of a data set or a plot.
◇ By manipulating these blocks you can create a new session file that contains different data sets from different files in different plots.
◇ Because the session file is made up of blocks, an edit program could manipulate individual lines as well as blocks of lines. For example: replace the list of class values for contours by a standard list or add the lines defining a land boundary data set to each plot area of interest, so that each plot will contain the land boundary.

We will list a number of possible edit actions in detail:

◇ If you have prepared plots from one data file and you want to get the same sort of plots for another file (of the same type), then you can *replace* the name of the file(s) in the definition

of the data sets.
For instance:
The original data set is defined as (results from calculation 1):

```
dataset-def 'NH4'
    model      'DELWAQ'
    filetype   'ODS_DELWAQ_HIS_BIN'
    file       "scen1.his" "" ""  end-files
    parameter  'NH4'
    all-times
    location   'noordw 4/10'
end-dataset-def
```

You can simply change the file name and read the new session file:

```
dataset-def 'NH4'
    model      'DELWAQ'
    filetype   'ODS_DELWAQ_HIS_BIN'
    file       "scen2.his" "" ""  end-files
    parameter  'NH4'
    all-times
    location   'noordw 4/10'
end-dataset-def
```

Warnings:

- This can only be done with files of the same type. GPP will not verify this, nor in some cases would be able to do so.
- If a parameter is asked for that does not exist in the new file, then the data set can not be defined. Similarly, locations have to match. Times are matched by looking for the one equal or just later than the one asked for.

◇ If you have data from one location, parameter, layer or time and you want to see the data for another location, parameter, layer or time. One way to proceed is:

- Create a data set that contains all locations, parameters, layers or times that you might be interested in:
  - For locations and times, this is simple: *do not select a single location or time, but click Create directly.*
  - For parameters, this will depend on the file type: some file types can produce so-called hierarchical parameters, such as the D-Water Quality balances file and the PHAROS files.
  - For layers you need not do anything special.
- Insert a block for creating a *resultant dataset*.

For instance:

```
resultant-dataset 'NH4 (tersch 4/10)'
    selection 'SelectLocation'
    operand 'NH4'
    options
        logical 'Interactive' false
        string 'SelectedString1' 'tersch 4/10'
    end-options
end-resultant-dataset
```

Another way is:

- Copy the definition of a data set and change the name of the parameter, the location or the time value.
- Adjust the name of the data set (as they must be unique)

For example:

```
dataset-def 'NO3'
    model      'DELWAQ'
    filetype   'ODS_DELWAQ_HIS_BIN'
    file       "scen1.his" "" ""  end-files
    parameter  'NO3'
    all-times
    location   'noordw 4/10'
end-dataset-def
```

Warning:

- You need to give the new data set a unique name and use that whenever you use it in a plot.

◇ If you want to use a different data set in a plot, but with the same plot routine and the same options, then you can simply replace the name of the old data set with the new one.
Warning:

- The new data set must be of the same type and subtype as the previous one. GPP will assume that is the case. Difficulties arise, from strange plots to program crashes, should this not be the case.[1]

◇ If you use a different data set, the axes may not have an appropriate scaling or the contour classes may not match the values:

- By setting the axis type of any axis to *unknown-axis*, rather than to *linear-axis* and so on, you force a re-scaling of the axis.
- By replacing the list of values for contour classes by the single keyword *automatic-scaling*, you force re-evaluation of the contour classes.

If you require a uniform zoom area for contour plots and such, you can copy the axis definitions for a plot area that is to your liking to any others using similar type axes.
Warnings:

- The sizes of the plot area are important, as the limits for the horizontal and vertical geographic axes are coupled. Use this only for plot areas with *the same aspect ratio*.
- If the aspect ratio is slightly off, you may change the type of the axes into linear in stead of geographic. By doing so you break the connection (the risk is that the picture gets distorted a bit). It may be safer to try and resize the plot area itself.

◇ An alternative method is to create a dedicated layout. The layout will then contain the axes definitions and they will be copied in directly by the user-interface (see the next section).
◇ If you want to add a set of standard data sets (like land boundaries) to each plot area, you can do so by copying the lines *dataset ...* to *end-dataset* that put such a data set with the associated plot routine into the plot. The order in which such blocks appear in the plot definition is the order in which they will be drawn.

Warning:

◇ When you edit a session file yourself, you must make sure that the syntax is correct. GPP will warn about syntax errors and stop reading the file. Something GPP will *not* do is check whether data sets are indeed compatible:

◇ When a link to a topographical data set (better known as a grid data set) is encountered in the definition of a data set, there is no check if this is indeed compatible with the data set itself.
◇ When a binary operation, like addition, is specified, again there is no check whether the two data sets are indeed compatible.

[1]Actually, the condition is a bit more relaxed than this. The given condition is the simplest and the safest. To check the type and subtype: see the definition of the data set in the state/session file. Unfortunately, this does not work with the resultant data sets.

◇ There is, in general, no way to make sure that the data files are of the same type as stated in the definition.

These checks should be built in to make the editing of session files safer. Right now, these are the caveats you must deal with. Especially the last one is of importance!

8.1.3 Using dedicated layouts

A layout defines the position of plot areas, the (default) contents of the frame and so on. Internally, the data structure for a layout is also used for keeping information about the plots. As the plots need to retain information about the extreme axis co-ordinates and other parameters for the *plot area,* this information is actually part of the data structure for the *layout*. In other words, layouts may now also define the *default* axis settings: colours, visibility, but also the extreme co-ordinates, in fact anything there is to tell about plot areas and the associated axes except for the data sets and plot routines.

Using this new feature, the layouts may be specialised in such a way that you can zoom in on a fixed area, if you specify default axis settings via the layout. Simply copy the lines that define the axis settings from a plot definition into a (new) layout and any data set that is drawn in that particular plot area will be plotted using these very same co-ordinates. This works not only with geographical axes, but in fact with any axes.

It does have one drawback: the layout becomes dedicated to a particular type of plot, and you will be forced to be careful about the sort of presentations you use in it. (Currently, there is no fully operational auxiliary program that helps you with the editing.[2])

Below is an example of a *filled-in* layout:

```
layout 'portrait-filledin' 'Partly filled in, with legend'
    units stretch
    size  18 27
    orientation portrait
    no frame
    plotarea 'single-area' 'Single plot area'
       position  3  7
       size     12 19
       legend
          position  2  3
          size     14  2
       end-legend
       #
       # Define the default axes
       #
       default-area-settings
       axis bottom
          type     time-axis
          visible  yes
          text     ''
          start    1997/02/05 12:00:00
          stop     1997/02/11 12:00:00
          stepsize 1:00:00:00
          default-axis-settings
       end-axis
       axis left
          type     linear-axis
```

[2]You can use scripting languages like AWK or Perl to achieve the automated editing via small dedicated programs. This is the most practical solution, but thus require some programming skill. An example is shown in Appendix E.

```
          visible  yes
          text     ''
          start    7100
          stop     7350
          stepsize 25
          default-axis-settings
       end-axis
    end-plotarea
end-layout
```

Note that this is simply an example and has no particular meaning.

This makes a layout more specific. The reverse situation occurs with the definition of plots. These specify precisely what numbers to use on the axes. It would be nice, to allow some automatic scaling, when putting in a different data set than the one(s) used to define the plot. This can now be done: *by replacing the type of the axis in question by the keyword "unknown-axis"*. This triggers the scaling algorithm to use the actual scaling information from the data sets in the plot area, rather than rely on the values from the definition.

The last remark about layouts concerns the positioning of the legend. Normally, the position is given with respect to the lower-left corner of the whole plot, as is the position of the plot area to which it belongs. By using the keyword *relative-position* instead of *position* you can place it with respect to the lower left corner of the plot area. Thus it is easier to vary the layout:

```
plotarea 'single-area' 'Single plot area'
    position  3  7
    size     12 19
    legend
        relative-position -1 -4
        size              14  2
    end-legend
```

8.2 Creating animations

Creating animation files is relatively simple, but the procedure is a bit special and there are some pitfalls some of which are platform dependent. This section will clarify both the procedure and the pitfalls.

The procedure can be divided in three steps:

◇ create data sets that contain several time steps so that the results can be drawn for these times
◇ prepare individual pictures (or frames) for each time
◇ create the animation file from the individual frames

Suppose you have a file that contains the salinity over a whole model grid and several times. Rather than selecting the parameter *and* a time in the dialogue to add new data sets (click *Add* in the Data Group *Datasets*), you simply select the parameter and *do not select a time*. This will result in a data set defined over the grid with more than one time. Such a data set can not be drawn directly, instead you are asked to select a time when adding the data set to a plot.

Select a time (this needs not be the first time), prepare the whole plot, by adding a land boundary, changing the plot options etc. When you are satisfied (see the pitfalls), then click *Start animation* (Step 2). The result of this action is that the data for the first time are drawn and the picture is stored in a bitmap file, then the data for the next time are retrieved and drawn. The new picture is stored in another file and so on. When the hourglass disappears, all times will have been treated this way and a series of picture files results.

These files are called <anim0001.xwd>, <anim0002.xwd>, <. . . > (on Linux) and <anim0001.bmp>, <anim0002.bmp>, <. . . > (on MS Windows). They are found in the work directory. The files are either in XWD-format or in the Windows bitmap format. Specialised programs, such as ImageMagick's *convert* can be used to create a very compact animation file (Step 3)[3] Other programs create AVI-files, a file format popular with Windows multimedia applications. The drawback is that the file seems to be about as large as the sum of the original bitmaps.

It is beyond the intentions of this manual to discuss further the advantages and disadvantages of the various programs. Many freeware and shareware programs exist, but the tools from ImageMagick give very good results.

It is more important at the moment to know the pitfalls of the procedure within GPP:

◇ Once started, the animation can not be stopped in an elegant way. You can stop it, though, by closing the window from the system menu.
◇ Data sets that are used in an animation do not, currently, retain the original time, but rather refer to the last time. When preparing a different plot, you should keep this in mind.
◇ Automatic scaling of, for instance, contour classes is based on the *first time step shown*, not on the data in the whole time frame. So either choose a representative time or change the contour levels manually.
◇ Existing animation files will not be overwritten, rather the count is increased until a gap is found. GPP does not give any warnings about it.
◇ When making an animation of different data sets in the same plotarea, the various data sets should have the same time information (i.e. start and stop time, and time interval).
◇ When making an animation of a plot with more than one plotarea, all plotareas should be filled-in.

8.3 Facilities for making animations

It has long been possible within GPP to create picture files for each timestep in a data set. However, converting these picture files into a single animation file, such as an AVI file or an MPEG file was not supported via GPP. The reason for this is that there are many programs available that can do this conversion and every user was supposed to find an appropriate solution for themselves. For the Linux platform, a popular choice for such a conversion program is ImageMagick's convert (http://www.imagemagick.org). For MS Windows there are many free and commercial products available. Unfortunately most come with a GUI that helps you select and order the individual frames but they do not allow you to specify them via a batch file.

The solution described below does make it possible to automate the conversion process on MS Windows. It relies on a program called VideoMach. As this is a commercial product, you will have to get a trial version yourself and decide if this is something you want to continue to use (http://www.gromada.com/videomach.html). But it at least gives a smooth procedure to turn the frames into an AVI file.

The procedure is simple:[4]

◇ Create a session file with the data sets you want to show
◇ Prepare the picture that is to be animated *as the first plot*

[3]The procedure for creating an animation is described in more detail in Appendix D.
[4]By courtey of S. Luger, CSIR South Africa.

- ◇ Store the data sets and the plot in a session file

Then run the batch file "gpp_animate.bat" with the name of the session file as its argument (you will find this batch file in the directory ...\delft3d\w32\gpp\bin\):

```
C:\> gpp-animate.bat filename.ssn
```

This will start GPP with a number of command-line options:

- ◇ *-animate* to start the animation for the first plot
- ◇ *-plotsize* to set the width and height of the plot window to convenient values

When the animation is completed, one or more frames remain on disk and the conversion program is started. The end result is an AVI file.

8.4 Automatically exporting data sets

It is possible to automate the export of data sets. This is especially useful if you need the data from several data sets in a different format for further analysis. The method for doing this consists of the following steps:

- ◇ Define the data sets and store the definitions in a session file
- ◇ Insert blocks like the one below into the session file (by using an ordinary text editor), these blocks should come after the data set they refer to:

```
export
    dataset 'name of dataset'
    to-file 'filename'
    export-routine 'WriteTimeseries'
    options
       # If needed
    end-options
end-export
```

- ◇ Load the session file into GPP. During the loading process, the export functions will be executed as indicated by the *export* blocks. (You can of course do this via the batch option too.)

The format of the *export* blocks is straightforward:

- ◇ A block starts with the keyword export and ends with the keyword end-export.
- ◇ Within the block you need to indicate what data set to export, what export routine to use and to what file to write the data.
- ◇ Because several export routines have options that control their operation, you need to specify a block of options too.

The names of the export routines (not the descriptions) and the corresponding options can be found in the *routines.gpp* file. For completeness, here are a few examples:

- ◇ Exporting a timeseries to a file which uses spaces to separate the values:

```
export
    dataset 'name of dataset'
    to-file 'filename'
    export-routine 'WriteTimeseries'
    options
    end-options
 end-export
```

◇ Exporting a time-series to a file which uses tabs to separate the values (a format commonly used by such programs as MicroSoft Excel):

```
export
    dataset 'name of dataset'
    to-file 'filename'
    export-routine 'WriteTimeseries'
    options
        list `SeparatorType' 'tab'
    end-options
end-export
```

(If you want a comma instead, use *'comma'* as the value to the option '*SeparatorType'*.)

◇ Exporting a time-series to a "TEKAL" file (one with a simple tabular structure):

```
export
    dataset 'name of dataset'
    to-file 'filename'
    export-routine 'WriteTSTekal'
    options
    end-options
end-export
```

(If you want a comma instead, use *'comma'* as the value to the option '*SeparatorType'*.)

◇ Exporting a 2D data set to a "TEKAL" file:

```
export
    dataset 'name of dataset'
    to-file 'filename'
    export-routine 'WriteMAP2DTekal'
    options
    end-options
end-export
```

(In most cases, there is no option required.)
Though the list above is not exhaustive, it does include the most common types of output.

8.5 Automating tasks

As of version 2.11 GPP provides several so-called scripting interfaces, which enable sophisticated automation and customisation of tasks. For this it uses the Tool Command Language or Tcl, which is a very simple yet flexible and powerful language.

Scripts are *interpreted* rather than *compiled* programs or routines and this makes it possible to extend the program without having to recompile and link. Instead the program reads the source code at start-up and executes it when asked. Another advantage of scripting is that it can hide many of the tedious details from the casual programmer, making the source code more concise and easier to read and write.

You can distinguish two sets of scripting capabilities. The first set is more or less an alternative to the user-interface: rather than interactively define data sets and plot, you can use the scripting interface to programmatically define them and thereby automate the tasks. *This has not been implemented to its full potential yet* and we mention it *pro memorie*.

The other set allows you to define your own routines for presenting and exporting the data sets. This is the subject of the next section.

8.6 Defining your own plot and export routines

Via the scripting interface you can define a routine to plot a particular data set or to export the contents to a file. For instance: GPP does not contain a plot routine that draws a truncated Fourier series (that is: the time-series is fitted to a Fourier series with only a few terms and that series is then drawn). With the scripting interface, you can define such a routine yourself and add it to GPP.

When you use the scripting interface to define new plotting or exporting routines, you need to follow a simple protocol:

◇ For plotting routines, there are two steps:

  - Specify the co-ordinates for the axes and what kind of axes should be used
  - Draw the data set

  The reason for these two steps is simple: the axes are a common resource, they are shared by all the data sets that are plotted within the plot area – this way you can combine two or more time series for instance in one graph. The first step allows GPP to make a common scaling and the second step allows the individual routines to use this scaling.

◇ For exporting routines, there is only one step:

  - Write the data in the form you want to the external file

  The file to which the data should be written is managed by GPP, so there is no need to open or close it.

◇ The routines must be registered within GPP. For this, there is a simple mechanism:

  - Use the *plot-routine* command to register a new plotting routine
  - Use the *export-routine* command to register a new export routine
  - Both commands have the same interface (modelled after the blocks in <routines.gpp> – see section C.4):

    - A formal name (for recognition in the session file, this must be unique)
    - A title (for display in the user-interface)
    - A list of acceptable types for topographical data sets
    - A list of acceptable types for ordinary data sets
    - A list of options
    - The code for the routine

  Here is an example:

```
plot-routine PlotTest "Plot Cumulative Distribution" {} \
    {TIMESERIES SINGLE} {} {
    PlotTest $mode
 }
```

Let us examine a simple example: a routine to draw the (estimated) cumulative distribution for a time-series:

First step (mode “specify”):

◇ We need to determine the range for the horizontal axis. So we get the values from the data set via the command “dataset data” and examine them in the “foreach” loop.
◇ We take the range for the vertical axis to be 0 to number of values.

Second step (mode “draw”):

◇ We need to determine the rank of each value in the time-series – get the values and sort them in ascending order (via the lsort command).
◇ We then loop over the sorted values and draw the line segments, where the vertical co-ordinate is the index in the list. This way we get a raw estimate of the cumulative distribution.

Here is the code:

```
proc PlotCumulativeDistribution {mode} {
    #
    # Determine the extremes
    #
    if { mode == "specify" } {
       set vmin  1.0e20
       set vmax -1.0e20
       set count 0
       foreach value [dataset data] {
          if { $vmin > $value } {
             set $vmin $value
          }
          if { $vmax < $value } {
             set $vmax $value
          }
          incr count
       }

       #
       # Define the axes that we want to use
       #
       setaxis bottom linear vmin vmax
       setaxis left   linear 0     count
    }

    #
    # The actual drawing part
    #
    if { \mode == "draw" } {
       #
       # Select the axes, so that we can use ''natural'' coordinates
       #
       useaxes bottom left;# in that order

       set count 0
       set sorted [lsort --real [dataset data]]
       foreach value $sorted {
          if { count == 0 } {
             set xend   $value
             set yend   $count
          } else {
             set xbgn   $xend
             set ybgn   $yend
             set xend   $value
             set yend   $count
             plotline $xbgn $ybgn $xend $yend
          }
          incr count
       }
    }
}
```

If we want to export this distribution to an external file, then we could do this via the following routine (its one argument is the handle to the output file):

```
proc WriteCumulativeDistribution {outfile} {
    set count 0
    set sorted [lsort --real [dataset data]]
    foreach value $sorted {
       puts outfile ''$count\t$value''
       incr count
```

```
        }
}
```

Note that we use a tab (\t) to separate the two values. The routine could be enhanced by also writing information about the data set in question and so on.

8.6.1 Script commands

For plotting the following commands are available, besides the general commands of the scripting language:

- ◇ *plotline x1 y1 x2 y2*
  Plot a straight line segment from (x1,y1) to (x2,y2)
- ◇ *plottext x y string*
  Plot the text string at position (x,y)
- ◇ *setcolour colour*
  Set the colour for drawing or filling. The colour argument can be a name or an index as returned for colour options.
- ◇ *setthickness thickn*
  Set the line thickness (in mm).
- ◇ *getarea*
  Returns a list of four numbers: the minimum x and y co-ordinates of the plot area and the width and height (all in mm).
- ◇ *getworldcoords*
  Returns a list of four numbers: the minimum and maximum x co-ordinates and the minimum and maximum y co-ordinates of the current world co-ordinate system.
- ◇ *setaxis which type min max step*
  Let the axis at *which* side (bottom, left, right or top) from *min* to *max* (at least) with optionally a stepsize of *step*. The type of axis is *type* (linear, logarithmic, time, geographic or polar).
- ◇ *useaxes horiz vert*
  Select which axes to use when drawing (where *horiz* is either "bottom" or "top" and *vert* is either "left" or "right")
- ◇ *dataset subcommand*
  Get information about the data set to be drawn. The subcommand determines what information is returned:

name:	return the name of the data set
parameters:	return the names of the parameters it contains (as a list)
locations:	return the names of the locations it contains (if any, as a list)
times:	return the times it contains (as a list)
data:	return the data it contains (as a list)

- ◇ *getoption name*
  Return the value of the named option. If there is no such option, an error is raised.

For exporting only the *dataset* and the *getoption* commands are available (as they have nothing to do with plotting).

9 Installation

Installing GPP is simple: most of it is taken care when you install the Delft3D package. A few items remain and they are described separately for each platform.

9.1 Installing on the PC

The first step in the installation is taken care of by the Delft3D installation procedure. You will find that the GPP executable is stored in a directory under Delft3D (the name is . . . \w32\gpp\bin) and the configuration files can be found in . . . \w32\gpp\lib.

There remain these two issues:

◇ *You may want to run GPP outside Delft3D.*
In that case, making a short-cut in the standard MS Windows way will suffice. Note that the start-up directory for the short-cut will be the system and working directory for GPP, unless you give the proper command-line options.

◇ *You may want to customise the configuration files.*
As explained in chapter 7, the configuration files are read from the GPP system directory. Simply create a separate directory and copy the files (*.gpp) in the lib directory to this new one. You can then set the start-up directory for the short-cut to that same directory. Or you can use the command-line options to make GPP read the customised versions.

Remark:

◇ When you use GPP via the Delft3D menu system, it will read the set of configuration files found in the ..\w32\gpp\lib directory, as no special system directory will be specified.

9.2 Installing under Linux

The first step in the installation is taken care of by the Delft3D installation procedure. You will find that the GPP executable is stored in a directory under Delft3D (the name is $D3D_HOME/$ARCH/gpp/bin) and the configuration files can be found in $D3D_HOME/$ARCH/gpp/lib.[1]

There remain these two issues:

◇ *You may want to run GPP outside Delft3D.*
Simply start the program via:
```
> gpp
```
(with or without additional command-line arguments)

◇ *You may want to customise the configuration files.*
The script *gpp_install* will create a directory ˜/gpp if it does not already exist and copy the default configuration files to that directory. The script will make a backup of any existing configuration files. Simply type:
```
> gpp_install
```
Of course, if you want to use specific configuration files, you can do so by copying these configuration files to a separate directory and edit them. Then run GPP via:
```
> gpp -sysdir some directory
```

Remark:

◇ Under Linux GPP is started via a shell script, even in the Delft3D menu system. This means that it will read the set of configuration files found in the directory $HOME/gpp,

[1]The environment variables are set by the Delft3D login script or profile.

if you have such a directory (run *gpp_install* for this) or from the central directory if you do not.

10 Glossary

Below is a list of terms commonly used in the context of GPP:

absolute time	Time given in the form of calendar date and time
action routine	Routine in GPP designed to perform a certain task using data sets, such as plotting or exporting the data to an external file
colour ramp	Sequence of colours that are used for instance in contour maps
command-line argument	Options that can be specified at start-up
configuration file	File that contains certain information important to the working of Delft3D-gpp
contour classes	Sequence of numbers that are used to create contour maps and such
data set	Collection of data, identified by a unique name
Delft3D	Comprehensive user-interface for multi-dimensional models
devices.gpp	Configuration file, contains definition of printers and plotters
dialogue	User-interface element, an area on the screen meant to enter data in some way or other. It can be moved, but in most cases it can not be resized
export routine	Subroutine to export the data in a data set to an external file. May have options
file	Output file from a model, containing results, or a database
filetype	ods type of an output file
filetype.gpp	Configuration file, contains models and associated filetypes
gppstate.0	File containing previous data set and plot definitions (the last state is saved in it)
gregorian date	Representation of date and time in year, month, day of the month etc.
history file	File containing time-series for quantities at separate locations
julian date	Internal representation of date and time, as the number of days since a reference date and time.
layout	Specification of the position and size of plot areas, legends additional texts etc.
Linux	Operating system that resembles UNIX
list box	User-interface element that allows selection from a list
list button	User-interface element that allows selection from a list, but the list has to be opened first
layouts.gpp	Configuration file, contains definitions of layouts
location	Location in the area that is studied, such as a monitoring station
map file	File containing information on the value of a quantity in the whole model area, such as the concentration distribution at several times.
menu	User-interface element, represents one or more tasks that can be selected with the left mouse button
menubar	User-interface element, collections of pull-down menus. Selecting an item shows the pull-down menu
model	Computer program which produces the output files (or any other source of datafiles)
model-grid	Special parameter, handles the grid used by models but can also contain geographical data
MS Windows	Windowing system commonly used on PC's. In this manual the term covers Windows 95, 98, NT and XP
ODS	Open Data Structure, a set of concepts and subroutine definitions to deal with a wide variety of filetypes

operation	Operation on the data in one or more data sets, like adding two parameters or calculating the average over time. This will result in a new data set
operation routine	Subroutine that takes care of a particular operation
options	Options for action routines (defined in file routines.gpp)
parameter	Quantity for which data can be imported
plot	Layout plus data sets and associated presentation forms
plot area	Area in a layout or plot designated for plotting data sets
plotroutine	Subroutine that plots the data set in some form. May have several options to customise the appearance of the plot.
presentation	Form of graphical presentation of a data set
push button	User-interface element to make an action start (or finish)
relative time	Time given as the number of time units since a reference time
routines.gpp	Configuration file, contains the definitions of action routines with their options
selection	Method of creating a subset of a particular data set
selection routine	Subroutine that takes care of the selection (including the necessary dialogue)
session file	File containing the definitions of data sets and plots
setting.gpp	Configuration file, contains graphical settings
TEKAL	Name of a general plot package that defines one particular file format
text field	User-interface element to enter a text string (in the case of GPP only single-line texts can be entered)
time	Time (date and time) for which the imported value holds
window	User-interface element, area on the screen that acts as a unit. Can be moved and resized.

Deltares, 2016. “BIBTEX key with no entry, needed if no citations are made in the document.”

A Command-line arguments

GPP recognises the following command-line arguments (see below for some examples):

-display <display>	This indicates which X-terminal or console to use. It is a standard X command line argument and hence has no meaning under MS Windows. (Other X arguments are recognised as well, but they are much less common.)[1]
-sysdir <directory>	Specify the directory where the configuration files can be found (different from the default directory).
-workdir <directory>	Specify the directory where the state file (gppstate.0) can be found and will be written to. Any other files produced by GPP will also be written to this directory, unless the name explicitly refers to a different location.
-descfile <description file>	Specify a so-called description file. This allows GPP to link to integrated model systems where you do not deal with files directly but with scenario names and such. The actual data files are hidden from you and therefore they should not appear in GPP either (see chapter 7)
-session <session file>	Specify the session file to read instead of the default state file <gppstate.0>
-batch <session file>	Specify the session file to read and print all the plots it contains. After that, the program will finish.
-animate <session file>	Specify the session file for which to automatically start the animation. Note only the first plot is animated in this way. The program will automatically stop when the animation is completed.
-convertto <extension>	Convert the raw bitmap file to a file of the type indicated by the extension (like: gif). This option relies on ImageMagick and for valid extensions we refer to the ImageMagick documentation (see <www.imagemagick.org>).
-printer <printer name>	Specify the name of the default printer. This makes sense under Linux only, as on PC a different method is used. This option overrides the values from the LPDEST and PRINTER environment variables.
-plotsize <widthxheight>	Specify the initial size of plot windows as width and height in pixels. For instance: `-plotsize 600x400`. Useful for controlling the result of an animation.
-noprint	Do not send the print files to the printer. This is useful in combination with the `-batch` and `-savefile` options. Printing will be suppressed and instead the print files are saved. *This is useful under Linux only.*

[1]Sometimes it is useful to specify a foreground and background colour, if the display can not allocate the colours from the resource database. This would look like: `gpp -fg black -bg white`. Such arguments are not taken care of by GPP explicitly and cause it to complain about unknown arguments. Simply ignore these messages.

-savefile	When printing, save the print file (that is do not delete it after the print command has finished). *This is useful under Linux only.*
-scriptfile <file name>	Instruct GPP to run a script file after initialisation. This enables you to automate certain tasks, like opening a plot window.
-verbose	Instruct GPP to print additional information on the screen, such which command-line options are used and where all the files come from. This should help you to identify possible problems with the configuration.

Note that the arguments are evaluated from left to right and that they take immediate effect. If you rely on relative directory names, you must be aware of this.

Examples:

```
gpp -display foo:0.0 -workdir .  -sysdir $HOME/gpp
```

This is used under Linux to make GPP use the X-terminal called "foo", get the statefile (if any) from the current directory and use the configuration files from the directory $HOME/gpp.

```
gpp -printer laser1 -savefile -noprint -batch scen1.ssn
```

Select the "laser1" printer from the <devices.gpp> file as the printer to prepare print files for, leave the print files, do not send them to the printer. Use the session file <scen1.ssn> and process this in batch mode, so that we get all the pictures in it in a bunch of print files.

GPP uses a small number of environment variables. They are listed in Table A.2. You do not need to define them, as appropriate defaults are supplied.

Remark:

◇ On PC, GPP uses a number of dlls, notably the XVT dlls. When loading the program, MS Windows will search for any such libraries and uses the PATH variable for this. It is safest, however, to install these libraries in the same directory as the executable.

Table A.2: *Environment variables used by GPP*

Environment variable	**Platform**	**Meaning**
DISPLAY	Linux	Name of X-terminal to be used
GPPHOME	Linux	Directory where GPP has been installed
LD_LIBRARY_PATH	Linux	Path for locating the shared objects
LM_LICENSE_FILE	Both	Full name of the license file
LPDEST	Linux	Name of the standard printer
PATH	MSWindows	Used for locating the DLLs
PRINTER	Linux	Also name of the standard printer
UIDPATH	Linux	Path for Motif UID file

B ODS error codes

The table below gives the meaning of the ODS error codes. Sometimes the code is displayed instead of an explanatory text:

Error code	Description	Name
0	Okay	IEOK
1	Unable to determine filetype	IEUNDE
2	File type not implemented in this version	IEUNKN
3	File is not of indicated type	IETYPE
10	File does not exist	IENOFI
11	No free handle (too many open files)	IENOHA
12	File already open	IEFIAO
13	File locked by other program	IEFLCK
14	Access denied/file is read-only	IEFIRO
15	Record locked by other program	IERLCK
16	Cannot lock file/record/share not installed	IENLCK
17	File not new	IEFNNW
20	File does not contain wanted information	IEINFO
21	Unexpected end of file	IEUEOF
30	Too many parameters found for array space	IEPMNY
31	Too many locations found for array space	IELMNY
32	Too many times found for array space	IETMNY
35	No. of parameters < 1	IEPLOW
36	No. of locations < 1	IELLOW
37	No. of times < 1	IETLOW
40	Bad date/time format	IETIME
41	RunId not equal	IERUNI
42	Par. not equal	IEPARI
43	Loc. not equal	IELOCI
44	Time not equal	IETIMI
45	Time-step too small (time can not be represented)	IESTEP
91	Buffer space too small (warn WL technical support)	IEBUFF
92	No space left on device	IEDISK
99	Other error	IEOTHR

C Description of files used by GPP

GPP uses the following configuration files:

<devices.gpp>	Which printers and plotters are defined for the system (used only on workstations)
<filetype.gpp>	Description of the filetypes and the models or information sources in general they belong to
<layouts.gpp>	Layouts of the plots that can be used
<routines.gpp>	Plot routines and such and their properties
<scripts.gpp>	Script library
<setting.gpp>	Graphical settings for (new) plots

It also uses a so-called state file, <gppstate.0>, which contains the data sets and the plot routines that were defined during the last session and session files which serve the same purposes. They can be explicitly selected via the user-interface.

In this appendix the format of these configuration files is explained, as well as that of the state or session file. All these files are simple text files (or ASCII files) so that if you want to, you can edit them via a standard text editor.

This appendix also describes the X resources files for GPP that are used under Linux.

C.1 Description of the file <devices gpp>

GPP uses a device definition file to define the properties of the printers and plotters. This file is used only under UNIX/X Window, as X Window or indeed the UNIX operating system itself provides no way to identify the printers, plotters and their capabilities.

Under MS Windows the operating system itself is responsible for the printer and its capabilities.

Under Linux the method of printing and plotting is simply this:

◇ produce a file which can be printed or plotted (taken care of by agX/UNIRAS ROUTINES and device drivers)
◇ issue a command to send the file to the printer or plotter.

As the workstation itself provides no method to check the capabilities of the device, you must yourself take some care: a PostScript file on an ordinary printer simply produces a large stack of paper with a lot of print commands. The above way of working allows you to save the plot file, something which can only be achieved in MS Windows or Windows NT with screen grabbers (we will work on it, it is not that hard).

The following is a description of the format of the file containing these definitions:

◇ Any text following and including a hash (#) is considered comment and is ignored up to the end of the line. Any number of blanks can appear between keywords and values. They are used as separators.
◇ The file starts with a version string in the following format:
`version 2 minor 00`
◇ Each printer or plotter is defined by a separate block. The order of the blocks is irrelevant, though the order of the statements within the block is fixed.
◇ Each block starts with a descriptive string, which will be shown to the user. The string

includes the name of the printer or plotter as it is known by the system as the first word. For instance, if the system has a fast printer called "prt1" and you would print to it via a command like: *lp -dprt1 file*, then the description might look like:
`device 'prt1 (fast printer)'`

- ◇ Other useful information may include: the type of printer or its location. The printer's name is used to determine the default printer (LPDEST or PRINTER) in the list of devices.
- ◇ The following properties are important:
  - can it print or plot colours?
  - what paper size and orientation?
  - what print command?

In the file:

```
device '<name>'                          # Description useful for user
   type black-whitetextbar colour        # Either black/white or colour
   uniras-driver '<drivername>'          # Consult uniras documentation!
   orientation portraittextbar landscape
   hardcopy-size <height> <width>        # in mm, note the order
   left-margin   <mm>                    # the actual paper size may
   right-margin  <mm>                    # require correction: seldom
   top-margin    <mm>                    # the whole sheet is useable
   bottom-margin <mm>
   print-command '<command>'             # how to put the print file
                                         # on the printer/plotter
end-device
```

This block may be repeated as often as necessary.

The following is an example, defining a typical HP LaserJet printer, capable of PostScript:

```
device 'in2las4-P Portrait (HP Laserjet 4M; PS)'
    type           black-white        # alternative: colour
    uniras-driver  'HPOSTA4'
    orientation    portrait           # alternative: landscape
    hardcopy-size    0.0    0.0       # long, short side (in mm)
    left-margin      9.0
    right-margin     1.0
    top-margin       3.0
    bottom-margin    2.5
    print-command  'lp -c -din2las4 -onb -opostscript'
end-device
```

Remarks:
- ◇ The margins are used to make sure that the size and origin of the plot correspond to the definition. This depends, unfortunately, on the specific properties of the printer. Also, they depend on the orientation. So create *two* entries, one for portrait and one for landscape orientation.
- ◇ The option -c in the print command makes sure that the print file is copied rather than linked to, so that when GPP removes the print file, the print command will not fail.
- ◇ The <devices.gpp> file distributed with GPP contains several examples that you can use as a template.

C.2 Description of the file <filetype.gpp>

GPP uses a configuration file for the supported filetypes. This file provides the user-interface with a means to use the ODS-routines and to select the files containing the data. Whether such files can actually be read is determined by the ODS library.

The following is a description of this file:

◇ Any text following and including a hash (#) is considered comment and is ignored up to the end of the line. Any number of blanks can appear between keywords and values. They are used as separators.
◇ The file starts with a version string in the following format:
`version 2 minor 10`
◇ Each filetype is assigned to a model: a model is in general the source of information or data (in many cases a numerical model, hence the name). A model may contain several filetypes. It is a means of grouping the filetypes.

In the file:

```
model '<name>' '<description>'
  presentation
    no | use colours          # Whether or not to use these
    no | use linetypes        # features. Default: use all
    no | use lines            # No required order or keyword
    no | use symbols
  end-presentation

  filetype ...                      # any number of file types allowed
    ...                             # though zero is not useful
  end-filetype

  filetype ...
    ...
  end-filetype
  ...

end-model
```

You can repeat this block for all the models you want to specify. The block with presentation options may be empty or may be left out.

With these options you can make sure for instance that measurement data are presented by symbols only.

The name of the model is used to identify the type of file, the description is shown to the user.

◇ Each file type is defined by a block of the following type:

```
filetype '<ODS-name>' '<description>'
  mask '<filemask>'

  containstextbar no topography

  [default-subtype '<subtype>']   # statement may be left out

  implicit-components             # block may be left out
    parameter '<parameter name>'
    ...
  end-implicit-components
  hidden-parameters               # block may be left out
    parameter '<parameter name>'
```

```
        ...
      end-hidden-parameters

      extra-parameter '<name>' '<description>'
        subtype '<new subtype>'
        component '<parameter name>'
        ...
      end-extra-parameter
      ...                             # more than one extra parameter
                                      # may be defined
    end-filetype
```

This block requires some explanation:

◇ The name of the filetype is a description of the ods filetype (a string indicating the model and the meaning of the filetype). The description is a more elaborate version of this, which is presented to the user.
◇ A file is recognised as being of the specified type by means of the file mask: a string like ∗*.his* that the filename should match. The string can contain several asterisks, both on workstation and PC, so that a string like ∗*admin*∗ is also accepted.
◇ A file may contain the definition of the model grid or other so-called topographical information. Topographical data sets are supposed to contain the parameter *model-grid*.
The meaning of the keyword *contains topography* is, that the files of this type contain not only co-ordinate data, but also an administration array to describe the actual grid.
◇ GPP normally defines a data set to be of subtype SINGLE, that is, the quantities are scalar. To import vector quantities and discern them from other data sets, you can define an *extra parameter*: this may contain more than one component (e.g. the x- and y-components of the flow velocity) and it may have a distinct subtype. It is also possible to set the subtype explicitly. This can be useful if all parameters require a subtype different from *SINGLE*.
◇ Some data sets and plot routines require an extra component, an example is the attribute for a grid cell in FLOW files that indicates the status of the cell. This attribute may be used by the plot routine to indicate dry cells and such. To prevent you from having to select that parameter yourself, the filetype may be defined to require an implicit parameter. GPP will create an implicit component to the data set for the same time and location.
◇ In a similar way, some parameters are meaningless for you. Hence they may be hidden.

Remark:
◇ You can define any number of models and any number of filetypes per model, as long as within a *model* block the ODS-type is unique.

C.3 Description of the file <layouts.gpp>

GPP uses a configuration file for layouts: the organisation of plots into separate areas. The following is a description of this file:

◇ Any text following and including a hash (#) is considered comment and is ignored up to the end of the line. Any number of blanks can appear between keywords and values. They are used as separators.
◇ The file starts with a version string in the following format:
`version 2 minor 10`
◇ Each layout is defined by a block of the following type:

```
    layout '<name>' '<description>'
      units cm | inches | stretch
      size <width> <height>                         # in units
      orientation portrait | landscape
      suppress | simple | standard | custom frame
      frame                                               # only if "contains frame"
        '<name>' '<text>' '<fontname>' <fontsize> <boldness> '<colour>'
        '<name>' '<text>' '<fontname>' <fontsize> <boldness> '<colour>'
        '<name>' '<text>' '<fontname>' <fontsize> <boldness> '<colour>'
     ...     (nine such lines in total!)
      end-frame
```

(alternatively a line like:

```
        '<name>' '<text>' default-font
```

can be specified. The default font is the text font in the settings file.)
After this, one or more of the following sub-blocks which all define a layout element, follow:

```
  plotarea '<name>' '<description>'
    position <x> <y>
    size <width> <height>
    legend
      position <x> <y>          # relative to same point as
                                # plot area!
      size <width> <height>
      font '<fontname>' <font-size> <boldness> '<colour>'
                                             # size in mm!
    end-legend
   (or: "no legend" or leave it out.
   Note: <boldness>= normal, medium or bold)
  end-plotarea

  text '<name>' '<description>'
    position   <x> <y>
    size       <width> <height>
    font       '<fontname>' <font-size> <boldness> <colour>
             # size in mm!
    justify    lefttextbar righttextbar centred
  end-text

  group '<name>'
    position   <x> <y>
    size       <width> <height>
    ...
   (other blocks defining elements)
  end-group
```

Close the layout definition with:

```
  end-layout
```

Remarks:

◇ You can define any number of layouts.
◇ A layout has both a name and a description. The name uniquely identifies the layout, whereas the description is shown to the user.
◇ The units keyword specifies how to interpret the sizes of the layout and the sizes and positions of layout elements. The stretch option means that the plot will always fill up the window or the paper and that the actual sizes will be relative to the given layout size.

◇ There are four options for plotting or not plotting a frame around the plot:

- ▫ suppress: do not draw a frame at all
- ▫ simple: draw a simple rectangle
- ▫ standard: draw a standard frame containing nine texts
- ▫ custom: draw a line around the plot and use the custom-frame settings from the settings file to position the part with the text

◇ The first option is especially useful if you want to draw your own frame, for instance via a land boundary data set (this is the easiest way to get arbitrary lines in the plot).

If you use the custom frame, you can:

- Set the total width and height of the part with the text.
- Set the relative width of the three sections.
- Position it either to the left- or to the right-hand side.

The custom frame text is oriented in the same way as the plot, instead of always along the short side.

- The description for a text element is the text to be shown.
- Sizes are always given in the unit defined for the layout, except for font sizes which are expressed in mm.
- A plot area is a viewport within the rectangle on screen or paper, which is designated to contain data sets. You can have any number of plot areas and you may group them in every way you want, the main restriction is readability.
- Axes are drawn on the four sides of the plot area, the axis labels and text are usually drawn outside the area. This restricts the useful width of the plot area.
- A legend is *logically* connected to a plot area, even though the physical position may suggest otherwise. In other words, this particular legend area is used by any plot routines in that plot area.
- The position of the legend can also be given via:

  ```
  relative-position <x> <y>
  ```

  in which case the x- and y-co-ordinates are relative to the plot area, not to the same whole plot (or the group in which it is contained).

Below is an example, taken from the standard <layouts.gpp> file:

```
layout 'portrait-legend' '1 plot portrait'
    units stretch
    size  18 27
    orientation portrait
    standard frame
    frame
       'company' 'WL | Delft Hydraulics'  font 'simplex roman' 3.5
             normal 'Black'
       'main text 1' ' '  default-font
       'main text 2' ' '  default-font
       'main text 3' ' '  default-font
       'upper left'  ' '  default-font
       'upper right' ' '  default-font
       'middle'      ' '  default-font
       'lower left'  ' '  default-font
       'lower right' ' '  default-font
    end-frame
    plotarea 'single-area' 'Single plot area'
       position 3  7
       size     12 18
       legend
          position  3  3
          size     14  2
          font 'simplex roman' 1.3 normal 'Black'
       end-legend
    end-plotarea
 end-layout
```

It defines a single plot area (with a size of 12 cm wide and 18 cm high). This plot area has a legend just below it. The frame is a standard frame, with one text, the company name, filled in. A font is specified to make it appear in a convenient way. For all other texts, a blank is given and the default font is used.

C.4 Description of the file <routines.gpp>

GPP uses a definition file for the supported action routines. This file provides the user-interface with a means to select the relevant plot, selection and transformation routines for a given data set.

The following is a description of this file:

◇ Any text following and including a hash (#) is considered comment and is ignored up to the end of the line. Any number of blanks can appear between keywords and values. They are used as separators.

◇ The file starts with a version string in the following format:

```
version 2 minor 10
```

◇ Each routine is defined by a block of the following type:

```
<type-of-routine> '<name>' '<description>'
   accepts-topography # or: no-topography
      '<type>' '<subtype>'
      ...
   end-topography
   accepts-data sets
      '<type>' '<subtype>'
      ...
   end-data sets
   options   # or: no-options
      <type> '<name>'  '<description>'  <default>
      ...
   end-options
end-routine
```

◇ The type of routine is one of:

plot-routine	Routine to actually plot a data set
export-routine	Routine to write the data to an external file
selection-routine	Routine to create a new data set by selecting a subset (selecting a single layer for instance)
operation-routine	Routine to create a new data set by manipulating a data set (such as calculating the magnitude of a vector)
binary-operation	Routine to combine two data sets into a new one (such as calculating the sum of two data sets)

◇ The blocks "accepts-topography" and "accept-data sets" contain lists of data set types that are accepted by the routine.

◇ The block "options" contains one or more options of the following types:

- *integer*: an integer number
- *real*: a real number
- *logical*: a logical option, with the value TRUE or FALSE
- *string*: a text string
- *colour*: a colour from the list of colours defined in <setting.gpp>
- *symbol*: similarly a symbol from the list of symbols
- *line style*: a line style from the list of line styles

◇ Two further option types are available, but they are more complicated:

- *list*: specify a user-defined list
  Definition:

```
list '<name>' '<description>' '<default item>'
         from '<item>' ... end-values
```

- *classes-list*: specify a list of reals
  Definition:

```
      classes-list '<name>' '<description>'
               values '<item>' ... end-values
```

or:

```
      classes-list '<name>' '<description>' automatic-scaling
```

◇ Each routine is known internally by the *routine name*. The description is shown to you. You may copy the block to define a "new" routine with different default settings.
◇ Each option is known internally by the *option name*. The description is shown to you. You may change the default value or delete the option. You can also add new options if you like, but they will not have any effect, unless you change the implementation of the routine.

Below is an example from the standard <routines.gpp> file:

```
plot-routine 'PlotContours' 'Plot contour map'
    no-topography
    accepts-data sets
       'MAP2D' 'SINGLE'
       'MAP2D' 'VALUE_AT_VERTEX'
    end-data sets
    options
       logical      'PlotAreaBord'   'Border around plotarea'      FALSE
       classes-list 'ContourClasses' 'Contour classes'  automatic-scaling
       logical      'UseClassesFile' 'Use classes file'           FALSE
       string       'ClassesFile'    'Name classes file'   'default.cls'
       real         'ExtraMissVal'   'Extra missing value'        -999.0
       list        'TypeAxes'        'Axis type'        'Geographic axes'
                                      from
                                          'Geographic axes'
                                          'Linear axes'
                                          'Polar axes'
                                      end-values
    end-options
 end-routine
```

C.5 Description of the file <setting.gpp>

GPP uses a settings file to define the graphical settings by default. It should be noted that the actual usage of these settings is taken care of by the agX/UNIRAS graphics library, so that it may be necessary to consult the agX/UNIRAS manuals. The standard <setting.gpp> file which is distributed with GPP can be edited to better fit your purposes. For examples, we refer to that file.

Note that not all keywords are described in detail, but their purpose should be clear from their names.

The following is a description of the format of this file:

◇ Any text following and including a hash (#) is considered comment and is ignored up to the end of the line. Any number of blanks can appear between keywords and values. They are used as separators.
◇ The file starts with a version string in the following format:

```
version 2 minor 10
```

◇ The file is divided in a number of parts which should come in the given order (some blocks need information that is defined in another block):

1 A block defining the colours that can be used
2 A block defining the fonts that can be used
3 A block defining line types

4 A block defining colour ramps
5 A block defining symbols
6 A block defining the names of the months (∗)
7 A block defining the names of the various types of axis (∗)
8 A block defining the names of the various types of label formats (∗)
9 A block defining preferences for printer/plotter and screen
10 A block defining certain defaults
11 A block defining the combinations of colour, line type and symbol for individual data sets

(∗) These blocks are meant for internationalisation.

Each block starts with a line like *series*, which identifies the block and ends with a line to close the block, *end-series*. It should be noted that each of the above blocks can be defined only once and in this order.

The philosophy behind the file is, that it is much easier to use meaningful names than encoding. So, all items that can appear in lists are represented by names that you may give yourself. If the item (a colour or a line type for instance) needs to be referred to it is always by this name.

Note that this does not mean that you should never consult the agX/UNIRAS manuals for certain things. We refer to the listing at the end of this document for some information about fonts, line types and symbols that are standard available from agX/UNIRAS.

Detailed description

1. Block for colours:
This block contains lines that define the colour by name and by RGB, CMY or HLS components. The default is RGB with values ranging from 0 to 255, the three numbers after the colour name then represent the amount of red, green and blue in the colour. Alternatively, you may specify all colours via the CMY method, that is the amounts of cyan, magenta and yellow are given (also ranging from 0 to 255). The last method utilises the hue (from 0 to 360°), lightness (0 to 100 %) and saturation (from 0 to 100 %) of the colours on a colour cone.

In the file:

```
colours [RGB | CMY | HLS]
    'name'    <value>   <value>   <value>
    'name'    <value>   <value>   <value>
    ...
end-colours
```

2. Block for fonts:
This block contains lines that define the font in the graphs by name. Each font has a user-defined name, a UNIRAS code and the code 1 or 0 (meaning whether to use a software or hardware font; this can best be set to 1).

In the file:

```
fonts
   'font-name'  'UNIRAS-code'   1
   'font-name'  'UNIRAS-code'   1
   ...
end-fonts
```

3. Block for line types
This block contains lines that define the line type by name and its UNIRAS code. We have chosen to support only the predefined line types in the graphics library, as some hardware seems to have trouble with other line types (see the agX/UNIRAS manuals). So you have 20 line types at your disposal.

A special line type (not defined by agX/UNIRAS) is the type *no line*, the code for this is -1. You may want to use it for plotting measurement data.

In the file:

```
linetypes
    'name'   <code>
    'name'   <code>
    ...
end-linetypes
```

4. Block for colour ramps
This block contains zero or more sub-blocks which each define sets of colours to be used (in the given order) in contour plots, histograms and such: in some cases you might prefer continuous ramps, rainbow-like or grey-scales. In others you may want to see different colours. That is why you can define more than one colour ramp.

Note:

In principle there is no limit to the number of colour ramps you can define nor to the number of colours that they can contain. However, we had to make some compromises with the implementation of these settings in GPP and decided that it is unlikely that you want more than 20 classes or data sets in a drawing. So, in practice:

- ◇ Legends will contain no more than 20 items, which means that you should not define more than 20 colours per colour ramp.
- ◇ The sum of the number of colour names (from the first section) and the total number of colours referred in the colour ramps must not exceed 220.

In the file:

```
  colour-ramps
     colour-ramp 'name'
        'colourname'
        'colourname'
        ...
     end-colour-ramp
     colour-ramp 'name'
        'colourname'
        'colourname'
        ...
     end-colour-ramp
  ...
  end-colour-ramps
```

5. Block for symbols
This block contains lines that define the symbols or markers by name and UNIRAS code. We have chosen to support only the predefined symbols in the graphics library, as defining new symbols is troublesome. So you have 22 symbols at your disposal.

A special symbol (not defined by agX/UNIRAS) is the symbol *no symbol*, the code for this is -1. You may want to use it for plotting lines only.

In the file:

```
symbols
    'name'  <code>
    'name'  <code>
    ...
end-symbols
```

6. Block for names of months
This block contains lines that define the months of the year: both the full name and the three-characters abbreviation that is used as a shorthand notation with axes and dates*. It is not currently used, but it is expected to be present in the file.*

As there are twelve months in the Gregorian calendar, you are assumed to specify twelve months in this block.

In the file:

```
  months
     '<full name>'  '<abb>'  \# Example: 'janvier' 'jan'
     '<full name>'  '<abb>'  \# Example: 'fevrier' 'fev'
     ...
  end-months
```

7. Block with the names of axis types
The plot routines in GPP use different sorts of axes for different purposes. In some case you can interactively change the axis type, so that it is convenient to have a list of names for these types. This list is read from the settings file, as this allows later translation to other user languages.

In the file:

```
  axis-types               # To be given in this order!
     'Unknown axis'
     'No axis'
     'Special axis'
     'Linear axis'
     'Logarithmic axis'
     'Time axis'
     'Geographical axis'
  end-axis-types
```

8. Block with the names of label formats
The axes may be plotted using different label formats, so it is convenient to have a list of names for these formats. This list is read from the settings file, as this allows later translation to other user languages.

In the file:

```
  label-formats            # To be given in this order!
     'Exponential'
     'Floating'
```

```
    'Size-dependent'
 end-label-formats
```

9. Block for preferences for plotter/printer and screen
This block contains lines in a fixed order that indicate which abilities lack in the graphics device:

◇ Black-and-white printers will use dithering or grey-scales to represent colours. In many a case the quality is not satisfactory.
◇ Screens have limited resolution, so that text should not appear too small and line types (certainly intricate ones, with lots of dashes and dots) are not easily recognised.

To overcome these problems to some extent, you may specify whether a colour printer/plotter, a black-and-white printer/plotter or a screen should use such features at all.

In the file:

```
 general-settings
    bw-printer: no colours    # or: use colours
    bw-printer: no linetypes  # or: use linetypes
    bw-printer: no symbols    # or: use symbols
    bw-printer: minimum-text-size <mm>
    colour-printer: no colours    # or: use colours
    colour-printer: no linetypes  # or: use linetypes
    colour-printer: no symbols    # or: use symbols
    colour-printer: minimum-text-size <mm>
    screen no colours    # or: use colours
    screen no linetypes  # or: use linetypes
    screen no symbols    # or: use symbols
    screen minimum-text-size <mm>
 end-general-settings
```

10. Block for defaults for plot areas
This block contains lines in a fixed order that indicate which defaults to use with plot areas. Most of these names are quite descriptive, so that it is not necessary to describe them in detail.

In the file:

```
 default-settings
    symbol-size <mm>
    symbol-distance <mm>
    text-size <mm>
    text-font '<fontname>'
    text-colour '<colourname>'
    axis-text-size <mm>
    axis-text-font '<fontname>'
    axis-text-colour '<colourname>'
    # Note: label size can not be set independently from
    # axis text size (limitation of agx/uniras)
    #
    axis-label-font '<fontname>'
    axis-label-colour '<colourname>'

    axis-numeric-format floating\textbar exponential\textbar size-dependent
    axis-decimals <number>

    major-tick-size <mm>
    major-tick-orientation in\textbar out
    major-tick-lines yes\textbar no

    minor-tick-number <number>
    minor-tick-size <mm>
    minor-tick-orientation in\textbar out
    minor-tick-lines yes\textbar no

    axis-line-thickness <mm>
    axis-line-colour '<colour>'
    colour-ramp '<colourrampname>'

    geographic-axis-unit    kilometers\textbar meters
    orientation-polar-axis  clockwise\textbar counter-clockwise
    language-for-months     english\textbar dutch

  #
  # Escape characters:
  # When used in a text string, the next character will
  # be subscripted or superscripted.
  # Choose the characters with care - they can not be
  # used in the text
  #
    subscript-escape   '`'
    superscript-escape '\^{}'

  #
  # Custom frames (text boxes):
  # Modelled after the standard frame, but with variable
  # width and height
  #
    custom-frame-width      10.0 # <cm>
    custom-frame-height      3.0 # <cm>
    #custom-frame-side      right # Alternatives: left, right
    custom-frame-side      left  # Alternatives: left, right
    custom-frame-part1      70   # Percentage of total
    custom-frame-part2      20   # Percentage of total
    custom-frame-part3      10   # Percentage of total

  #
  # For MS Windows we offer a crude method to influence the
  # margins used for printing plots with a frame
  # (as "devices.gpp" is not used on these platforms)
  #
    mswindows-margin-left    0.0  # mm
    mswindows-margin-right   0.0  # mm
    mswindows-margin-top     0.0  # mm
    mswindows-margin-bottom  0.0  # mm
  end-default-settings
```

The last three options can *not* be changed via the user-interface, so they act as *global* settings.

11. Block for the combinations of colour, line type and symbol
This block contains lines that define for each series to be shown in a line graph (or a presentation form much like that) what colour, line type and symbol to use, even what the width of the line must be. You can specify up to 20 of these combinations. The order in which you specify them is the default order of usage. Later you can specify the order in which they should be used in detail, for each plot area individually.

In the file:

```
  series
    '<name>' '<colourname>'  '<symbolname>' '<linetype>' <mm>
    '<name>' '<colourname>'  '<symbolname>' '<linetype>' <mm>
    ...
end-series
```

Additional: Symbols, line types and fonts in Toolmaster/agX

Symbols are defined in Toolmaster/agX by numbers. This is a listing of the symbols and the corresponding numbers:

Table C.1: *Symbols in Toolmaster/agX*

Symbol	Code
Hollow square	1
Hollow octagon	2
Hollow triangle (up)	3
Plus sign	4
Cross	5
Hollow square (point up)	6
Wide arrow (up)	7
"Picknick table"	8
Hollow hexagon	9
Capital-Y	10
Four-pointed star	11
Star	12
Double triangle	13
Vertical line	14
David's star	15
Dot	16
Small circle	17
Medium circle	18
Large circle	19
Filled circle	20
Filled square	21
Filled triangle (down)	22

If you do not want a symbol to be plotted, use the code -1.

Line styles are also defined by numbers. 21 line styles are predefined in agX/UNIRAS and more could be defined. Because defining new line styles may give problems with some hardware devices, GPP uses only those predefined line styles. The following list indicates these line styles:

Table C.2: *Line types in Toolmaster/agX*

Line style	Code	Example
Solid	0	___________________
Dot	1	....
Dot, medium-spaced	2	. . . .

continued on next page

Table C.2 – continued from previous page

Line style	**Code**	**Example**
Dot, wide-spaced	3	. . . . . .
Short dash	4	――――――
Medium dash	5	――――――
Longer dash	6	――――――
Very long dash	7	――――――
Longer-medium dash	8	――――――
Very long-medium dash	9	――――――
Very long dash - dot	10	—.—.—.—.-
Dot, medium-spaced	11	. . . . (seems identical to 2)
Dot, widest-spaced	12	. . . . .
Medium dash, medium-spaced	13	- - - - - - - - -
Longer dash, wide-spaced	14	– – – – -
Medium dash, two spaces	15	- - - - - - -
Longest dash, medium-spaced	16	—- —- —- –
Longest dash, dot	17	—-.—-.—-.–
Longest dash, two dots	18	—-..—-..—-.
Longest dash, three dots	19	—-...—-...—
Longest dash, four dots	20	—-....—-....-

If you do not want a line to be plotted, use the code -1.

Fonts are defined in agX/UNIRAS by a code of four characters. Below is a list of font codes and a description of the fonts. We refer to the agX/UNIRAS manuals for examples of the fonts: the agX User's Guide (volume 2) provides tables of the fonts.

SIMP	Simplex Roman
COMP	Complex Roman
ITAL	Italic Complex
DUPL	Duplex Roman
TRIP	Triplex Roman
CART	Cartographic
SMAL	Small Complex
SCRI	Script Complex
SIMS	Script Simplex
TRII	Italic Triplex
SMAI	Small Italic Complex
GREE	Greek Complex
SIMG	Greek Simplex
CARG	Greek Cartographic
SMAG	Greek Small Complex
CYRI	Cyrillic Complex
GOTG	Gothic German
GOTE	Gothic English
GOTI	Gothic Italian
VSIM	Vector Simplex
PSIM	Polygon Simplex
FUTU	Futura

CENB	Century Bold
SWIL	Swiss Light
SWIM	Swiss Medium
SWIB	Swiss Bold

Remarks:

◇ The symbol size and distance have as yet no effect, nor have the names of the months.
◇ There is no way to define what to do with contour maps on a black/white device. Even though it is easier to represent coloured patches than coloured lines in grey tones, it is not possible to guarantee that the contours will indeed look different on paper. Currently, the most effective way to solve this is to use a colour ramp consisting of greys.

C.6 Description of the file <gppstate.0>

GPP uses a so-called state file to store and retrieve the latest information on data sets and plots. It contains all the information needed to restore the last session, except any command-line arguments that were given:

◇ A list of the data sets that were defined when the session was finished.
◇ A list of so-called resultant data sets (the results of operations, but also of selections, if appropriate).
◇ A list of the defined plots.

The state file has the name <gppstate.0> and is always written to the directory that was current at start-up or the work directory specified by the command-line argument *-workdir*. Session files are essentially the same as the state file, except that a more concise format is used. The reason for this is that this allows you to change the session files and define new data sets based on the same things you would select via the user-interface. For some file types, this concise format is *not* suitable for technical reasons. This will be indicated in the discussion.

Remark:

◇ Though, normally, the definitions of the data sets appear separately from the definitions of the plots, this is not necessary: the only condition is that a data set be defined *before* it is referenced (in the definition of a *resultant* data set or in a plot).

The following is a description of the format of the state files:

◇ Any text following and including a hash (#) is considered comment and is ignored up to the end of the line. Any number of blanks can appear between keywords and values. They are used as separators.
◇ The file starts with a version string in the following format:

```
version 2 minor 10
```

◇ Each data set is defined by the following block (the text after the hash indicates the meaning of the item):

```
dataset-def '<name>'
   defining    '<name>'     # normally 'NONE' - no parent dataset
   type        '<type>'     # type of dataset - note: from list!
   subtype     '<subtype>'  # subtype of dataset - note: normally
                               # 'SINGLE'
   topography  '<dataset>'  # name of topographical dataset or
                            # 'NONE'
   model       '<model>'    # name of the model/data source
   filetype    '<filetype>' # ODS type of file containing the data
   files                     # names of the files: at most three
```

```
    "<file1>"              # NOTE: double quotes distinguish file
    "<file2>"              # names from ordinary strings
    "<file3>"
  end-files
  parameters                # names of the parameters, code is
    '<parameter>' <parcode> # the ID given to the parameter by
    '<parameter>' <parcode> # the ODS routines
    ...
  end-parameters
  times
    number      <number>   # number of time steps
    start-time  <time>     # date and time: yyyy/mm/dd hh:mm:ss
    stop-time   <time>     # ditto
    timestep    <time step> # expressed as: dd:hh:mm:ss
  end-times
  location-names           # names and codes of locations
    '<location>' <loccode>
    '<location>' <loccode>
    ...
  end-location-names
  location-matrix       # matrix for grid-like location structure
    start     <start1> <start2> <start3>
    stop      <stop1>  <stop2>  <stop3>
    stepsize  <step1>  <step2>  <step3>
  end-location-matrix
end-dataset-def
```

Such blocks are repeated until all data sets have been defined. They come after the configuration files and before the definitions of plots.

◇ Each plot is defined by a block of the following type:

```
plot '<name>'
  layout '<name>' '<description>'
    units cm | inches | stretch
    size <width> <height>          # in units
    orientation portrait\textbar landscape
    no\textbar contains frame
    frame                          # only if "contains frame"
      '<name>' '<text>' '<fontname>' <size> <boldness> '<colour>'
      '<name>' '<text>' '<fontname>' <size> <boldness> '<colour>'
      '<name>' '<text>' '<fontname>' <size> <boldness> '<colour>'
      ... (nine such lines!)
    end-frame
```

(alternatively a line like:

```
      '<name>' '<text>' default-font
```

can be specified. The default font is the text font in the settings file.)
After this, one or more of the following sub-blocks which all define a layout element, follow:

```
    plotarea '<name>' '<description>'
      position <x> <y>
      size <width> <height>
      legend
        position <x> <y>           # relative to same point as
                                      # plot area!
        size <width> <height>
        font '<fontname>' <font-size> <boldness> '<colour>'
                                      # size in mm!
      end-legend
      (or: no legend or leave it out. Note: <boldness>= normal, medium or bold)
      area-settings
        font            <font>  # font for text inside area
        symbol-size     <size>  # size of symbols
        symbol-distance <dist>  # minimum distance between symbols
        colour-ramp   '<rampname>'  # colour ramp to be used
        series-settings
          <setting-name>              # order in which settings
          <setting-name>               # for line presentations
          ...                          # should be used
        end-series-settings
      end-area-settings
```

(or: the keyword default-area-settings instead of this block)

```
      axis left | top | bottom | right
        type         <string>          # string: type of axis
        visible      yes | no          # axis visible yes or no
        text         <string>          # text to the axis
        start        <value>           # start values for axis
        stop         <value>           # stop values for axis
        stepsize     <value>           # stepsize values for axis
        axis-settings                  # data on axes
        axis-colour  <colour>          # colour for labels
        thickness    <thickness>       # thickness for axis lines
        text-font <font-parameters>
        label-font <font-parameters>
        major-tick-size <size>        # size of major tickmarks
        major-tick-orientation in | out # orientation major
                                      # tickmarks
        major-ticklines   yes | no      # yes or no major ticklines
        minor-ticks     <number>      # no. of minor tickmarks
        minor-tick-size <size>        # size of minor tickmarks
        minor-tick-orientation in | out # orientation minor
                                      # tickmarks
        minor-ticklines   yes | no      # yes or no minor ticklines
        numeric-format  <format>      # exponential or floating
        decimals        <number>      # number of decimals in
                                      # labels
      end-axis-settings
```

(or: the keyword default-axis-settings instead of this block)

```
    end-axis
  ...
```

Note: the block may be repeated for other axes. You can also use the keyword default-axes to explicitly indicate that you want default axes.

```
      dataset '<name>'
        plotroutine '<plotroutine>'
        options
        integer | real | logical | list | string | classes-list option
           '<name>' <value>
           # (depends on option! see description of routines.gpp)
        ...
      end-options
    end-dataset

    dataset '<name>'
      plotroutine '<plotroutine>'
      options
        integer option '<name>' <value>     # (depends on option!)
        ...
      end-options
    end-dataset
    ...
  end-plot area

  text '<name>' '<description>'
    position   <x> <y>
    size       <width> <height>
    font       '<fontname>' <font-size> <boldness> <colour>
                           # size in mm!
    justify    left | right | centred
  end-text
```

```
      group '<name>'
        position   <x> <y>
        size       <width> <height>
        ...
        (other blocks defining elements)
      end-group
```

Close the plot definition with:

```
      end-layout
    end-plot
```

The usage of the state and session files as described above has several subtle issues:

1 The existence of so-called hierarchical parameters
2 Data sets that are the result of an operation like the addition of two separate data sets (via the *Combine* dialogue)
3 The format above contains too much information

ad 1.

A hierarchical parameter is a parameter that represents a list of other parameters. There are essentially no data for the hierarchical parameter. It serves as a convenient name for the group. ODS routines that support these parameters are responsible for retrieving consistent lists of names and arrays of data.[1]

GPP stores the parameters that belong to the hierarchical parameter in a list along with the ODS codes. However, the parameter code that is passed to the ODS routines is stored in a separate field. The situation used to be this: the code field (in the data set structure) had the correct value when the data set is interactively defined, but not when its definition is read back from the state/session file. In that case, the code for the first parameter is used.

The changes that have been made to the state file are fairly subtle and limited:

◇ Explicitly store the name and the code of the hierarchical parameter, if the parameter is hierarchical
◇ Do not add this information if the parameter is an ordinary parameter.

The state file will then contain the following information:

```
parameter 'Name' <code>
    parameters
    ...
end-parameters
```

The one plot routine that currently is able to handle such data sets properly is the *Plot balances* routine.

ad 2.

The difficulty with *combined data sets* was that the data for these data sets can not be retrieved from a file, but instead have to be calculated. Similarly, calculations are required for vertical cross-sections. By extending the syntax of the state/session files it has become pos-

[1]The abbreviation ODS stands for Open Data Structure and is the term for the library of reading routines. The information that follows is rather technical and you can ignore it, if you are not involved in developing such routines.

sible to include the *operations* involved. This can also be used with selection routines (see also the discussion on batch editing).

The complete definition of such a *resultant data set* is as follows:

```
resultant-dataset '<Name of new dataset>'
    selection\textbar operation '<Name routine>'
    operand '<Existing dataset name>'
    options
        logical 'Interactive' false
        string 'SelectedString1' '<Name from list>'
        string 'SelectedString2' '<Possible second name>'
    end-options
end-resultant-dataset
```

And in case of a binary operation, like adding two data sets:

```
resultant-dataset '<Name of new dataset>'
    binary-operation '<Name routine>'
    first-operand '<Existing dataset name>'
    second-operand '<Second dataset name>'
    # There are currently no options to these routines
end-resultant-dataset
```

The meaning is “simple” (much like the way data sets and plot routines are incorporated in a plot):

◇ The result of the operation (or selection) is a data set that needs some name
◇ There are one or two operands to the operation or selection, which are indicated by the name (they should have been defined earlier in the file)
◇ An operation or selection is in turn identified by the name found in the <routines.gpp> file.
◇ This file also presents the list of options. For the routines that select a parameter, a location or a time, two are important:

  - *Interactive:* whether you want to select the parameter, location or time from a dialogue or not
  - *SelectedString1:* if the interactive option is false, then the parameter, location, layer or time must come from a different source, the *value* of this option. It is this *name or string* and no code or index that determines the contents of this new data set.
  - *SelectedString2:* some selection or operation routines use a second list. In that case, this option indicates the *string value* of the second choice.

The routines that select a vertical cross-section or a vertical profile work in a similar way (and to make things easier, they use the same names for these general options).

Note that the string value is not interpreted in any way. You should use the same strings (including embedded spaces) as appear in the user-interface. This is especially important with layers (the first layer is called *layer 1(surface)* for instance) and times (if the strings do not match exactly, the program will *not* use the next one or the one closest).

When you create new data sets via *operations*, GPP keeps track of the actual definitions and later stores them in the state/session file. This does *not* happen for *selections*, as these can be handled in the classical way. You may edit the session file and use this facility, however, if you want to define such new data sets outside the user-interface of GPP.

ad 3.

The state/session file can in principle be edited to define new data sets. However, in the current definition of this file there are a number of difficulties to be reckoned with:

- ◇ The parameter or parameters in the data set are defined by both the name and the ODS code. It is the latter that is actually used to retrieve the data
- ◇ The same holds for the locations if defined by name
- ◇ The number of times is reported in the data set definition and is used to determine the size of several arrays. If by specifying a different file, this number should change, the new value must be included.
- ◇ For the actual retrieval of the data, the so-called location-index matrix is used. Again, there is a strong and arcane relationship with the internals of the file from which the data should be retrieved.

All this means that you have to know too much about the internals of GPP and ODS to use these definitions as freely as desired.

There is a further difficulty: TEKAL 1D files contain so little information that a special trick is used to identify the *time* or *x* column. This involves the third filename: a string like “COLUMN1” is copied into the name and when the data are retrieved, column 1 is interpreted as the column containing time.

To improve the possibilities for batch editing and processing we have extended the procedure by which the data set definitions are read:

- ◇ The parameter *names* can be used to retrieve the ODS parameter codes *directly*, that is, the file is read and the returned list is compared to the list from the definition.
- ◇ The location *names* can be used to retrieve the ODS location codes, in the same way as the parameter names
- ◇ The times can now also be specified as follows:
  - ▫ A single time, which is used if present in the file or, if there is no exact match, is changed into the next time that is present.
  - ▫ All times, that is, the times are retrieved directly from the file and the data set is defined for all of them
- ◇ If no location names are given, the data set uses some kind of grid. The dimensions are retrieved directly from file, except for the layer information that may be present.

As the state/session file should be clear and understandable, we introduced a number of new keywords. The overall effect is that you need to do little more than you would do via the user-interface:

- ◇ To select a parameter you can use:

  ```
  parameter 'Name'
  ```

  This is enough to select any valid parameter from the file. (Hierarchical parameters are automatically taken care of.)
- ◇ To specify a specific time use:

  ```
  time 1990/01/01 12:00:00
  ```
- ◇ Alternatively,

  ```
  all-times
  ```

  will create a data set for all times in the file.
- ◇ To select a single location, use:

```
location 'Name'
```

- ◇ To select all *named* locations:

  ```
  all-locations
  ```

  If the data are defined on a grid, rather than separate locations, use the keyword:

  ```
  whole-grid
  ```

  (The reason is that it turned out to be difficult to identify the two types of locations, named and within a grid, automatically. So, in order to get started, we chose the easiest way out of the problem.)
- ◇ To specify the layer (important for 3D data sets for instance), use:

  ```
  layer 1
  ```

  To specify all layers (so a three-dimensional data set results), use:

  ```
  all-layers
  ```

  Note that the layer numbering starts at 1, the surface layer. If you leave out the *layer* keyword, then all layers will be selected.

Most of the existing keywords have become optional:

- ◇ The keywords *parent* and *topography* default to 'NONE', which means that the data set will have no parent (if it has one time, the data will not change during animations). For the topographical data set, GPP will simply apply the standard procedure.
- ◇ The keywords *type* and *subtype* were used for debugging purposes only and can be left out. When present, the information is ignored.
- ◇ The keywords *model*, *filetype* and *files* are required, because they identify the data file.

The order in which the keywords appear, if they appear, is the same as before, as some information needs to be present before other information can be retrieved. So, the data set definition:

```
dataset-def 'NH4'
    parent     'NONE'
    type       'STACKED_DIAGRAM'
    subtype    'SINGLE'
    topography 'NONE'
    model      'DELWAQ'
    filetype   'ODS_DELWAQ_HIS_BIN'
    files
       "uitestdy.his"
       ""
       ""
    end-files
    parameters
       'NH4' 1
    end-parameters
    times
       number     53
       start-time 1900/01/01 00:00:00
       stop-time  1900/12/31 00:00:00
       timestep   7:00:00:00
    end-times
    location-names
       'noordw 4/10' 0
    end-location-names
    location-matrix
       start    0 0 0
       stop     0 0 0
       stepsize 1 1 1
```

```
    end-location-matrix
end-dataset-def
```

can be stripped down to:

```
dataset-def 'NH4'
    model      'DELWAQ'
    filetype   'ODS_DELWAQ_HIS_BIN'
    file       "uitestdy.his" "" ""  end-files
    parameter  'NH4'
    all-times
    location   'noordw 4/10'
end-dataset-def
```

Remarks:
- ◇ You have to use double quotes with the file names. The NEFIS file types require two files: the data file and the definition file.
- ◇ The above specification is incomplete as far as TEKAL 1D data files are concerned. There is no solution yet, you will have to use the *third* file name.
- ◇ For debugging, interpretation purposes and performance, the old format will still be used when storing the data set definitions, but some comments will be added, regarding the obsolete nature of things. It will remain possible to read the old-style session files.

Remarks:
- ◇ The plot only has a name. Since it is up to you to enter that name, it is assumed to be clear enough. The name uniquely identifies the plot.
- ◇ The description for a text element is the text to be shown.
- ◇ Sizes are always given in the unit defined for the layout, except for font sizes which are expressed in mm.
- ◇ Plot options depend on the plot routines that are used.
- ◇ When saving the state file, a back-up is created, called <gppstate.0>.

C.7 Description of the GPP description file

GPP has three ways of selecting files:

1 use the file system directly
2 use a description file as produced by Delft3D or SOBEK
3 use the cases defined by the Case Management Tool

ad 1.

If you do not specify the option -descfile <description file> when starting GPP, it will use the files and directories as they are found on the disks. The disadvantage of this is that you have to know yourself what these files mean. They are distinguished by their name and position only.

ad 2 and 3.

Many integrated model systems have some sort of case management, that is, you work with scenarios or calculations, identified by descriptive strings, instead of filenames. You do not need to know where the files are located, what they are called, how you use them. This administrative information must be transferred to GPP in some way: via a description file. Examples of such systems are:

- ◇ Delft3D: model system for two-dimensional and three-dimensional model applications
- ◇ SOBEK: model system for rivers, canal and other one-dimensional (branched) water systems

These systems have their own way of administrating the calculations. A more general, but simpler, system, which mainly takes care of the administration, is CMT (the case management tool). This tool provides a library of subroutines to get hold of the filenames and the descriptions of the cases and so on. Therefore GPP uses two methods:

- ◇ The library routines from CMT, if the name of the description file is <caselist.cmt>. That is, GPP needs to know the name of the file containing the cases.[2]
- ◇ Its own routines, if the name is anything else.

The following is a description of these files (though, not of the files produced by CMT):

- ◇ Any text following and including a hash (#) is considered comment and is ignored up to the end of the line. Any number of blanks can appear between keywords and values. They are used as separators.
- ◇ The file consists of one or more blocks that define a scenario or case:

```
begin '<description of scenario>'
 "<filename>" '<description of file>'
 ...
end
begin ...
 ...
end
```

- ◇ Inside each scenario you may define other scenarios with similar blocks. Scenarios inside another scenario block are supposed to be sub-scenarios. There is no limit to the number of hierarchical levels that is created in this way.
- ◇ There is no fixed order for files and scenario blocks inside a block.

If you want to use GPP in such an integrated environment, it may be advantageous to edit the file with file type definitions so that it reflects the tasks that you are familiar with. For instance, instead of using the model name FLOW, specify Hydrodynamics.

C.8 Description of the X resources used in GPP

For Linux the following resources are defined which are used to control such things as the font and the window colours (for an explanation of X resources, consult the relevant literature):

gpp*background: <X colour>	Background colour for windows and dialogues
gpp*foreground: <X colour>	Text colour in windows and dialogues
gpp*fontList: <X fonts>	List of fonts to be used (only one needed)
gpp*highlightColor: <X colour>	Colour for highlighted text
gpp*selectColor: <X colour>	Colour for selected items in lists

These resources will normally be contained in a file called "Gpp" located in the system directory. They can be loaded into the resource database by the command:

```
xrdb -merge Gpp  (or whatever file you are using)
```

This is normally taken care of by the Delft3D profile script or the start-up script.

[2]This is not yet operational.

C.9 Description of the script library

Pro memorie

D Creating animations

GPP has the ability to draw plots for successive times from a contour or vector data set that has several time steps. The details about how to do this can be found in Section 8.2. If you choose this option, the plots will be stored as so-called XWD-files under Linux or BMP-files under MS Windows. To create an animation file you need to run a set of auxiliary programs that convert these individual picture files into, for instance, an animated GIF-file.

The procedure described below assumes you are using the ImageMagick tools:

◇ Start GPP and create the series of plots according to Section 8.2.
◇ As the picture files are stored in the working directory, change to this directory.
◇ Run the command (make sure the convert program is the one from ImageMagick):

  ```
  convert anim* movie.gif
  ```

  or, if you want MPEG files:

  ```
  convert anim* movie.mpg
  ```

  (The convert command determines the output format by means of the extension of its second argument, but we advise you to look at the manual for details).

You can use several command-line options to make it easier to create such animations:

◇ The option –plotsize controls the initial size of the plot window. You can use this to create animations of the desired width and height.
◇ The option –animate allows you to create the individual pictures automatically, much like the –batch option does for printing.
◇ The option –convertto specifies that you want to create output as, say, GIF files instead of XWD or BMP files. GIF files are usually much smaller and thus you can save a lot of disk space.

E Example of using AWK to edit the state/session file

This appendix describes a small, dedicated AWK script as an example of how you can use scripts to create new session files or change existing ones. The AWK scripting language is standardly available on Linux systems and PC versions are available as well.

The reason for building this script was simple: we had to check all layouts, because some plot areas were defined in such a way that text to the axes would be outside the frame. Hence we built a script that transforms the layouts into plots (which requires adding a unique name to each layout) and defines four axes for each plot area (no data sets required though).

The script looks like this:

```
#
# AWK-script to transform the layouts to pictures with axes
#
BEGIN    {
          plot = 0 ;
          cont = getline < "axes.lay"
          i    = 0
          while ( cont == 1 )
          {
             array[i] = $0
             i ++
             cont = getline < "axes.lay"
          }
          nolines = i
        }
#
# Extract the lines:
# layout '...'        - Beginning of layout
# end-layout          - End of layout
# end-plotarea        - End of plot area (insert axes)

$1 == "layout"       { plot ++ ;
                      print "plot ", "'", plot, "'"
                     }
$1 == "end-layout"   {
                      print "end-layout"
                      print "end-plot"
                      next \# Skip handling of all lines
                     }
$1 == "end-plotarea" {
                      for ( i = 0 ; i < nolines ; i ++ )
                      {
                         print array[i]
                      }# Any line
                     # print $0}
```

The block of statements after BEGIN (enclosed in braces) is used to initialise the plot number and to read a file containing the lines that define the axes (just an excerpt from one suitable plot in an existing session file). These lines are stored in an array so that they can be used over and over again.

Before the line that starts a new layout (layout 'name'), we have to add a line like "plot '1'". And after the line 'end-layout' we have to add the line "end-plot". Using the pattern recognition facilities of AWK, this is really easy: $1 is the first word of the current line. So if this is equal to one of the keywords we need to look at, we have to take action. In almost all cases we can simply print the line that was read the last block).

Then using the command:

```
awk -f tstlay.awk layouts.gpp > tstlay.ssn
```

we created the new session file and using the command:

```
gpp -batch tstlay.ssn
```

we sent all these plots to the default printer.

As for the file <axes.lay>: it is included *before* lines containing the keyword `end-plotarea` and it contained the following:

```
axis bottom
   type     linear-axis
   visible  yes
   text     'Bottom'
   start    101468
   stop     134994
   stepsize 999.999
   default-axis-settings
end-axis
axis left
   type     linear-axis
   visible  yes
   text     'Left'
   start    555091
   stop     603705
   stepsize 999.999
   default-axis-settings
end-axis
axis right
   type     linear-axis
   visible  yes
   text     'Right'
   start    555091
   stop     603705
   stepsize 999.999
   default-axis-settings
end-axis
axis top
   type     linear-axis
   visible  yes
   text     'Top'
   start    101468
   stop     134994
   stepsize 999.999
   default-axis-settings
end-axis
```

This is simply an abstract from a session file created via the user-interface. It contains all the information required to draw some axes. Originally they were geographical axes, but in order to avoid possible trouble with different aspect ratios, we changed the type to linear.

F Printers, plotters and pictures

F.1 Storing pictures

Under MS Windows, the easiest way to store the plots as picture files is to use the clipboard:

- ◇ Select the menu item *Edit - Copy to clipboard*.
- ◇ Use an MS Windows word processor, Paint Brush or other graphical applications to get it from the clipboard.

An alternative way is to use *Start Animation*: this will store the picture in a bitmap file, even if there is only one time to show.

Under Linux a "clipboard" exists but is not as accessible as under MS Windows.

The freely available tools by ImageMagick (convert, mogrify and so on) can be used to manipulate the bitmap files. These tools are available for both Linux and Windows (*cf.* http://www.imagemagick.org)

F.2 Support of printers and plotters

The post-processing tool GPP relies on the PLplot graphical library for plotting on screen and printing to printers and plotters. This library supports a number of different printers and plotters, but on Linux we mainly use PostScript output. This section describes some important aspects of printing support by GPP.

F.2.1 Printing on MS Windows systems

On PCs running MS Windows 95 or Windows NT/XP/. . . (in various versions) the philosophy for printing is simple enough in principle: it is the operating system that takes full responsibility. Via the user-interface of either the operating system itself or of GPP you can select a printer (and perhaps change the properties for the current print jobs, like the paper format). Then GPP will draw on the printer device that is supplied by Windows. Once the drawing is complete, the print manager takes care of the rest.

The advantage is that the program does not have to “know” anything about the printer (whether it is a laser printer using a vendor-specific printer command language or a pen plotter using PostScript.) The disadvantage is, that if an old version of the printer driver has been installed on the system, the results may not be optimal. *And GPP or any other application has no control over that.*

So, because the *operating system* is in charge, anything that goes wrong has to be solved at that level. An example of what can go wrong: with some old printer drivers contour maps contain fine lines surrounding the underlying grid cells.

Also, if you want to store the print file (for example, store the plot as a PostScript file to incorporate it later on in a report), you will have to arrange for this in the printer properties. *The printer driver then determines* when *you will be asked to select a file name.* Some require a file name to be specified in the printer set-up dialogue, others will ask you when you actually print something.

To be independent of the properties of the printer driver, over which you have no control, select a printer from the list of printers other than the one described as “Windows - print directly via printing system”. This will result in a print file on disk, but it is not sent to the printer.

F.2.2 Printing on Linux systems

On Linux printing can be taken care of in numerous ways, but as far as you (or applications like GPP) is concerned, everything is simple - unless there are problems. Let us start with the ordinary situation: all printers that you want to use are online and working as they are supposed to. Then the print command (usually *lp*) with zero, one or several options is enough to print a file, whether it is a simple text file, a PostScript file or a binary file containing plot instructions.

Unfortunately, problems may arise in any of the following situations:

◇ *The options for the print command are unknown:*
No where on the system the properties of the printers are described in an easily useable form. You need to consult the system manager to find out what the options are for printing a PostScript file as a real PostScript file, rather than as plain text consisting of PostScript commands. As a user you ought not to be aware of the various printer models that are used by the printer system, but you may be confronted with them searching for the capabilities of the installed printers.

◇ *Incomplete set-up of the printing system*:
In a number of cases we have come across, print jobs were redirected to a different system and the protocol was not meant for binary files or anything else than simple text files. As a consequence, there was no way to tell the printer system on the Linux machine that the files were actually PostScript files and that they should be treated as such. The workaround we found, was that we added a prologue and an epilogue to the print file before printing. This way the control characters could be added that instruct the printer on the other end of the whole network to do its job properly. Such solutions require a lot of work to find out and make work smoothly.

◇ *Unsupported printer types*:
Problems can also occur because the printers use a different command language or different dialects of these languages than supported by the graphical library (to give an impression: the library supports several hundreds of printer types by tens of vendors, but still we run into printers or plotters unknown to the library).

The printing system does have a few advantages:

◇ An application like GPP has quite some control over the way the printing is done (this is what the <devices.gpp> file is used for).

◇ You can choose to save the print file for later use in a report: GPP produces an external file that is later sent to the printer or plotter.

F.2.3 Supported printers and plotters

Within GPP we have ample experience with the following types of printers:

◇ *HP LaserJets (black and white):*
The graphical library supports HPGL, PCL and PostScript. In most cases we use either PCL or PostScript.

◇ *HP DeskJet's and Paintjets (colour)*:
The graphical library supports both Colour PCL and Colour PostScript. However, the various "dialects" of Colour PCL have presented quite a few problems in the past:

- ◻ The colour map for newer models is different from older ones.
- ◻ The specific properties of the language have changed.
- ◻ As a result, the Colour PCL driver can be used without a problem on an HP DeskJet 500C, but not on an HP DeskJet 600C and later.

We prefer using the PostScript driver for this, even though here we have found the need to change the origin of plotting sometimes (this is handled by a simple *sed* command).

◇ *PostScript printers in general*:
Whenever a printer supports PostScript, we tend to use that, as it presents the least problems and has the advantage of producing a file that can be used in word processors as well.

◇ *HPGL and HPGL2 for plotters*:
For pen plotters the driver of choice is any of the HPGL drivers, at least we have some experience with these. The variety in properties for plotter types is probably the reason for the existence of several different drivers.

G Frequently asked questions

This chapter aims to help you with common questions that may arise while using GPP. (Many issues are covered in the User Manual as well and perhaps in greater detail). Some questions have a simple answer, others require some discussions or are covered in separate documents. To make finding the questions and possibly their answers a bit easier, the questions have been grouped:

- *Installation:* any questions that arise around installing the program on a particular system or for a particular user.
- *Printing:* plotting the data sets is one thing, printing can be quite an other.
- *Plotting:* the precise meaning of some common options, manipulating the plot
- *Customising:* setting the options for the plot routines, making new layouts.
- *Animations:* how to prepare animations, what happens and so on.
- *Files and data:* types of files that are supported, their contents, configuration files.

Note: errors like when there is a crash of the program or the program does not start at all are covered in a separate chapter: Appendix H.

The table below summarises the questions:

Installation
Where are the configuration files? What happens when I re-install GPP for my user-ID?
Printing
How to install a new printer? Can I print all pictures at once? How to save the plot file under Windows? How can I save a picture as a bitmap? On paper the picture is shifted or it does not fit
Plotting
What is the scaling factor for vectors? How can I set the extremes for axes? Why does GPP refuse to use the new values for the axes? How do I get GIS data in my pictures? What happens when I click *Clear* in the selection of data sets for a plot? I want to zoom in on the same area each time I want to return to automatic scaling in a contour plot I want to add "dry" cells to my plot I want to plot a vertical cross-section and all I get is a rectangular block I want to calculate the average over a fixed thickness and I get an error message I want to plot measured vectors I want to compare two data sets How can I get numbers in the isoline plots?

Customising

I want a different layout How can I use the same contour classes for my data sets? How can I change the colours/line styles/symbols
Animations
How do I create an animation? Why is my data set changed after an animation? How can I set up my pictures for an animation? How can I display the time? How can I stop an animation? I want to make an animation and it does not work.
Files and data
I want a different extension for my . . . files I get an extra dialogue when I use simple text files How do I get my measurements into a plot? What is the difference between a state file and a session file? Where do the plot files go? What is the current directory? I see data sets that I did not create myself.

G.1 Installation

Question: ***Where are the configuration files?***

Answer: When you start GPP, you can give it a number of command-line options, one being `-sysdir.` This option sets the (preferred) directory containing the configuration files. If the program can not find them there, it will try the <lib> directory parallel to the directory containing the program itself and finally that directory.

Under Linux, the script that is usually used, as part of the installation, calls the actual program with the option `−sysdir ˜/gpp`, that is a directory with personal copies under your home-directory. (This default option can be overwritten though.)

On PC, the command connected to the icon (Windows 3.x and Windows NT 3.x) or the short-cut (Windows 95 and Windows NT 4.0) contains a very similar option.

So, unless the wrong directory is given or files are missing, GPP uses your personal copies of the configuration files. For more information: see the appendix in the User Manual.

You can find out what files are being used with the command-line option `−verbose.` This will print the names of the files and the directories.

Question: ***What happens when I re-install GPP for my user-ID?***

Answer: The installation procedure will copy the new configuration files into the designated directory. On Linux it is able to save the existing files (with a second extension), on PC this, unfortunately, does not happen. If you want to save the old files, then you must copy them yourself, *before* re-installing GPP in your user-ID.

In most updates, the files that are changed are: <filetype.gpp> and <routines.gpp>, as extensions to the capabilities of GPP concern mostly new filetypes or new plot- and selection routines.

G.2 Printing

Question: ***How to install a new printer?***

Answer: The installation procedure for a new printer depends on the platform:

- ◇ *On PC*:
  Use the Windows system's utilities to correctly install a new printer. Then select it as the default printer. GPP will recognise it as the system or default printer and print to this device.
- ◇ *Under Linux*:
  GPP uses a configuration file <devices.gpp> to define the printers that are available on a particular system. Unfortunately, the Linux system itself can not provide the information, such as the capabilities of the printers. See Appendix C.1 for a detailed description of this file.

You can add a new printer by adding a new block of lines to this configuration file. Be sure to use the correct device driver. Some experimentation will be necessary with regard to the margins - there is no system to these, we found them by trial and error - as the relationship between the lower-left corner of the paper and the origin of the plot co-ordinate system is something of a black art. In many cases it is best to copy the block that defines a similar printer. To illustrate the difficulties involved, let us quote from a book by Charles Geschke:[1]

Every output device has a built-in co-ordinate system by which it addresses points on a page. We call this built-in co-ordinate system, idiosyncratic to each device, *device space*. Device space varies widely from printer to printer; there is no uniformity in the placement of co-ordinate origins or in horizontal and vertical scaling.

Effectively, this means that for *each type of printer* trial and error is the only way to find the correct margins as there is no automatically determinable relationship between the plot origin and its actual position on paper.

Question: ***Can I print all pictures at once?***

Answer: Yes, you can. There are in fact several ways of achieving this:

- ◇ Use the *Make Job* menu item (in the *Print job* menu from the main window). This allows you to interactively select the plots you want to print
- ◇ Use the batch option. This will print all plots at once

The batch option (on the command-line: `-batch <session file>`) will instruct GPP to print all pictures contained in the session file and then exit.

It prints to the current printer or, under Linux, if you add the option *-printer <printer name>*, to the designated printer. (See the appendix on the command-line options).

[1]Charles Geschke (Adobe Systems Incorporated): PostScript language, Tutorial and Cookbook Addison Wesley, 1990

Two additional options (also working under Linux only) further control the activities:

`-savefile` will suppress the removal of the files, so that the print files remain on disk.

`-noprint` will suppress printing (and exiting) and is useful in combination with the `-savefile` option.

The reason that the latter two options are available on UNIX only is that the printing method works via external files, whereas under MS Windows the printer driver takes care of all details.[2]

Question: ***How to save the plot file under Windows?***

Answer: The simplest way is to use a different printer than the default one, select the appropriate one in the printing dialogue.

Question: ***How can I save a picture as a bitmap?***

Answer: Depending on the platform:

◇ *On PC*:
You can use a screen capture program or the key combination *Alt-PrtSc*. However, the most direct way is to select the menu option *Edit/Copy to clipboard.*

◇ *Under Linux*:
There are several possibilities here as well. One approach that is likely to work on most systems is to use the X Window dump program, `xwd`. Consult the man-pages for details about this utility and its companions `xwud` ("undump" the picture) and `xpr` (print a X Windows dump file). As Linux does not use a “clipboard”, the menu option *Edit/Copy to clipboard* has no function under Linux.

Other very useful programs include: `convert` and `display` by ImageMagick, which are part of a series of public-domain programs for manipulating images.

Question: ***On paper the picture is shifted or it does not fit***

Answer: This has to do with the size of the paper, its orientation and the settings in the program. The program may think that the orientation is landscape, but actually it is portrait (or vice versa).

Other reasons may be that the margins are incorrect. You should check the margins in the configuration file <devices.gpp>. (On PC, the <setting.gpp> file has options to set the margins of the frame, see the appendix on the configuration files.)

[2] Our experiments with defining printer drivers that print to a file rather than to a printer have been limited and rather ambiguous. This has nothing to do with GPP, though. sometimes the file was correctly created, sometimes it was not - which is why we never used it much.

G.3 Plotting

Question: ***What is the scaling factor for vectors?***

Answer: In vector plots use is made of a so-called unit vector. It is a vector that has length unity (1) in whatever units the vector quantity is expressed. The length of such a vector converted to *millimetres* on the paper or the screen is used as the scaling factor for all vectors in the plot.

When you set its value to zero or negative in the (**Plot Options** dialogue), the plot routine will determine an automatic scaling factor (as it will do at first). The philosophy is that the vectors should not overlap too much, so the mean size of the grid cells is used as well as the size on paper or screen of the area that is visible.

Question: ***How can I set the extremes for axes?***

Answer: By double clicking on an axis you get a dialogue that enables you to set the minimum and maximum of the axis. (see next question).

Question: ***Why does GPP refuse to use the new values for the axes?***

Answer: GPP distinguishes a variety of axes, one of them being *geographic axes*. Such axes are meant to show a square expressed in the axis co-ordinates as a square on the screen, no matter how you zoom in. This causes some confusion when you try and set new extremes for such axes: the vertical and the horizontal axes are connected via the condition explained above. Hence you can not set the extremes arbitrarily. (The dialogue probably should be adapted to reflect this limitation.)

Question: ***How do I get GIS data in my pictures?***

Answer: GPP supports a number of filetypes that may contain GIS co-ordinate information, such as DXF files (commonly produced by ArcInfo or AutoCad) and BNA files (produced by Atlas-GIS). A very simple format is that of the TEKAL land boundary files. Such files are simple tables of x- and y-co-ordinates with a header consisting of a "block name" and two numbers, the number of rows and columns in the tables (see chapter 5).

The plot routine offers a number of options to plot such data:

◇ The colour in which to display the lines
◇ Fill the polygons (closed polylines) or not
◇ The thickness of the lines

By adding the same data set with co-ordinate information one, two or in fact any number of times to the plot and setting the right plot options for each instance, you can get a full-colour map, similar to the *layers* in a GIS.

Question: ***What happens when I click Clear in the selection of data sets for a plot?***

Answer: *Clear* resets the whole plot area, that is, it removes all data sets from the plot area, it resets the properties of the axes to their default values and similarly the properties of the plot area itself. Use *Show* $\rightarrow$ *Delete* to selectively remove data sets.

Question: ***I want to zoom in on the same area each time***

Answer: If you want to zoom in to the same area each time, currently, you will have to edit the session or state file and change the axes' extremes This can simply be done by replacing a block of lines describing the axes for some plot area by the block of lines that describe the precise co-ordinates you want to zoom to. Be aware of one thing: the *height/width ratio* of each plot area that you treat that way, must be the same as the one containing the zoom co-ordinates. Otherwise the picture will be distorted.

An alternative way is that you use a specialised or *filled-in* layout, which is a layout that already contains the axes' extremes for one or plot areas.

Question: ***I want to return to automatic scaling in a contour plot***

Answer: If you have edited the contour classes, and you are not satisfied with them, you can start from scratch, that is, have the plot routine figure out what classes to use by removing all classes from the list of classes. This will instruct the routine to apply automatic scaling again.

Question: ***I want to add "dry" cells to my plot***

Answer: Computational models like Delft3D-FLOW calculate the drying and flooding of grid cells. This information is stored in a special way and is in fact automatically retrieved by GPP.

The plot routine that will show this information is described as *Plot thin dams*. You do not have to define a special data set for it, as it is part of any data set derived from Delft3D-FLOW map files. Because of limitations in the recognition algorithm, the user-interface allows you to plot thin dams for any data set defined on a two-dimensional grid. However, only Delft3D-FLOW map files contain the information in the correct form.

Remark:

◇ You can not use data sets from Delft3D communication files for this, due to limitations in the reading routine.

Question: ***I want to plot a vertical cross-section and all I get is a rectangular block***

Answer: You can plot vertical cross-sections (the selection is described as Select a grid line). This requires information on the vertical co-ordinate and this may or may not be available from the data file.

The selection routine uses either of two parameters for this: z-co-ordinate and LocalDepth. (The reasons for using two different parameters are highly arcane and beyond the scope of this document.) If no such parameters are found (as part of the data set), it decides to use the layer index as vertical co-ordinate, which is evident from the seemingly uniform depth along the cross-section.

Question: ***I want to calculate the average over a fixed thickness and I get an error message***

Answer: You can only calculate the average over a fixed thickness if the vertical co-ordinate is known. Some data files do not contain this information and data sets defined via such data files can not actually be used in the averaging operation. Such data files are notably the Delft3D communication files.

Question: ***I want to plot measured vectors***

Answer: The plot routine for vector plots accepts both vector fields defined on a regular grid and vector data in arbitrary points. There is only one issue: upon reading the data, the two components of the vector must be known. This is achieved by automatically matching the parameter names (via the so-called *extra parameters* defined in the file <filetype.gpp>.

The two components of vector data sets are either:

◇ cartesian, subtype "VECTOR" or "VECTOR_AT_VERTEX"
◇ polar (that is magnitude and direction in degrees from positive x-axis, counter-clockwise), subtype "POLAR_COMPONENTS"
◇ nautical (magnitude and direction in degrees from north, clockwise)

Question: ***I want to compare two data sets***

Answer: You can combine two data sets in the same plot, either the same plot area or two different plot areas. There is another possibility and that is that you calculate the *difference* between the two data sets first and then plot the resulting data set.

Plotting the two data sets is the best way to proceed if they are of a different nature, one a calculated time-series, the other measurements for instance. You can use symbols to explicitly show the data points.

Calculating the difference is done via the *Combine* dialogue available in the *Datasets* Data Group. Note that it is only possible if the two data sets have the same dimensions. (The algorithm simply consists of a loop in which the difference between two arrays is calculated, there is nothing sophisticated about it). Despite this restriction, it may be a very useful method because it highlights the differences.

Question: ***How can I get numbers in the isoline plots?***

Answer: Currently, you can not. The reason for this is that the iso-lines are drawn on a per cell basis so that the lines are not recognised as continuous lines.

In principle it is possible, but that would require a different set-up of the iso-lines routine. The original use of the routine was to emphasise the borders between contour classes and the exact handling of the plotting near internal and external boundaries (cells that do not contain information or cells whose sides are "dry") makes it awfully difficult to use the alternative approach of a whole grid instead of individual cells.

G.4 Customising

Question: ***I want a different layout***

Answer: If you are not satisfied with the layouts that are provided by the installation, then you can edit your personal copy of the configuration file that contains the layout definitions <layouts.gpp>. The format has been described in detail in Section C.3.

Remark:

It is also possible to use specialised layouts. In the User Manual such layouts have been called *filled-in layouts*, as they predefine the axes' properties and other characteristics of the plot areas. This is a means to zoom in on a particular area for instance. The easiest way to create such a layout is:

◇ Prepare the picture with the co-ordinates as you want them

◇ Save the session in a session file
◇ Remove the definition of any data sets and plots that you do not want
◇ Remove the lines containing "plot '<plot name>" and :"end-plot" that surround the plot definition
◇ Remove the blocks of lines beginning with "dataset '<dataset name>'" and ending with "end-dataset" from all plot areas.
◇ The result is a complete layout definition which includes the axes' properties *a priori.*
◇ Put the layout in the file <layouts.gpp> and give the layout a unique name.

Question: ***How can I use the same contour classes for my data sets?***

Answer: Unfortunately the user interface does not readily help you to set the same list of contour classes. You can however use three different methods outside the user-interface:

◇ Edit the session file.
◇ Create a new routine description in <routines.gpp>.
◇ Use a classes file in the contour plotting routine.

The first method requires that you save the session (or simply leave GPP, which will then write the data to the file <gppstate.0>). Then edit the file:

◇ Look for the plots (lines like plot 'Some plot') that indicate the start of a plot definition
◇ Change the values listed in the plot-option "ContourClasses" to whatever you like (you can put them on the same line. Be sure to add the keyword *end-values*). For instance:

```
classes-list 'ContourClasses'
   values 0 1 21 5 10 20 50 100 end-values
```

◇ If you then load this session file again, the new values will be used for displaying the data sets. Or use the -*batch* option to print all the plots you defined.

The second method is more permanent. You can copy the block defining a routine in the file <routines.gpp>, give it a new description (the name, the first string is fixed!) and change the default options. The changes are very similar to the first method:

```
classes-list 'ContourClasses' 'Contour classes'
          values 0 1 21 5 10 20 50 100 end-values
```

instead of the word *automatic*.

The third method requires you to set two plot options, but is the most flexible:

◇ Set the option *Use classes file* to true
◇ Set the option *Name classes file* to the name of a classes file of choice.

Currently, these files are located in the system directory (unless you specify the name with a directory). They have a very simple format: any line may contain one single number, the numbers must be in ascending order and for documentation purposes you can add comments by using a hash (#) or an asterisk (∗) in the first column.

Question: ***How can I change the colours/line styles/symbols***

Answer: You have several options:

◇ Changes per plot area:

Double-click in the plot area to get a dialogue that allows you to change the order in which the line types are used or to change the colour ramp (for contour maps etc.)
- ◇ Changes that hold for all new plots:
You can modify your copy of the appropriate configuration file.

The configuration file <setting.gpp> contains all the colours, line styles and symbols that GPP will use. You can change your personal copy any way you want to define new colour ramps (sequences of colours to be used in contour plots), single colours, line styles and so on. The file is described in detail in the appendix to the manual.

Warning:

- ◇ When you change this file and load a session file that contains references to things you eliminated, GPP will give warnings that it can not find a certain colour or line style *by name*. It will instead use a default. Other than that, the changes should present no problem.

G.5 Animations

Question: ***How do I create an animation?***

Answer: Creating an animation is discussed in considerable detail in the Appendix D in the User-Manual. We refer to this text for more information. However, some comments will be made here:

- ◇ It is important to realise that during the animation GPP will change *only* the underlying data and will keep all plot options as defined before *Start Animation* was clicked. So, the basic problem then is to get all data sets you need into the picture (together with the presentation type), set the plot options to whatever you want and *then* press the button. This is particularly important for contour maps, as the classes will be determined from the time originally shown.
- ◇ During animation, GPP reads the data from file, plots the data and then writes the picture as a bitmap file to disk for later reuse.
- ◇ The actual animation files (like FLI/FLC files) are created after the pictures have been written.

Question: ***Why is my data set changed after an animation?***

Answer: When preparing the animation, GPP changes some settings in the data set definition and then retrieves the data. This means that at the end of the animation procedure the data set definition may have changed! It is a shortcoming of the program.

Question: ***How can I set up my pictures for an animation?***

Answer: As explained in the first question of this section, you should set up the pictures before you start the animation. Some special features exist that are particularly useful for animations:

- ◇ Showing a time bar can be very useful to indicate the progress of time, especially if you combine that with a time-series for the flow rate or a water level. For this you probably need a separate plot area.
- ◇ The time can also be shown as a date/time string, via the plot routine *Add text to drawing*. This routine draws a string for the data set it is used with, by default, *the time in the data set*. But it can also draw an analogue clock.

Question: ***How can I display the time?***

Answer: See the previous question, which lists some of the plot routines that allow the visualisation of time.

Question: ***How can I stop an animation?***

Answer: When you start the animation, it can take a long time to finish, as with each time step the data are read and redrawn. Unfortunately, the user-interface will not listen to button clicks (this is due to some mysterious limitation in the user-interface library). The best way, as non-interruptive, is to close the window in which the animation is running. Do this via the system menu button (upper-left corner) or the square with X in the upper-right corner. It is a crude method, but it does work!

Question: ***I want to make an animation and it does not work***

Answer: For animation to work you need at least one data set in the picture that is a *child* of a data set with more than one time. The easiest way to do that is to create a data set from a map file by selecting only the parameter and not a time. Then try and put this data set into a plot. You will be asked to select a single time.

If the data set is three-dimensional, however, you will have two or more choices: to select a time and to select a layer (or a grid line and so on). Now you should select a *layer* first, thereby creating a new data set and for that data set you select the time. Otherwise the *parent* of the data set you plot will have one time only (the *grandparent* is not taken into account for this).

See also the explanation at the first question: *How do I create an animation?*

G.6 Files and data

Question: ***I want a different extension for my . . . files***

Answer: The file selection dialogue allows you to set the filter for displaying the file names, but this is set for the current selection only. The dialogue always starts with the default filter.

This default filter (the file extension, or better, the *mask* for the file names), is set in the file <filetype.gpp>. If your files typically have a different extension than the one given there, you can change it in your personal copy of that file. The user-interface will then come up with the new mask the next time you start GPP.

Question: ***I get an extra dialogue when I use simple text files***

Answer: In some cases, an extra dialogue will be displayed after you click *Create*. The reason is that the file you selected belongs to a type that does not contain enough information for the data set definition to be completed. Typically this is a so-called TEKAL time-series file. Such files can be barren of any textual information and at the time we implemented the support for these files, it was decided that we solve this lack of information by displaying the extra dialogue, rather than requiring that the information be put into the file in one way or another. The extra dialogue allows you to refine the filetype and to select a column from the table to serve as date/time or as an x-co-ordinate. (see The description of data set and data files).

Question: ***How do I get my measurements into a plot?***

Answer: GPP supports a number of filetypes that can be used to input measurement data:

◇ *2D observation data:*
This filetype has been designed for the case that you have observation data at a set of arbitrary points. The file must contain the x- and y-co-ordinates of the points and the values that were observed.
◇ *Tabular data:*
Data as a function of some independent parameter.
◇ *Time-series or XY series file:*
Tables of data that may be a function of date and time (or of an arbitrary parameter).

Details can be found in the User Manual.

Remark:
- ◇ If you want, then the configuration file <filetype.gpp> can be used to automatically emphasise the fact that they are measurements. Each *model* chapter may begin with a section *presentation* that contains for instance the sentence *no lines.* This instructs GPP to suppress the drawing of lines regardless of the line type. (If you want to see something though, the line type must include a symbol!) Appendix C.2 contains more information.

Question: ***What is the difference between a state file and a session file?***

Answer: There is in fact no difference in contents. GPP makes this distinction only at start-up and at the end of the session. At start-up it reads a file called <gppstate.0>, which is the state file, unless an option *-session <file>* has been given. Similarly, at the end of the program it will write the file <gppstate.0>. To save the data sets and plots in a file that you can name yourself, use the *Session* menu. The default extension for session files is <∗.ssn>>.

Question: ***Where do the plot files go?***

Answer: When GPP saves a plot file, it puts it in the *working directory*, which is either the directory at start-up or the one given via the option *-workdir <directory>.* This also holds for the bitmap files created when animating the plots.

Question: ***What is the current directory?***

Answer: The current directory is either the directory at start-up or, the last selected directory when you have selected a file via the *Select File* dialogue when defining data sets. The current directory is not set by GPP. It simply is the directory from which the program was started or the directory that is selected during the selection of an input file.

Remark:
- ◇ Under MS Windows programs are often started via an icon or Start Menu and then the current directory is the working directory, as set in the properties of the icon.

Question: ***I see data sets that I did not create myself***

Answer: Especially when selecting a grid-line from a three-dimensional data set, you will see new data sets being created. The reason is that these data sets represent the new grid on which the selected data should be displayed. These data sets are made *public*, because it may be advantageous to look at the grid thus created - to inspect the layer thickness for instance or the depth.

H Trouble shooting

Though we have tried to make GPP as robust a program as possible, it is known to crash or behave oddly in a number of situations: Most are due to external influences and some are due to bugs in the program itself. This chapter is meant to help identifying the most common causes of trouble. It contains a checklist and a detailed list of problems that have been encountered in the past and their possible solutions. Please use the checklist to find the causes of the problem and handle accordingly.

As the program consists of several well-defined parts and working with it involves a number of well-defined steps, one step in identifying a problem is determining which category of misbehaviour it belongs to. A second refinement is the operating system you are working on, because especially problems caused by external influences are connected to details of the operating environment.

H.1 Checklist

First we define the terms by which a problem can be pinned down:

Operating systems:

The following platforms (operating systems) are distinguished:

1 *Linux:* Any workstation running Linux
2 *Windows:* Any PC or workstation running MS Windows 95/98 or MS Windows NT

Symptoms:

The misbehaviour that GPP can exhibit is defined by the following terms:

1 *Crash:*
The program simply stops, on Linux mostly after writing a core file, on Windows after displaying an error message like General Protection Fault: ...
2 *Message boxes with errors:*
The program displays one or more message boxes and then continues or stops.
3 *Messages on the screen:*
The program writes text to the screen. The text describes - sometimes cryptically - what went wrong.[1]
4 *No picture:*
If something goes wrong with drawing a data set, often the result is a (partly) empty graphical window.
5 *Incorrect graphical result (Graph):*
The result of drawing a data set is not what you expected: some parts of the window are not drawn, axes are missing, and so on.
6 *Wrong contents for files (Files):*
GPP does not allow you to select a certain parameter that you know to be in the file or the data set can not be drawn ("No presentations available").
7 *Misbehaviour of user-interface (UI):*
Anything that appears to be directly connected to the user-interface, like dialogues not coming up, not being able to select a directory and so on.

[1]Under Windows, GPP will write messages to two files, rather than to a terminal window or DOS-box. The reason is, that such a separate window is not always available. The files to check are: <gppdebug.out> and <gppmess.out> in the working directory (the directory that was the current directory when the program was started).

It is important to realise that a misbehaviour of the program is not always a crash. To solve the problem you need to be precise in defining what goes wrong and, especially, what you tried to do.

Occurrence:

1 At *start-up*: no window appears, some messages in the terminal window.
2 After the start-up screen has disappeared (*initialisation phase*): initialisation messages, either in the terminal window or via message boxes.
3 After the start-up screen has disappeared: core dump or a general protection fault (*failure to initialise*).
4 *Selecting or defining data sets:* not being able to find the files you want, errors reading the files, the data sets can not be plotted at all or not in the way you want.
5 *Errors when plotting:* the result of plotting data sets is unexpected (nothing appears, the picture seems mangled, etc.).
6 *User-interface errors:* any misbehaviour that occurs while working with dialogues or menu bars.

H.2 Errors that may occur

Below are tables describing the known problems. The tables are organised by the type of occurrence.

At *start-up (1)* or *failure to initialise (2):*

No.	System	Symptom	Details
1.1	Linux	Message	"Could not open file gen.uid - MrmNOT_FOUND"[2]
1.2	Linux	Message	“Could not open display”
1.3	Linux	Message	"Can not connect to :0.0"
1.4	Linux	Message	"Connection to server refused"
1.5	Linux	Message	"Could not allocate colour map entry"
1.6	Linux	Message	"Could not convert String to Font"
1.7	Linux	Message	"Warning: ..." (other than above)
2.1	Linux	Message	"can not fork: too many processes"

In the initialisation phase (3):

No.	System	Symptom	Details
3.1	Linux	UI	Unexpected colours or fonts (text may not be readable)
3.2	all	Message-box	"Error reading file routines.gpp"
3.3	all	Message	"Data set could not be created: . . . " (mostly a file is missing)
3.5	all	Message	"Syntax error at or near line 15"
3.7	all	Message	"Unknown option: . . . "
3.8	all	Message-box	"There seems to be a newer version . . . "
3.9	all	Message-box	"Serious differences between versions . . . "
3.10	all	Message-box	"Version of GPP newer than configuration files"

When *selecting or defining data sets (4):*

No.	System	Symptom	Details
4.2	all	Message box	"No write permission for NEFIS file"
4.3	all	Crash/UI-errors	Data set or plot from previous session does not work any more
4.4	all	UI-errors	Data set appears to be of type “XY-graph”
4.5	all	Crash	(no further details)
4.6	all	Message-box	Errors concerning ODS-routines (extra information is displayed)
4.8	all	Crash	After selecting a binary file
4.9	all	UI-errors	Defining a data set fails: the run that produced the data file failed and you want to find out why
4.10	Windows	Message-box	"Error in ODS-routine getdim: File not found"

Errors that occur when plotting (5):

No.	System	Symptom	Details
5.5	all	No picture	For no apparent reason, nothing is drawn
5.7	all	Graph	Axes are missing from plot
5.8	all	Graph	Data from a text file (like a samples file) appear to be wrongly read, hence totally different scale for co-ordinates etc.
5.10	all	Graph	Contour map of a data set displays a checker pattern
5.11	Linux	Message	"lp: can’t access file plot0001.plt"
5.13	Linux	Crash	After deleting a plot and manipulating some windows, the program crashes
5.14	all	No picture	Redisplaying pictures from previous sessions fails
5.15	all	No picture	Displaying data sets from files that are being written, fails (online visualisation)
5.17	all	Missing line	Some data line is missing from the plot

User-interface errors (6):

No.	System	Symptom	Details
6.1	Linux	UI-errors	"Unable to change directory"
6.2	all	Message box	Errors concerning SLISTs, wrong window or control types
6.4	Linux	Message box	"Current printer ... is not defined in ..."
6.5	Windows	Message box	"No printer defined"
6.6	all	Message box	"Error in selection/operation routine"
6.7	all	Graph	No effect of plot option (especially changing axes)
6.8	all	UI-errors	Parameters that are displayed for a file are not correct or the parameters result in a wrong data set (the data set is 2D, where you expected 3D), and so on
6.9	Linux	Message box	"Unable to access file ..."

The above list of errors and odd behaviour is not complete. Therefore some advice is in order about what to do if something happens that can not be fit in the above tables:

1 Should the program crash under Linux, then most probably a core dump is produced. It would be interesting to find out what caused the crash. For this the *core* file is available. The procedure is:[3]

   1.1 Start the appropriate debugger (xdb, dbx or if all else fails, adb).
   1.2 Retrieve the list of subroutines that are called (the stack trace).
   1.3 Send this list with additional information to the GPP Support team.

2 Should the program crash under Windows, then there is very little you can do with the debugging facilities that Windows provides (such as the Developer Studio): it requires a debugging database which has to be located in precisely the same directory as on the machine the executable was created on. The assembly code that may be shown is not very informative, as no trace is provided.
3 Document the problem via the above terms and provide information about the files and data sets you were using at the time - if at all possible.

Notes on version 2.00:

The following errors listed in the tables above have been solved or should have been solved. Their description is retained both for documentation purposes and to make sure that they do not reoccur:

◇ Error 5.2: bars in histograms (balance plots) no longer filled (this has not been seen in version 2.00, though there is no report of the *cause* being solved).
◇ Error 5.4: printed contour maps showing the underlying grid.
◇ Error 5.6: uniform values in contour maps caused crash or hanging program
◇ Error 5.9: large arrow heads.
◇ Error 5.11: disappearing print files.
◇ Error 5.12: crash when clicking *Start animation*.
◇ Error 6.3: missing data window (showing the results of point selections)

The release notes contain more detailed information about these and other corrections.

Explanation of the errors:

Error	**Explanation**	**Remedy**
1.1	Under Linux the environment variable UIDPATH is used to find the so-called UID file. This variable should have been exported. It is set by the profile and by the scripts via which GPP is run.	Check if the variable has a proper value; consult the maintenance team.
1.2	The environment variable DISPLAY identifies the workstation or X-terminal to use for displaying the windows. If not set, then no screen is available.	Check if the variable is properly set. You may use a command-line option instead of the variable.

continued on next page

[3]The precise commands differ from program to program. Consult the appendix for details.

Table H.1 – continued from previous page

Error	Explanation	Remedy
1.3	If the workstation or X-terminal uses an authorisation scheme, you must be allowed to connect to it.	Use the command *xhost* to ask for connection.
1.4	Two possible causes for errors regarding colours: 1 The colour name is unknown. 2 The colour table is filled up.	Check the X-resources via `xrdb -query`: the name might contain a space.
1.5	The font, as specified via the X-resources, is not available on the X-server or an error was made in the string value for this resource.	Check the available fonts (via *xlsfonts*).
1.6, 1.7	Warnings concerning “translations” and other obscure messages occur sometimes.	Ignore them, if everything seems to work. Otherwise consult the system manager.
2.1	GPP is actually started via a script. If you have no permission to run the executable itself or the executable is not found, then the script is started recursively.	Check the file permissions for the executable of GPP.
3.1	Under the CDE environment a lot of resources (colours, fonts and so on) are provided directly by the window manager. These may conflict with the ones contained in the GPP resources file ($HOME/gpp/gpp). We have not found the proper solution for this yet.	Rename the file <gpp> to <gpp.org> and restart the window manager.
3.2	When GPP starts, a number of configuration files are read. Errors opening these files or (syntax) errors reading them are reported via message boxes. Details are reported on screen.	Check the mentioned configuration file for possible errors.
3.3	At start-up the file <gppstate.0> or a session file is read. This defines the initial data sets and plots. If the file that is used to retrieve data for a data set does not exist any longer or can not be found (see below), the data set can not be created.	Check if the file still exists. (Note: Plots may be missing as a consequence.)

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Table H.1 – continued from previous page

Error	Explanation	Remedy
3.5	While reading a configuration or session file a syntax error was found. The message tells you what line and which word. It should also tell the name of the file.	Correct the error by editing the file.
3.7	If the program reports that some (plot) option is unknown in the session file, you probably created it with a different set of configuration files, specifically the file <routines.gpp>.	Check if the file <routines.gpp> contains the same list of options for the plot routine in question.
3.8	If GPP reads a configuration file with a higher version number than is registered in the program, it will display this message. It probably means that you are using an old executable.	Check if you are using the correct executable. Use the *-verbose* to find out where the configuration files come from.
3.9	If the major number of the version of a configuration file is different from the program, you may have an incompatibility. To warn against this, it displays this message.	Re-install the configuration files, via the *gpp_install* script, for instance.
3.10	If the minor number of the version of a configuration file is lower than that of the program, no incompatibility should exist, but you may be using less functionality than is available.	Re-install the configuration files, via the *gpp_install* script, for instance.
4.2	NEFIS files actually consist of two files, a definition file (extension often *.def*) and a data file (*.dat*). Both need to be opened read-write in the current set-up of the NEFIS library.	Make sure you that you can write to the files, even though the files will not actually be written to.
4.3	GPP stores information about the data set in the session file for quick access. This information should match the information that is actually in the file. If the file has been overwritten (for instance, another run is done with a different number of time steps), there will be a mismatch between the session file and the actual data file.	Avoid overwriting existing files or choose Session/New to start without any data sets or plots.

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Table H.1 – continued from previous page

Error	Explanation	Remedy
4.4	Some models (notably D-Water Quality or DELWAQ) do not put co-ordinate data in their output files. This means that the model grid must be selected separately. Only then does the program have the relevant grid information.	Select the appropriate grid file *before* defining a data set from a DELWAQ/D-Water Quality map file.
4.5	Some filetypes offer little or no information that the program can check. So, if the program tries to read an arbitrary file assuming the *wrong filetype*, it may fail in this attempt.	Be careful when selecting files: use the correct filetype whenever possible.
4.6	Errors that occur while reading the files are presented via a message box. In many cases the text is descriptive enough to identify the problem. But see also 4.10.	Handle according to the message.
4.8	If you try to read a binary file that was written for a different platform, then GPP will fail in most circumstances, because it is almost impossible to recognise that it was not meant for the current platform. This is especially true for files written on PC and read on Linux and vice versa. For the various Linux workstations there is no such problem.	Never use binary files written on a PC under Linux and vice versa.
4.9	If a program fails to complete, the resulting data files may or may not be readable by GPP. This depends on the type of file, on the implementation of the reading routines and on the type of failure.	Use different methods to inspect the run.
4.10	The current versions of MS Windows make it very easy to create directories that contain embedded spaces (like "My Documents"). Some reading routines do not expect this and use the space as the end of the filename. Consequently, some types of files can not be read, if one of the directories contains an embedded space.	Move the file or files to a directory path that does not contain spaces.

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Table H.1 – continued from previous page

Error	Explanation	Remedy
5.5	If a conflict arises in the co-ordinate systems that the various plot routines want, for instance, a time axis and simultaneously an ordinary axis, nothing can be drawn. A similar situation occurs, when a data set could not be properly read. For technical reasons, no message box can be displayed.	Try to redraw the picture with one data set at a time. Check the types of axes the data sets and plot routines use.
5.7	If the axes use a lot of labels or are defined with minimum and maximum reversed (but no suitable sign for the step-size), the graphics library decides it can not plot the axes.	Double-click in the plot area and reset the axes domain (*via Plot options*).
5.8	The data in a data set from a TEKAL data file or another text file were specified using the D-format, e.g. 1.0D+00. This format is not recognised by the C reading routines. (Fortran90 does not write it anymore). As a consequence the exponent is not read properly.	Change the D-format to the equivalent but more widely supported E-format. (1.0E+00).
5.10	Checker patterns in contour maps may arise in the following situations: 1 The contour value is equal to the initial value in a calculation. Very small deviations may be positive and negative in a checker-like pattern. 2 The calculation is in fact diverging, resulting in positive and negative errors that propagate and grow. 3 The underlying grid has a different numbering, as might be when a grid from Delft3D-FLOW is present when a map file from D-Water Quality is read.	Check which of these situations apply. In the last case: make sure no model grids or data sets from Delft3D-FLOW in general are present in the current session.
5.11	On some Linux systems the *lp* command does not make a copy of the file to be printed. As the *lp* command finishes, GPP continues with the next step: deleting the plot file. Hence when the printer spooler tries to access the file, it is not there anymore.	In the file <devices.gpp> use the option -c (for copy) in the printer command: `lp -c -dprinter`

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Table H.1 – continued from previous page

Error	Explanation	Remedy
5.13	The plot that was deleted was still in use by some window. This received a message to redraw the picture and then tried to access freed memory. (The real solution is that GPP keep track of windows and plots.)	Be careful when iconising plot windows - the most common circumstance in which this occurs.
5.14	Redisplaying data sets may fail if the underlying data files have changed. A typical example is: you have run a program, looked at the results, changed the input and have run the program again. The definitions of the data sets in the state file are now inconsistent with the actual contents.	If you rewrite data files, be sure to redefine the data sets. One easy way: select *File/New* , to remove all data sets and plots and start again.
5.15	You can use GPP as a somewhat cumbersome on-line visualisation tool, but it was not actually designed for this. Thus, the user-interface may show a time to be available, but the data for that time need not be in the file yet.	If you want to use GPP in that way, do not import data sets for times near the end of the available list.
5.17	There are a couple of reasons why a data line might be missing from a plot: 1 The data fall outside the range of axes. 2 The data set was not added to the plot (*Add* was not clicked properly). 3 The line is too thin to be displayed visibly on the screen. 4 The data set belongs to a model that suppresses the drawing of lines.	Use the plot options dialogue to reset the axes' domain or select a different line type, especially one that uses a symbol.[4]

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[4]Some extra remarks are relevant here:
The thickness of the lines and the occurrence of symbols is controlled by the file <setting.gpp>, one of the configuration files. Very thin dotted lines may actually be invisible. Making the line thicker helps.
In <filetype.gpp> the presentation section for each model may be used to exclude certain attributes for plotting lines - which is especially useful for measurements. You may want to check that not too much is excluded though. If it contains the keywords no lines and no symbols, then nothing will be displayed!

Table H.1 – continued from previous page

Error	Explanation	Remedy
6.1	In very rare circumstances changing a directory may be impossible: 1 The network is very busy and a timeout is encountered 2 The directory contains an invalid subdirectory (this is a very rare situation which has occurred once in the four years' time we have been working on GPP)	Either try again or have the system manager look at the contents of the directory.
6.2	Error messages about SLISTs or invalid handles and the like should not occur. If they do, they represent unsolved program errors.	Make as detailed a report as possible and send it to the maintenance team.
6.4	The default printer is determined by the command-line option *-printer*, the environment variable *LPDEST* or by the environment variable *PRINTER*, in that order. If neither is defined or it is set to a value that does not correspond to a printer in the file <devices.gpp>, GPP will complain about it.	Set the environment variable *LPDEST* via your login file (this is also very convenient for printing in general).
6.5	At present, the Windows system does not define a default printer.	You should set a printer via the *Print setup* dialogue.
6.6	When you select a selection routine to create a new data set, but later click *Cancel* in one of the dialogues, the program displays this message. (The text should be less intimidating.)	Ignore the message - the text should be changed.
6.7	In some cases, changing the plot options only takes effect if you also ask for a resetting of the axes (in the *Plot options* dialogue). Changes in the options only take effect if *Apply* is clicked.	Be sure to click *Apply* when you change an option and to use *Reset axes domain* if you change an option connected to axes.

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Table H.1 – continued from previous page

Error	Explanation	Remedy
6.8	If you expect a data set to be of a particular type (for instance 3D), hence you can select certain plot routines or selection routines, and it is not, then the following causes may apply: 1 The file does not contain 3D data 2 You have no corresponding grid (*cf.* 5.10) 3 The reading routine contains a bug	Try to detect which applies, by examining the data file with different means or by importing other data sets from that file. Sometimes you need to explicitly load a model grid (see below).
6.9	When moving to a directory like "/", you get this message. The reason is quite unclear, but may have to do with the so-called auto-mounter. After clicking *OK*-the directory list is empty.	You can do nothing else than restart GPP. Try starting it in the directory you wanted in the first place - this avoids a repetition of the error.

H.3 Problems involving files and directories

There are a few problems that require a more extensive explanation than can be given in the above tables:

1. Dealing with so-called NEFIS files (all platforms)
2. Dealing with map files from D-Water Quality (or DELWAQ; all platforms)
3. Dealing with binary files (all platforms)
4. Directories under Linux

H.3.1 NEFIS files

GPP can read numerous different NEFIS files, as this file format is used by a large number of computational models of WL |Delft Hydraulics. The things you should be aware of are:

1. The NEFIS files are portable among platforms (one of the reasons this format was developed).
2. They consist of a data file (usually with the extension *.dat*) and an accompanying definition file (extension, usually, *.def*). You need both files to read the data.
3. To avoid the selection of both files, GPP *always* assumes that the files have names that only differ by the extension and that they are located in the same directory. *This does not normally present any problem.* It is just that when copying the files you must be aware of the fact that there are physically two files.
4. Due to the way the NEFIS subroutine library has been set up, the files must be *read-write* for anyone trying to read them. *This can be a problem, especially if you want to look at the files that some one else created.* As a consequence, the user-interface will warn you about the fact that the files are not read-write and will refuse to read them.
5. Some NEFIS files are written in such a way that the information that constitutes a complete time step (time and data) is dispersed. On failure, part of the information is present and can be read, other parts are not available or accessing them causes an error. Depending on the way the information is retrieved, GPP may or may not be capable of handling such files.

H.3.2 Map files from D-Water Quality (DELWAQ)

One of the computational models supported by GPP is D-Water Quality (also known as DELWAQ). This water quality model is extremely flexible in the kind of geometry it uses for representing the water body. Because of this, it does not actually uses a *grid*, rather it uses a *pointer table.* Unfortunately, this means that you must import the model grid separately.

The algorithm used by GPP to match the data sets from the D-Water Quality map files to the grid files may get confused. The criteria for matching are:

1. The sizes of the matrices are equal, or
2. The number of active grid cells (per layer) are equal
3. The first one in the (alphabetic) list that matches will do

Model grids from Delft3D-FLOW map files use a different numbering technique than those involved in the water quality calculations. As a consequence, you should not try to mix them, as then checkerboard patterns will occur. The workaround is easy:

1. First import the grid underlying the water quality files (a DELWAQ curvilinear grid file in most cases)
2. Then import the water quality model results or the flow model results. This will make sure that the appropriate grid is used for any water quality data set you create.

H.3.3 Binary and unformatted files

In general binary or unformatted files can be used only on the same platform as they were created. That is:

1. Binary or unformatted files created on a PC can only be used on a PC, though the version of MS Windows does not matter.
2. Files created on a Linux workstation can be used on any other UINX workstation that uses the same number formatting. You can safely exchange such files among HP, SUN Solaris, IBM RS6000 and Silicon Graphics workstations. (The list may include other vendors as well, but we have mainly experience with the ones mentioned.)

The reason is that the files contain raw bytes that should be correctly interpreted by the program. It is however next to impossible to detect whether the contents of a binary or unformatted file is indeed appropriate for the platform you are working on. *This means that the checks should be made by you as a user!*

H.3.4 Navigating over directories

Under Linux files and directories may actually be *links*.[5] They serve as an alias for the actual name of the directory or the file for that matter. Some Linux environments, such as the Korn shell are able to maintain the logic of these links as if they were regular files and directories, others (e.g. the C shell) are not. Unfortunately, this logic has to be implemented explicitly by each program that wants to behave in the same way.

An example will help to show the problem. Suppose that the *physical* directory where your home-directory is located is:

/disk4.users32/dep1/smith on the workstation *workdep1*

[5]Links are similar to but not the same as shortcuts known from the Windows platform. They are more flexible than that, as they can represent entire directories.

To enable you work conveniently, the system manager has made links, such that any machine you work on knows about the directory */u/smith*:

> On *workdep1* the directory /u/smith is linked to /disk4/.users32/dep1/smith
> On *calc2* the directory /u/smith is linked to a NFS mount to the workstation *workdep1*, such that your *logical* home-directory is the same. The actual name of this mount is /workdep1/disk4/dep1/smith.

If you use the Korn shell, and you are in the directory */u/smith* the command *cd ..* changes the work directory to */u*, on any machine. This is because the Korn shell keeps track of the logical path. However, the C shell follows the physical path and will come up with this:

workdep1	the new directory becomes /disk4/.users32/dep1
calc2	the new directory becomes /workdep1/disk4/dep1

This also happens in any program, like GPP, that asks for the current directory: the *physical* rather than the *logical* path is returned.

I Overview of data sets

GPP supports a wide range of data set types. The purpose of this appendix is to provide an overview of these types and some of their properties. Data sets in Delf3D-GPP are classified according to their structure and their purpose. The structure (whether it is a time-series for instance) is indicated by the *type* and the purpose and further properties are recognisable via the *subtype*. Here are two examples:

- ◇ A time-series for some quantity where also error parameters are available (so that the error margin around each point can be drawn) is characterised as TIMESERIES/ERROR_MARGINS. This way the correct plot routine can be chosen automatically.
- ◇ The flow velocity as computed for a coastal area with a three-dimensional model is defined on a three-dimensional grid. The flow velocity at each point of this grid consists of three components: one for each co-ordinate direction. In GPP such a data set (assuming there is only one time) is called MAP3D/VECTOR3D. Again these two keywords are used to identify what can be done with such data sets.

The *type* of the data set is completely determined by the number of spatial dimensions and whether there is one or more than one time involved. One complication is that not all data sets are defined on a computational grid, but rather on separate locations recognised by a name. Another complication is that there are several types of computational grids possible, structured and non-structured. These complications are taken care of within the program in such a way that the user does not have to worry about them.

In the table below the most important types are described (an asterisk - $*$ - in the column for the spatial dimension means that the data set is defined on separate named locations).

Type	**Number of times**	**Spatial dimension**	**Remarks**
TIMESERIES	>1	0	Mostly defined on one named location
XY_GRAPH	1	1	Requires an array with x co-ordinates
MAP2D	1	2	Assumes a two-dimensional grid
MAP3D	1	3	Vertical dimension is a set of layers
TOPOGRAPHY	1	>0	Keyword for any kind of grid data set or data set holding co-ordinates in general
DIAGRAM	1	$*$	Data defined on two or more named locations - e.g. data for a histogram
ANIMATED_MAP2D	>1	2	Like a MAP2D data set, but with two or more times

Notes:

◇ There are more data set types than the above, in fact GPP defines a type for each combination of dimensions.
◇ There are also data sets defined on a “named” location that have yet another spatial dimension, such as wave spectra.

The *subtype* of the data set is used to distinguish scalar data from vector data, to select special plot routines and so on. In the table below the most important subtypes are explained:

Time-series	**Description**
SINGLE	Ordinary time-series of one parameter
MULTIPLE	Time-series with more than one component
X_APPENDED	Time-series with an x co-ordinate appended, so that the data set can also be used for plotting the parameter as function of the travelled distance
LIMITING_FACTORS	Time-series with several indicator parameters attached. This kind of data set arises in the ecological model Delft3D-ECO for algae and the limits on growth.
ERROR_MARGINS	Time-series with minimum and maximum values attached, so that an interval can be drawn.
XY_COORDINATES	Time-series consisting of x and y co-ordinates of for instance a drogue or a particle as function of time. This kind of data set is used for the *trajectory* of such drogues and particles.

Map2D/Map3D	**Description**
SINGLE	Scalar quantity, such as salinity or water level, defined in the centre of the grid cell
VALUE_AT_VERTEX	Scalar quantity defined at the corner (vertex) of a grid cell
VECTOR	Vector quantity (two directions) defined in the centre of the grid cell
VECTOR_AT_VERTEX	Vector quantity (two directions) defined at the corner (vertex) of a grid cell
VECTOR3D	Vector quantity (in *three* directions) defined in the centre of the grid cell
POLAR_COMPONENTS	Vector quantity whose components are given as magnitude and direction (counter-clockwise, the mathematical convention)
NAUTIC_COMPONENTS	Vector quantity whose components are given as magnitude and direction, but according to the nautical (clockwise) convention, where “north” is zero degrees
FINITE ELEMENTS 3	Scalar quantity defined on a finite elements grid (type 1, used by the SHYFEM model)
FINITE ELEMENTS 3P	Scalar quantity defined on a finite elements grid (type 2, used by the PHAROS model)
GRID_POLAR_LOCAL	Vector quantity whose components are given as magnitude and direction but with respect to the local grid orientation

XY-graph	**Description**
SINGLE	Scalar quantity, such as salinity or water level, defined along some co-ordinate
MULTIPLE	Several scalar quantities defined along some co-ordinate
SAMPLES	Scalar quantity defined on one or more locations in the horizontal plane (x and y co-ordinates appended)
VECTOR	Vector quantity defined on one or more locations in the horizontal plane (x and y co-ordinates appended)
POLAR_COMPONENTS	Vector quantity whose components are given as magnitude and direction (counter-clockwise, the mathematical convention) - also on one or more locations
NAUTIC_COMPONENTS	Vector quantity whose components are given as magnitude and direction, but according to the nautical (clockwise) convention, where “north” is zero degrees- also on one or more locations
VERTPROFILE	Scalar quantity defined on a vertical co-ordinate (this subtype is used mainly to select a specific plotroutine)

Diagram	**Description**
SINGLE	Scalar quantity, defined on a set of named locations (displayed as a histogram)
XY_TEXT	Text defined at some xy co-ordinate, the text itself is displayed in the user-interface as the names of locations. (Yes, this is a somewhat peculiar workaround)

Topography	**Description**
CURVILINEAR GRID	Curvilinear grid (a structured grid) where each grid cell is characterised by an index number and the co-ordinates of one corner
FINITE ELEMENTS 3	Finite elements grid of the type used by the SHYFEM model
FINITE ELEMENTS 3P	Finite elements grid of the type used by the PHAROS model
LANDCONTOURS	Set of xy co-ordinates forming a land boundary (the boundary itself can consist of one or more polylines and polygons)

Further notes:

◇ A parameter with the name *model-grid* is *always* assumed to be a topographical data set and is thus handled in a specific way.
◇ Two other parameter names exist which are handled in a special way: z*-coordinate* and *LocalDepth*. Both have to do with the need to determine the vertical co-ordinate for three-dimensional data sets. As these parameters are not very useful for any other purpose, they are not shown in the user-interface (see also the description of the file *filetype.gpp*).

J Models and filetypes

GPP organises filetypes in groups called *models*. The name comes from the computational models that produce the files that are visualised using GPP.

For simplicity, any data source is termed a *model*, but as long as the files are correctly structured according to the format, they may be produced by any program, including text editors.

In some cases an extra parameter *model-grid* is defined. This parameter is special within GPP as it represents the co-ordinates at which the data are defined. It is used for both two- or three-dimensional data sets defined on some computational grid, but also if the data set is a function of some independent parameter.

Remarks for version 2.00

This version contains several incompatibilities with the previous releases (versions 1.18 and 1.19), because we needed to handle things in a better way:

◇ Most parameters from the Delft3D communication filetype now have regular names, rather than encoding like "S1" or "DP". *This means old session files that refer to the old names will cause complaints from GPP*.
◇ The *Samples* filetype has been enhanced: now you can specify names for the data columns and the subtype is specified via the *default-subtype* keyword. This means that the old, somewhat clumsy names "Parameter 1", etc. will not be recognised in old session files.
◇ For the TEKAL 2D data files the *default-subtype* keyword is also used. The values are supposed to be defined on the corner of a grid cell, indicated by *VALUE_AT_VERTEX*. (See also the FAQ).

GPP will warn you about the possible incompatibility, because the major version numbers will be different.

A new subtype has been introduced: VECTOR_AT_VERTEX. This makes it possible to plot vectors starting in the corner of a grid cell. It is used for the TEKAL 2D vector files. Actually, two versions are supplied: vectors defined in the centre and vectors defined in the corner. (See also the Appendix G)

Some *models* are no longer supported:

◇ The hydrodynamic model TRISULA has been fully incorporated in the Delft3D package, as Delft3D-FLOW, and therefore the *model* TRISULA has been removed.
◇ This is only partly true for the water quality model DELWAQ, hence this *model* definition has been retained. The binary versions of the output files are used in other contexts.
◇ The wave model PHIDIAS has become obsolete. The *model* definition is still contained within this file, but only as comments.

Model/origin: Delft3D

The Delft3D system consists of a large number of modules, such as Delft3D-FLOW and D-Water Quality, that produce various types of output files.

Three general categories exist:

History files

Such files contain detailed information on the results of a calculation for selected monitoring points.

Map files

Files that contain the results for the whole grid. Because of the size of the files the number of times is generally smaller than for history files.
To visualise data sets from these files, it is necessary to have a matching grid. In most cases this is automatically taken care of (via the keyword *contains topography* and the special parameter *model-grid*), but for map files from D-Water Quality, the water quality module, you need to explicitly import a grid file.

Grid files

For the general water quality module (D-Water Quality) separate files are used that only contain the grid information.

Remark:
◇ The water quality modules within Delft3D use a so-called T0 string to store the date/time information. This is automatically taken care of by the user-interfaces. For an explanation of this convention we refer to the User Manual, as it is also used in other cases.

For your convenience the following table describes the naming conventions for the data files that you would select in GPP and their accompanying files that are automatically selected (the name is the same, except they have a different extension).

Data file	**Secondary file**	**Comments**
∗.dat	∗.def	Common extension, the *name*, not the extension determines the type of file. The files are independent of the platform.
∗.ada	∗.adf	Map file (WAQ; independent of the platform)
∗.had	∗.hdf	History file (WAQ; independent of the platform)
∗.lga	∗.cco	Grid file (WAQ). As the file is binary it must be used on the platform it was created on.
∗.bal	(none)	Balances file (also binary, used by WAQ)

Filetype	Description
Communication file	The communication file is used for transferring information between different modules of Delft3D, notably the hydrodynamic data calculated by Delft3D-FLOW. The map files from the Delft3D-MOR *Bottom* module can be handled as this type as well. The appropriate file mask is: *botm*.dat*. (We will introduce them as a separate file type in a future version). *Note:* Though it is possible to read communication files that contain the results for a three-dimensional model, GPP does not support vertical cross-sections yet, as the essential information, the vertical co-ordinate, can not be read from this type of file. Special parameter(s): ◇ model-grid ◇ Wave vector ◇ Wave forces ◇ Wave volume flux ◇ Av.Bed Load Transp ◇ Av.Susp. Transp ◇ Flow velocity
Hydrodynamic history file	This type of file is produced by Delft3D-FLOW and contains detailed results for selected monitoring points. If the model is three-dimensional, some parameters will be defined on layers, making it necessary to select a single layer before you can plot a time-series. Special parameter(s): ◇ Tidal ellipsis ◇ Tidal ellipsis (av.)
Hydrodynamic map file	This type of file is produced by Delft3D-FLOW and contains the results for the whole computational grid. Via the special (or extra) parameters you can view the flow velocity as a vector. Special parameter(s): ◇ model-grid ◇ Flow velocity ◇ Flow velocity (3D)
Hydrodynamic drogues file	This type of file is produced by Delft3D-FLOW and contains the trajectory of *drogues* calculated within the runs. Special parameter(s): ◇ drogue track

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Filetype	**Description**
Fourier vector file	File produced by Delft3D-FLOW and contains computed amplitudes and phases of selected parameters. Special parameter(s): ◇ Vectors-AMPL ◇ Vectors-PHAS
Water quality history file	This type of file is produced by D-Water Quality and the more specialised versions, Delft3D-ECO, Delft3D-SED and Delft3D-CHEM. The file contains detailed information on selected monitoring points. If all components are present, it can also return the so-called *limiting factors* that show details about algae growth processes. Special parameter(s): ◇ Limiting factors
Water quality map file	This type of file is produced by D-Water Quality and the more specialised versions, Delft3D-ECO, Delft3D-SED and Delft3D-CHEM. The file contains information on the whole grid. You will need to import a corresponding grid file for displaying contour maps.
Water quality grid file	This type of file contains the grid used in D-Water Quality and D-Waq PART calculations. (It is accompanied by a file with extension <*.cco>). Special parameter(s): ◇ model-grid
Mass balances file	This type of file contains the detailed water quality process terms, including the transport, for selected monitoring points. The contributions to the mass balance are automatically grouped per substance.
Mid field history file	This type of file is produced by D-Waq PART. The file contains detailed information on selected monitoring points.
Mid field map file	This type of file is produced by D-Waq PART. The file contains information on the whole grid. You will need to import a corresponding grid file for displaying contour maps.
Mid field plot grid file	This type of file is produced by D-Waq PART. The file contains information on the specified *counting grid*. (It contains the grid data itself) Special parameter(s): ◇ model-grid

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Filetype	**Description**
Mid field particles track file	This type of file is produced by D-Waq PART. The file contains detailed information on the trajectories of particles. Special parameter(s): particle track
Waves map file	The Delft3D-WAVE model uses this type of files to store the model results on the selected output grid. Special parameter(s): ◇ model-grid ◇ Flow velocity ◇ Wave vector ◇ Energy transport
Sediment transport map files	The output from the TRSTOT and TRSSUS sub modules from Delft3D-MOR is stored in these files. They contain the sediment transport on the whole (hydrodynamic) grid. Special parameter(s): ◇ model-grid ◇ Bedload tr. (frac) ◇ Bedload tr. (all) ◇ Susp.sed.tr. (frac) ◇ Susp.sed.tr. (all)
Sediment transport history files	The type of file is produced by Delft3D-MOR and contains detailed results for selected monitoring points. If the model is three-dimensional, some parameters will be defined on layers, making it necssary to select a single layer before you can plot a time-series.
Dredging results file	The *dredging* sub-module from Delft3D-MOR uses this type of files to store its results. Special parameter(s): ◇ Reference depth ◇ Cumulative dredging ◇ Depth with dredging ◇ Depth (no dredging) ◇ model-grid

Model/origin: DELWAQ

DELWAQ is the old name for D-Water Quality, it is still used, when the computational model is used *stand-alone*. The output files defined here are all in FORTRAN *unformatted* or *binary* form.

As the format is very simple, other programs have adopted the file formats for storing their output.

Remark:

◇ The original file format does not include an absolute time and date. To incorporate it, you can use a so-called T0 string as the fourth string in the header. This will define the reference time. (The User Manual explains this convention in detail.)

Filetype	**Description**
Binary history file	This type of file contains detailed results for selected monitoring points. If produced within the Delft3D context, the file contains the *same* information as the NEFIS files. Special parameter(s): ◇ Limiting factors
Binary map file	This type of file contains the results for the whole computational grid. As DELWAQ does not "know" the grid co-ordinates, you should import the grid separately. Otherwise the data sets will get the type XY_GRAPH, an unstructured set of data. If the model grid is three-dimensional, the output parameter *LocalDepth* represents the depth in the cell centres. This implicit parameter is used by some action routines to create the vertical co-ordinate.
Curvilinear grid files	This type of file contains the grid used in D-Water Quality and D-Waq PART calculations. (It is accompanied by a file with extension *.cco*). Special parameter(s): ◇ model-grid
Mass balances file	This type of file contains the detailed water quality process terms, including the transport, for selected monitoring points. The contributions to the mass balance are automatically grouped per substance.

Model/origin: DELWAQ-SHYF

When DELWAQ is used for computations based on the finite elements model SHYFEM, the grid is contained in a different kind of file than for most other applications.

Filetype	Description
Finite elements grid files (SHYFEM)	This type of file contains the grid according to the SHYFEM model. Special parameter(s): ◇ model-grid

Model/origin: DELPAR

Filetype	Description
Binary plot grid file	This type of file is produced by DELPAR. The file contains information on the specified *counting grid*. (It contains the grid data itself) Special parameter(s): ◇ model-grid

Model/origin: PHAROS

PHAROS is a wave prediction model that works in the frequency domain. Much of the results are therefore expressed as *spectra*, which can best be visualised in a polar co-ordinate system. Two kinds of data are stored in the output files:

◇ Wave characteristics in chosen locations
◇ Wave characteristics over the whole model grid

Because of the limitations in the interface definition for data files, the same output file can be read in two ways, each one corresponding to one of the above data types.

Remark:
◇ This model uses a finite elements approach, rather than a finite differences. As a consequence separate plot routines have been developed to support this model.

Filetype	Description
Administration file	Special parameter(s): ◇ model-grid ◇ Vector
Amplifications file	Special parameter(s): ◇ model-grid

Model/origin: JSPOST

JSPOST is the name of a predecessor of GPP. The file format it used is still used by some programs, especially utilities for manipulating the output from DELWAQ. The binary *PST* is accompanied by a text file with the extension *.STU*. This file contains the names of the parameters, but also the times stored in the binary file.

Note: When using this type of file, take care that the scale factor for time, as represented by the value of *SCU* in the T0 string (if present) is in accordance with the unit of time (a string like "day") appearing in the fifth line. Because the utilities ask one to supply the time string, there is no guarantee that these two pieces of information are consistent.

To be precise: the value of SCU is read, but used *only* if the time string is not recognised. The reading routines recognise: *sec, min, hour, day* and their Dutch equivalents (all in lower case).

Filetype	**Description**
JSPost files	See the above description.

Model/origin: Samples

Samples files are files in a specific text format that is suitable for incorporating measurement data with very little inherent structure. The format was designed to be as self-contained as possible (so the reading routines derive the number of parameters and data points from the file, there is no need to add this information to the file itself).

Because there is no need to count anything, a dump from a spreadsheet is (almost) enough to create this type of files.

There are two types:

◇ Data for a single moment in time, but for various locations
◇ Data depending on some x-co-ordinate

The structure of these files is described in Section 5.3.2.

Filetype	**Description**
2D observation data	This filetype is suited for observed field data that can be said to represent one single time. Special parameter(s): ◇ Vector ◇ Vector UV
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Filetype	Description
Tabular data	This filetype is defined as a simple table of data. The first column is the independent co-ordinate. All other columns contain parameters that depend on that co-ordinate. Special parameter(s): ◇ model-grid
Time-dependent data	This file type is defined as a simple table of data with the first two columns the date and time in the yyyymmdd and hhmmss format respectively. All other columns contain parameters that are given for that date/time.

Model/origin: TEKAL

TEKAL files are files in a specific, but very flexible text format. You can use them to incorporate measured time-series, but also to store the results of calculations on a grid. This might be a solution if the other file formats that are supported by GPP are not suitable.

From the point of view of the user and the user-interface, the file format contains too little information that can be guaranteed to be present (see the User Manual for a detailed discussion.)

To solve this and still be almost as flexible as possible with this type of files, the user-interface presents an extra dialogue in certain cases, to get the missing information from the user.

The structure of these files and possible usage is described in Section 5.3.1.

Filetype	Description
Time-series or XY series file	Time-series files can contain more than one table of data, somewhat uncomfortably regarded as *parameters*. The columns of each table are therefore shown as *locations*. XY series files are actually the same as time-series files, the user has to tell the GPP program whether the independent co-ordinate is a time/date co-ordinate or an ordinary co-ordinate. Special parameter(s): ◇ model-grid
2D data file	This filetype can be used to import data defined on a regular grid. The missing value "999.999" is used to inactivate certain grid cells. The values are supposed to be defined in the upper right corner of the cells (defined by the x and y co-ordinates in the first and second columns). Special parameter(s): ◇ model-grid

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Filetype	Description
Vector data file	This filetype is actually the same as the previous, however the reading routines will recognise that two consecutive columns together form a vector. *Note:* The present implementation assumes there is one vector quantity only but it can be defined in the centre of the grid cell or in the corner. The latter type is especially useful with measured vectors. Furthermore, the columns should *not* be given an explicit name. Otherwise they will not be recognised as belonging to the *extra parameters*. The program also assumes that the vector components are Cartesian, so there is no rotation necessary. Special parameter(s): ◇ model-grid ◇ Vector field 1 ◇ Vector (at vertex) 1
Annotation file	If you need text in a geographical map, then this is the sort of file that allows you to define a data set with text strings at xy-co-ordinates. There are some limitations: There can only one table of strings Only the whole table can be used, so do not select any *locations* in the user-interface. Special parameter(s): ◇ texts

Model/origin: GIS

GPP supports several file formats that are suitable for geographical maps. Within the context of for instance Delft3D, they are typically used to show land boundaries, but you can also use them for other purposes, such as incorporating a logo (see Appendix G on frequently asked questions).

The plot routine will treat each data set derived from these files as one *chart layer*. But of course, you can combine several data sets in one plot.

Remark:
◇ Currently, the types are limited to some popular textual formats. These are relatively easy to read and to create.

Filetype	Description
BNA file	BNA files are typically produced by CAD and DTM packages or by GIS's like Arc/Info and Atlas-GIS. They contain named polylines and polygons, the labels are not used by GPP. Special parameter(s): ◇ model-grid

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Filetype	Description
DXF file	DXF files originated from AutoCAD (tm). The implementation in GPP of the reading routines simply extracts the co-ordinate information and thus produces polylines and polygons. No information about line styles, text strings or other items is used. Special parameter(s): ◇ model-grid
TEKAL land boundary file	TEKAL land boundary files are yet another form of TEKAL files, but the use is limited to defining polylines and polygons. See section 5.3.1 for more information. Special parameter(s): ◇ model-grid

Model/origin: SHIPMA

SHIPMA is a model for predicting the path (track) of a ship in the flow field around a harbour or other constructions. The file types that GPP supports are derived from others, with some special details. As these files are created within the SHIPMA user-interface, the user will never be obliged to create them him/herself.

Filetype	Description
Data plot file	This type of file contains detailed results for the ship manoeuvring parameters along the track of the ship. To make it possible to plot the data as function of distance along the track, a special subtype is used (X_APPENDED)
Environmental data file	This file type is used for storing the environmental data, such depth and flow velocities. Use *Parameter 1* for scalar data (depth) and *Vector* for vector data such as the flow velocity or the wind speed. For vector data the *nautical* convention is used (the first component is the magnitude, the second is the clockwise angle to the north) Special parameter(s): ◇ Vector
Track plot file	Track plot files contain the realised or requested ship track as (a series of) polygons. The parameter that represents this information is called *model-grid*. Special parameter(s): ◇ model-grid

Other models/origins

When you have special requirements, or want to experiment with certain features, you can define your own model section in the *filetype.gpp* file. The only condition is that you use a file type that is already present. Several such models and corresponding filetypes may be present in the official installation to show you how particular functionality can be used.

For example the SPECDATA model:

The "model" *SPECDATA* is introduced mainly for supporting files with a special contents.

Filetype	**Description**
Error margins file	This file type is defined as a simple table of data with the first two columns the date and time in the yyyymmdd and hhmmss format respectively. All other columns contain parameters that are given for that date/time. The file should contain three columns to define error margin data labelled "Mean", "Minimum", "Maximum". Special parameter(s): ◇ Time-series 1

K Plot routines

GPP recognises several groups of routines that manipulate the data sets:

- ◇ Plot routines: they plot the data according to some predefined method.
- ◇ Export routines: to store the data in some convenient external format.
- ◇ Selection routines: to create subsets of data sets (for instance the data in a single layer.
- ◇ Operation routines: to create new data sets containing data that have been processed in one way or another.
- ◇ Binary operations: to create a new data set that is some (arithmetic) combination of two other data sets.

The properties of all these routines are stored in the file <routines.gpp>, which allows you to customise certain defaults or to create specialised routines.

K.1 Plot routines

K.1.1 Plot Timeseries

Routine to plot time-series, using a date/time axis. The options allow the appearance to be changed. For instance: a vertical axis on the right is used if the option "Use right axis" is set to true.

You can plot data sets with this or other routines in one and the same area, but the axes are shared resources. Sometimes it is convenient to use two independent scales. For this you can use the option mentioned above.

Option	**Default value**
Use right axis	FALSE
Logarithmic axis	FALSE
Border around plotarea	TRUE
American time notation	FALSE
Text in legend	Dataset name
User-defined string in legend	“?”
Date string at ends time-axis	Date and time
Horizontal line at 0.0	FALSE
Months as digits	FALSE
Character between date digits	:
Start at zero (remove offset)	FALSE

K.1.2 Plot Limiting Factors

This routine plots a graph of chlorophyll and the so-called limiting factors for algae growth. The type of presentation is somewhat specialised, but if it is suitable for your needs, then it is almost as general as the time-series routine "Plot Timeseries".

Remark:

◇ Logarithmic axes are not currently supported (as the negative vertical axis is reserved for plotting the limiting factors).

Option	**Default value**
Use right axis	FALSE
Border around plotarea	TRUE
American time notation	FALSE
Text in legend	Parameter and location
Date string at ends time-axis	Date and time
Horizontal line at 0.0	TRUE
Months as digits	FALSE
Character between date digits	:

K.1.3 Plot Error Margins

Routine to plot time-series that have error margin information. The data points appear as intervals, rather than a single dot.

Option	**Default value**
Use right axis	FALSE
Logarithmic axis	FALSE
Border around plotarea	TRUE
American time notation	FALSE
Text in legend	Parameter and location
User-defined string in legend	“?”
Date string at ends time-axis	Date and time
Horizontal line at 0.0	FALSE

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Option	Default value
Months as digits	FALSE
Character between date digits	:
Start at zero (remove offset)	FALSE
Width of horizontal bars (mm)	1.5
Radius of margin disk (mm)	1.0
Colour for drawing error margin	Black

K.1.4 Plot curvilinear grid

This routine plots the cells in a curvilinear grid. As an option, it may limit plotting to those sides of the *active* cells that are shared with *inactive cells*, thereby creating a primitive boundary outline.

Option	Default value
Border around plotarea	FALSE
Draw outline only	FALSE
Axis type	Geographic axes
Colour of grid lines	Black
Line thickness (mm)	0.15

K.1.5 Plot finite elements grid

This routine plots the grid used by finite elements models. The grid cells have triangular shapes.

Option	Default value
Border around plotarea	FALSE

K.1.6 Plot contour map

This routine plots contour maps based on a curvilinear grid. The contour classes are initially determined automatically, and can later be changed via the *plot options* dialogue.

To use predefined classes you can:

◇ Change the keyword automatic-scaling into a list of class values, like:

```
values 0 0.1 0.2 0.5 1.0 2.0 5.0 end-values
```

◇ Use a so-called classes file. This file is expected to reside in the system directory as if it were a configuration file. The format of these files is very simple indeed:
◇ An asterisk or a hash in the first column means comment.
◇ All other lines should contain a single number that is taken to be a class limit.

Remark:
◇ To resume automatic scaling, it suffices to delete all classes via the plot options dialogue. (Make sure not to leave empty lines, though).

The routine may use *linear* axes in stead of *geographic axes* if the aspect ratio of the bounding box that encloses all grid points is lower than 0.01 or greater than 100.0. This normally happens with vertical cross-sections (after selecting a grid line in a 3D data set): the depth is in general much smaller than the horizontal extent.

Option	**Default value**
Border around plotarea	FALSE
Contour classes	automatic-scaling
Add classes to legend	TRUE
Use classes file	FALSE
Name classes file	default.cls
Extra missing value	-999
Axis type	Geographic axes

K.1.7 Plot isolines

This routine plots iso-lines based on a curvilinear grid. It has the same capabilities as the contour routine (PlotContours). We refer to this routine for further details.

The iso-lines can be black or they can be coloured:

◇ Use *black* lines, if you want to emphasise contour maps (use the same contour classes then)
◇ Use *black* lines, if you want to overlay e.g. the depth on a contour map of another parameter.
◇ Use *coloured*, if you want a true iso-lines plot.

Remark:

◇ Unfortunately, the plot technique that is used does not allow the lines to be dashed: the lines in each grid cell are drawn separately, so there is no continuity. This is also the reason why the iso-lines can not be annotated with class values.

An alternative technique that could be used is that first the data set is interpolated to a regular grid and then the iso-lines are drawn. However, doing so would give slight but annoying differences in the precise shape of the iso-lines versus the contour maps.

Option	Default value
Border around plotarea	FALSE
Coloured iso-lines	FALSE
Contour classes	automatic-scaling
Add classes to legend	TRUE
Use classes file	FALSE
Name classes file	default.cls
Extra missing value	-999
Axis type	Geographic axes

K.1.8 Plot thin dams

This routine plots the sides of the grid cells that are considered *dry*. The sides can be:

◇ Adjacent to inactive cells (permanently dry cells, indicating land)
◇ Temporarily dry due to the water level (drying and flooding of tidal flat).

(*cf.* Documentation on Delft3D-FLOW for the meaning of dry grid cells and sides of grid cells).

Remark:

◇ The data set must contain a component called "UVDAMS" for this routine to work properly. Otherwise nothing will be drawn (see the file with definitions for the filetypes, <filetype.gpp>).

Option	Default value
Border around plotarea	FALSE
Draw outline only	FALSE
Axis type	Geographic axes

K.1.9 Plot XY graph

This routine plots simple XY-graphs. It expects an x-co-ordinate to be present either in the data set or in the topographical data set that is associated with the data set. If neither is the case, it will use the index of the data as the x-co-ordinate.

If you exchange the x- and y-axis via the plot options, for instance when the data represent a vertical profile, be sure to *reset* the axes, as otherwise the plot routine will continue to use the old co-ordinate system.

Remark:
- ◇ *You* can use this routine on data sets that were derived as a single grid line from a 2D data set (via *Select N/M grid-line*). The x-co-ordinate will then be the *chord* co-ordinate along the grid line.

Option	**Default value**
Use right axis	FALSE
Logarithmic axis	FALSE
Border around plotarea	FALSE
Exchange x/y axes	FALSE
Text in legend	Dataset name
Horizontal line at 0.0	FALSE

K.1.10 Plot vertical profile

This routine plots simple XY-graphs with the axes exchanged, so that the presentation is more suitable for vertical profiles.

Option	**Default value**
Use right axis	FALSE
Logarithmic axis	FALSE
Border around plotarea	FALSE
Exchange x/y axes	TRUE
Text in legend	Parameter
Horizontal line at 0.0	FALSE

K.1.11 Polar contourplot

This routine plots contour maps based on a polar co-ordinate system, that is, the x- and y-co-ordinates of the grid are interpreted as being the radial and tangential (in degrees) co-ordinates. It has similar capabilities as the ordinary contour routine (PlotContours), except that it does not support the use of classes files yet.

Option	**Default value**
Border around plotarea	FALSE
Contour classes	automatic-scaling

K.1.12 Polar isoline plot

This routine plots iso-lines based on a polar co-ordinate system (*cf* the routines PlotContours and PlotPolarContours for details).

Option	**Default value**
Border around plotarea	FALSE
Coloured iso-lines	FALSE
Contour classes	automatic-scaling

%———————————————————————————— subsectionPlot contour map (FEM)

This routine plots contours for data sets based on a finite elements grid. The elements must be triangular. It is similar in function to PlotContours, though it is less flexible (it does not allow a classes file to be used or different types of co-ordinate axes).

Option	**Default value**
Border around plotarea	FALSE
Contour classes	automatic-scaling
Extra missing value	-999

K.1.13 Plot isolines (FEM)

This routine plots iso-lines for data sets based on a finite elements grid. The elements must be triangular. It is similar in function to PlotIsolines, though it is less flexible (it does not allow a classes file to be used or different types of co-ordinate axes).

The iso-lines can be coloured or all in black, to emphasise the bounds between contours.

Option	Default value
Border around plotarea	FALSE
Coloured iso-lines	FALSE
Contour classes	automatic-scaling

K.1.14 Plot finite element grid

This routine plots the grid used by a finite elements model, The grid cells have triangular shapes.

Option	Default value
Border around plotarea	FALSE

K.1.15 Plot vector field

The purpose of this routine is to draw a vector field. It can plot the vectors in various ways:

◇ Uniformly coloured: each individual vector has the same colour and the vectors are scaled with the same factor.
◇ Coloured according to the length: just like in contour plots you can specify a set of classes. The vectors will be coloured according to the class the length of the vector.
◇ Thin out the vectors so that the underlying grid is no longer apparent or the thickening due to locally small grid sizes is reduced. The thinning is done by constructing a set of arrows whose starting points are at least a certain minimum distance from each other. Using a value of zero or less for this distance disables the thinning.
◇ Non-uniformly scaled: if you have a vertical cut-out from a 3D data set it may be advantageous to accentuate the vertical vector component. You do this by applying a scale factor larger than 1 to the y-component.
◇ The arrow head and shaft can be controlled in detail. By combining the correct options, you can make the arrow head always display the direction, even though the shaft itself is too short.

The routine tries to determine the default scaling in such a way that the mean vector length is roughly of the order of a single grid cell. The scale factor is reported as the length in mm of the arrow on the screen or paper that represents a vector of length 1 in the data set. (for instance, a flow velocity of 1 m/s and a scale factor of 10 mm would result in a arrow of 10 mm on screen.)

Option	Default value
Border around plotarea	FALSE
Colour of the vectors	Black
Unit of vector quantity	m/s

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Option	**Default value**
Length unit vector (mm)	0
Separate scaling y-component	FALSE
Scale factor y-component	1.0
Minimum distance arrows (mm)	0.0
Vector length for colour	FALSE
Minimum arrow head (mm)	0.0
Maximum arrow head (mm)	1000.0
Add vectors to legend	TRUE
Classes for vector length	automatic scaling
Relative size head (%)	25
Angle of arrow head	45.0
Line thickness (mm)	0.15
Axis type	Geographic axes

K.1.16 Plot balances

The balances that this routine draws are especially *mass balances*, as they occur in water quality and biochemical modelling. They are represented as a histogram that accumulates the positive and negative values of the balance terms.

The various options allow the appearance of the plot to be changed:

◇ The number of data per bar is used to average the values of several consecutive times. If the value is very large (larger than the number of times available, the mean contributions of each balance term is displayed.
◇ The drawing can be a histogram or a piecewise linear function, this depends on what you want to see.

(The *threshold* option has not been implemented yet).

The plot routine is quite flexible, even though the type of presentation is especially suitable for mass balances, any time-series can be used. There is one restriction because of the accumulation that needs to be done: the times for the data are taken from the *first* time-series. You must take care to combine data sets that are based on the same times only.

Option	Default value
Number of data per bar	2
Threshold (%)	10.0
Draw as histogram	TRUE
Text in legend	Parameter

K.1.17 Plot histogram

This routine will plot a histogram of one or more data series. The data need to be defined on various *named* locations (see the note below).

If more than one data series is used, the histogram will be accumulated, using different colours to indicate the contribution.

The options allow the plot to be enhanced with:

- ◇ Totals expressed as numbers above each bar.
- ◇ Horizontal lines to indicate critical or special values.

There is also an option that influences the relative thickness of the bars.

Remark:

- ◇ The user-interface does not easily allow data sets to be construed that are suitable for this plot routine. The procedure for D-Water Quality history files is:

- ◇ Select a parameter, but *do not select a location*. This creates a data set with several times and (named) locations.
- ◇ Then try adding the data set to a plot. You must then select either a location or a time. Choose *Select a time*.
- ◇ The new data set contains the data for one parameter, one time and one or several (named) locations. This is the type of data set that can be used.

Unfortunately, not all reading routines can handle requests for such data sets. The routines for D-Water Quality files have been adapted for this.

Option	Default value
Relative width of bars (%)	60
Show totals	FALSE
Show horizontal lines	FALSE
First horizontal line	0
Second horizontal line	0.0

K.1.18 Plot pie chart

This routine will plot a pie chart. It should be revised, however. If you need this sort of functionality, please let us know.

Option	**Default value**
Border around plotarea	FALSE

K.1.19 Plot land boundaries

Land boundaries and other geographic information can be plotted using this routine. The data sets (essentially xy-co-ordinates that together form a coast line or the contours of islands, areas of interest and other features) can come from various files, such as DXF-files or BNA-files.

The plot routine has a large number of options and by combining several data set/plot routines with the correct plot options in one picture, you can essentially do similar things as a geographical presentation or information system does with *chart layers*.

You can choose to:

- ◇ Draw the boundaries in solid black.
- ◇ Draw the boundaries in the colour of choice (only one colour per data set, but you can combine data sets in one picture of course).
- ◇ Fill any closed polygons with the plot colour (if you selected to draw the boundaries in black, the polygons will have a border.
- ◇ Draw with a thick or thin line.

Option	**Default value**
Border around plotarea	FALSE
Text in legend	land boundaries
Show text in legend	FALSE
Axis type	Geographic axes
Draw the boundaries in black	FALSE
Fill closed polygons	FALSE
Colour for drawing/filling	Black
Line thickness (mm)	0.15

K.1.20 Plot drogue tracks

Often, the trajectory of drogues is observed to get insight in the flow pattern in an area. This plot routine will visualise this trajectory or track.

It requires a composite data set: the time-series of x-co-ordinates and the time-series of y-co-ordinates. This way it can plot the track and annotate it at regular intervals with dots, to indicate the progress.

Option	**Default value**
Time between circles (h)	1
Radius of circles (mm)	1
Colour for drawing	Black
Line thickness (mm)	0.15

K.1.21 Plot time bar

In animations it is often advantageous to compare a contour plot that is being animated with the phase of the tide or whatever other time-dependent phenomenon. This plot routine allows you to do just that, by drawing a simple vertical line in the plot of a time-series.

To use it, put the data set for which you want to show the time in a plot area with a time-series. The time bar will be drawn at the time contained in the associated data set. In an animation it will move along the time axis.

Option	**Default value**
Colour for drawing	Black

K.1.22 Samples plot

Measurements of any parameter in a collection of sample points can be shown as coloured dots via this plot routine. You can combine it with a contour map for instance so that spatial comparison between model results and measurements is possible.

If you do so, be careful to use the *same* contour classes for both presentations, otherwise the colouring may be misleading. There is no automatic way to ensure the equality.

You can however suppress the set of contour classes showing up in the legend, once you have the same sets.

Option	**Default value**
Border around plotarea	FALSE

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Option	Default value
Contour classes	automatic-scaling
Axis type	Geographic axes
Plot contour map	Circles only
Radius of circles (mm)	1
Extra missing value	999.999
Add classes to legend	TRUE
Frames around circles	FALSE

K.1.23 Add text to drawing

To add an arbitrary text to a plot, use this routine. As it is also meant to indicate time in animations, it can automatically contain the time of the associated data set.

To keep the interface simple, the position of the text is related to the top or bottom sides of the plot area. The position of the text is not related to the co-ordinate system. (If you want text that has a particular geographical position, such as place names, use the plot routine *PlotGeoText*.

As it requires very little information from the data set, it can be used with all kinds of data sets.

Option	Default value
String to plot (as prefix)	Time:
Add date and time to string	TRUE
Position of the string	Upper-right
Distance from border (cm)	3.0
Draw an analogue clock	FALSE
Clock size (cm)	3.0

K.1.24 Add a simple annotation

Annotations like a *North arrow* are very useful, though unrelated to a particular data set. Currently, he plot routine allows the following symbols or annotations:

◇ a north arrow
◇ an incident wave

The position is related to the top-right corner, as this is the usual position for such picture elements.

It can be used with any kind of data sets, but is for reasons of usefulness restricted to data sets with a two-dimensional co-ordinate system.

Option	**Default value**
Type of annotation	North arrow
Angle of arrow to north (east=90)	0
Length of the arrow (mm)	10
Distance from right border (mm)	25.0
Distance from top border (mm)	25.0

K.1.25 Plot text at position

Pictures displaying a map of some kind can be enhanced with text at the right positions. Such text can represent the name of some feature, a landmark or a town for instance. The plot routine *PlotGeoText* takes care of drawing the associated data sets.

The routine has several options, such as the colour and the angle, but they will be applied to all text defined by the data set.

Option	**Default value**
Height of text (in mm)	2.5
Default text angle (degrees)	0
Colour of text	Black
Text justification	Left
Axis type	Geographic axes

K.1.26 Plot via a simple script

Plot routine that serves as a place holder. This definition is used when you register “scripted” plot routines.

Option	Default value
Name of script	PlotTest

K.2 Selection routines

GPP allows you to create subsets of data sets. This may be necessary, as in the case of 3D data sets, to plot the data (or a part of the data).

All routines have a similar interface: they present a list of possibilities and when you have selected one, they create the new data set (or data sets).

K.2.1 Select a parameter

This routine allows you to select a particular parameter from a data set with more than one parameter. Like all other selection routines, it will show the available parameters in a list box and after confirmation by you create a new data set with the desired parameter.

The options are for private use only, and have been introduced to allow batch processing.

Option	Default value
Interactive - private	TRUE
SelectedString1 - private	(–)
SelectedString2 - private	(–)

K.2.2 Select a time

This routine allows you to select a particular time from a data set with more than one time. Like all other selection routines, it will show the available times in a list box and after confirmation by you create a new data set with the desired time.

The options are for private use only, and have been introduced to allow batch processing.

Option	Default value
Interactive - private	TRUE
SelectedString1 - private	(–)
SelectedString2 - private	(–)

K.2.3 Select a location

This routine allows you to select a particular location from a data set with more than one (named) location. Like all other selection routines, it will show the available locations in a list box and after confirmation by you create a new data set with the desired location.

The options are for private use only, and have been introduced to allow batch processing.

Option	**Default value**
Interactive - private	TRUE
SelectedString1 - private	(–)
SelectedString2 - private	(–)

K.2.4 Select a layer

This routine allows you to select a particular layer from a 3D data set. It will show the available layers in a list box and after confirmation by you create a new data set. This will be a 2D data set, so that it can be plotted as a contour map and so on.

The options are for private use only, and have been introduced to allow batch processing.

Option	**Default value**
Interactive - private	TRUE
SelectedString1 - private	(–)
SelectedString2 - private	(–)

K.2.5 Select a grid line (M)

This routine allows you to select a particular *grid line* from a 3D data set. It will show the available grid lines and create a new data set. This will be a 2D data set but the two co-ordinates are the *distance* along the grid line and the z-co-ordinate in each grid cell. In other words, the new data set is a vertical cut-out.

To be able to do this properly, the 3D data set must contain the z-co-ordinate in the grid points or the *local depth*, the depth in the cell centres. Unfortunately, the general matching procedure can not distinguish this, so if such data are not available, the routine uses the layer number to generate a z-co-ordinate.

The routine also creates a grid data set for this new data set and you can view this in its own right.

The options are for private use only, and have been introduced to allow batch processing.

Option	Default value
Interactive - private	TRUE
SelectedString1 - private	(–)
SelectedString2 - private	(–)
Selected direction	1
Default indices	.. , .. ; .. , ..

K.2.6 Select a grid line (N)

The routine *SelectGridLine* displays the grid lines along one particular grid direction. This is controlled by the option *SelectedDirection*. See the first occurrence for a detailed discussion.

Option	Default value
Interactive - private	TRUE
SelectedString1 - private	(–)
SelectedString2 - private	(–)
Selected direction	2
Default indices	.. , .. ; .. , ..

K.2.7 Select a vertical profile

The routine allows you to select a single grid point and creates a new data set that contains the data at this point along the vertical, this way you can create a *vertical profile.*

Remark:

◇ The routine has similar restrictions as the routine *SelectGridLine*.

Option	Default value
Interactive - private	TRUE
SelectedString1 - private	(–)
SelectedString2 - private	(–)
Selected direction	3
Default indices	.. , .. ; .. , ..

K.2.8 Select an arbitrary transect

The routine *SelectGridLine* allows you not only to select a grid line, but also to specify an arbitrary transect. The transect is given as pairs of indices in a format like:

10,10;20,10;20,20 (semicolons separate the pairs)

The newly created data set contains the values of grid cells as closely as possible to the lines defined in the above way.

Option	**Default value**
Interactive - private	TRUE
SelectedString1 - private	(–)
SelectedString2 - private	(–)
Selected direction	4
Default indices	.. , .. ; .. , ..

K.3 Operation routines

Operation routines within GPP create a new data set by performing some kind of operation, like averaging. They may or may not display dialogues to ask for specific information.

K.3.1 Average over a fixed layer

This operation will calculate the average of a scalar or vector data set over a layer of fixed *physical* thickness. The layer starts at a user-specified distance (in meter) from the surface. The resulting data set is two-dimensional and also represents a scalar or a vector.

In interactive mode it will ask for the distance from the surface the layer starts, and the thickness of this layer, both in (in principle) meters. If the layer is thicker than the depth, the result is averaged over the whole water column.

Remark:
- ◇ The option "Squared average (vector)" applies to vector data sets only and is not set interactively.

Option	**Default value**
Interactive - private	TRUE
Start of layer (from surface)	0.0
Thickness of layer	1
Squared average (vector)	FALSE

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Option	Default value
Return the RMS value	FALSE

K.3.2 Average squared vector (fixed layer)

This operation will calculate the average of the square of a vector data set over a layer of fixed *physical* thickness. The idea is that by calculating the average of the squared vector, you get a measure for the *force* the flow field is exercising.

If the vector field is a flow velocity with m/s as the unit, then the result is a vector field with the unit m^2/s^2. If you need a root mean square value, use a different routine.

It is the same routine as "Average over fixed layer", except for the option, which instructs it to use another algorithm.

Option	Default value
Interactive - private	TRUE
Start of layer (from surface; m)	0.0
Thickness of layer	1
Squared average (vector)	TRUE
Return the RMS value	FALSE

K.3.3 Root-mean-square vector (fixed layer)

This operation will calculate the root mean square of a vector data set over a layer of fixed *physical* thickness. (cf. its companions).

Remark:
◇ If the vector field is a flow velocity with m/s as the unit, then the result is again a vector field with the unit m/s. If you need the average of the squared vector, use a different routine.

Internally, it is the same routine as "Average over fixed layer", except for the options, which instruct it to use another algorithm.

Option	Default value
Interactive - private	TRUE
Start of layer (from surface; m)	0.0

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Option	Default value
Thickness of layer	1
Squared average (vector)	TRUE
Return the RMS value	TRUE

K.3.4 Calculate length

This operation will calculate the length of vectors in a vector data set and store them in a new (scalar) data set. This resulting data set can then be displayed using a contour map or iso-lines.

Remark:
◇ The operation will work on 3D data sets as well, but this gives rise to conflicts when storing and reloading the data sets in a session file. For this reason the operation is limited to 2D data sets.

Option	Default value
Interactive - private	TRUE

K.4 Binary operations

GPP currently supports six arithmetic operations on two selected data sets. Such *binary* operations are available via the *Combine* menu item in the *Data* menu in the main window.

Remark:
◇ Data sets can only be combined if they are of the same type and have the same number of data. Missing values within the data arrays cause the data in the resulting data sets to be *missing* as well. All operations are done using pairs of corresponding data from the data sets.

K.4.1 $A - B$

This operation will calculate the *difference* between the corresponding values in two data sets.

Remark:
◇ The operation has not been implemented for vector data sets yet.

Option	Default value
Interactive - private	TRUE
Suffix - private	(–)

K.4.2 $A + B$

This operation will calculate the *sum* of corresponding values in two data sets. Such *binary* operations are available via the *Combine* menu item in the *Data* menu in the main window.

Remark:
◇ The operation has not been implemented for vector data sets yet.

Option	**Default value**
Interactive - private	TRUE
Suffix - private	(–)

K.4.3 $A * B$

This operation will calculate the *product* of two data sets. Such *binary* operations are available via the *Combine* menu item in the *Datasets* menu in the main window.

Remark:
◇ There is no obvious way to extend this operation to vector data sets.

Option	**Default value**
Interactive - private	TRUE
Suffix - private	(–)

K.4.4 A/B

This operation will calculate the *quotient* of two data sets. Should a value in the second data set be zero, then a *missing value* is inserted.

Remark:
◇ There is no obvious way to extend this operation to vector data sets.

Option	**Default value**
Interactive - private	TRUE
Suffix - private	(–)

K.4.5 $\min(A, B)$

This operation will calculate the *minimum* of the corresponding values in two data sets.

Remark:
◇ The operation has not been implemented for vector data sets yet.

Option	Default value
Interactive - private	TRUE
Suffix - private	(–)

K.4.6 $\max(A, B)$

This operation will calculate the *maximum* of the corresponding values in two data sets.

Remark:
◇ The operation has not been implemented for vector data sets yet.

Option	Default value
Interactive - private	TRUE
Suffix – private	(–)

K.4.7 $f(A, B)$

This operation will calculate the mathematical expression given by you using the corresponding values in two data sets. You can specify a formula with variables A and B as placeholders for the data sets. For example: if the expression is "$A + B * B$", then the values in the new data set are computed by substituting the values of the first data set wherever "A" is found and the values of the second data set wherever "B" is found.

- ◇ Neither "A" nor "B" need to occur in the formula, but these are the only variables allowed.
- ◇ All usual mathematical operations are allowed, except exponentiation, that is done via the pow() function.
- ◇ If you need minimum and maximum function, you will need to use a *ternary* operator:
  $A > B?(A : B)$
  (This is an emulation of the maximum function – if $A > B$, then the first expression after the question mark results, otherwise the second one is used, after the colon.)
- ◇ The following functions are supported:
  - ◻ abs(), acos(), asin(), atan(), atan2(), ceil(), cos(), cosh(), exp(), floor(), fmod(), hypot(), log(), log10(), pow(), rand(), round(), sin(), sinh(), sqrt(), tan(), tanh().
  - ◻ The function pow() takes two arguments: pow(x, y) yields x^y.
  - ◻ The function rand() takes no arguments
- ◇ Some care should be taken: $1/3 * A$ will not yield the correct values, as 1/3 is computed using integer arithmetic. You should always use a decimal point with numerical constants.

Remark:
◇ The operation has not been implemented for vector data sets yet.

Option	Default value
Interactive - private	TRUE

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Option	Default value
Suffix – private	(–)
Function of A and B	“$A + B$”

K.4.8 $f(A)$

This operation will calculate the mathematical expression given by you using the values in a single data set. You can specify a formula with the variables A as a placeholder. For example: if the expression is “$A + A * A$’, then the values in the new data set are computed by substituting the values of the first data set wherever “A” is found.

See the description of the previous operation for more details.

Remark:
◇ The operation has not been implemented for vector data sets yet.

Option	Default value
Interactive - private	TRUE
Suffix – private	(–)
Function of A	“$1.0 * A$”

K.5 Export routines

GPP currently supports the following routines to export the contents of data sets to external files. These routines are invoked via the *Export Dataset* dialogue.

K.5.1 Write Timeseries to Annotated File

This routine exports *time-series data* to a text file with some simple annotations. The routine is suitable for any data set that consists of one or more time-series.

Option	Default value
Default filename	data.out

K.5.2 Write Timeseries to TSV File

This routine exports *time-series data* to a so-called tab-separated-values file with some simple annotations. This type of files can easily be imported in spreadsheets.

The routine is suitable for any data set that consists of one or more time-series.

Option	Default value
Default filename	data.out
Separator to be used	tab

K.5.3 Write Timeseries to Text File

This routine exports *time-series data* to a text file in TEKAL format. The file can be read again by GPP, as a *TEKAL time-series file*. The routine is suitable for any data set that consists of one or more time-series.

Option	Default value
Default filename	data.out

K.5.4 Write MAP2D to Text File

This routine exports a data set defined on a *two-dimensional grid* to a text file in TEKAL format. The file can be read again by GPP, as a *TEKAL 2D data file*.

The output includes the co-ordinates as the first and second columns. If there are several parameters in the data set (such as with vector quantities), they will appear as multiple columns.

Option	Default value
Default filename	data.out

K.5.5 Write XY data to Text File

This routine exports a data set that contains data as a function of a single (X) co-ordinate to a text file in TEKAL format. The file can be read again by GPP, as a *TEKAL Timeseries or XY series file*.

The output includes the X co-ordinate as the first and second columns. If there are several parameters in the data set (such as with vector quantities), they will appear as multiple columns.

Option	Default value
Default filename	data.out

K.5.6 Write data sets (finite element grid) to Text File

This routine exports a data set defined on a finite element grid to a text file in TEKAL format. The file can be read again by GPP, as a *samples file* (the FEM structure is *not* preserved).

The output includes the co-ordinates of the FEM nodes as the first and second columns. If there are several parameters in the data set (such as with vector quantities), they will appear as multiple columns.

Option	Default value
Default filename	data.out

K.5.7 Write grid to ArcView/Info import file

This routine exports a grid data set to an import file for ArcView/ArcInfo.

Option	Default value
Default filename	data.out

K.5.8 Write results to ArcView/Info import file

This routine exports a MAP2D data set to an import file for ArcView/ArcInfo.

Option	Default value
Default filename	data.out

K.5.9 Write via a simple script

Export routine that serves as a place holder. This definition is used when you register “scripted” export routines.

Option	Default value
Name of script	WriteTest

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