Geodetic Data Modeling System: User Manual

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Table of Contents

List of Figures

Chapter 1. Quick start guide

Getting Started

Follow the instructions in the installation section of this user manual and then at a shell prompt type the following:

```
[user@localhost /home/user]$ gdms
```

To open a data set, select **File - Open**. Browse to the location of the desired data set and then click **Open**.

After the data set has been loaded, use the **Maths** menu to carry out data processing. For further details of specific options, please refer to the chapter titled 'Using GDMS'.

To close the data set currently in focus, select **File - Close.**.

To exit the program, select **File - Exit**.

To save the data set after processing, select **File - Save**. Choose the desired location and click **OK**.

To save under a different file name, select **File - Save As**. Choose a location, enter the file-name and click **OK**.

For further details on these features and the other **GDMS** functionality, please refer to the section titled 'Using GDMS'.

Chapter 2. Installing GDMS

Dependencies

There are several dependencies that the user needs to be aware of when installing GDMS from source. These are wxWindows, mplot, pcre, and freetype. All of the dependencies are provided in the contrib directory.

Please note that for some of the dependencies, having a later version installed might not be sufficient. This depends on how many interface changes have been imposed by that dependency author. Because the actual source of these dependencies is outside the control of the GDMS team, this might make installation of later versions harder. The versions which have been tested with GDMS are included in the contrib/ directory of the GDMS distribution.

Installing

The installation process for the **GDMS** is as follows:

- Change to the source directory
- Type the following commands:

```
./configure

make

make install
```

This will install the application to the default path, the prefix for which is currently `/usr/local/`. If your path is not set to search this location the this need to be done. Check the documentation for your specific operating system for more information on how to do this.

Chapter 3. Running the GDMS

Running the GDMS with the GUI

The **GDMS** can be invoked in a number of ways. The first and most obvious, is to invoke the Graphical User Interface. To run it in this mode, open a console and type

```
[user@localhost /home/user]$ gdms
```

The application is loaded and the user is presented with a window. For further information on specific functionality, see the quick reference guide.

Running the GDMS with arguments

The **GDMS** also possesses the ability to accept command line arguments. For example, a file name can be specified as an argument, avoiding having to open the file through the user interface once it has been invoked. Once again the GUI is invoked and can be used in the normal manner, the difference being that data sets provided as arguments are already loaded.

Command line arguments which are accepted are:

- `-b <filename>`
  : the batch file name. This is only available on the batch file interface
- `-d <filename>`
  : opens a specified dataset
- `-e <yes|no>`
  : sets the visibility of error messages
- `-x <yes|no>`
  : sets the visibility of the North plot
- `-y <yes|no>`
  : sets the visibility of the East plot
- `-z <yes|no>`
  : sets the visibility of the Vertical plot

Batch Processing

As the title suggests, the **GDMS** allows batch processing. This enables a batch of tasks to be carried out, thus avoiding individual processing of data sets. The way this is done is by specifying a batch file name as an argument to the **GDMS** command. The batch file contains the commands that will be run by the **GDMS**.

Chapter 4. User Interface Configuration

Configuring the Interface

The user interface can be customised to suit user preferences. This includes the ability to changes the colours of the axes, graphs, error bars and grid. As well as the type and colour of the font used to display text on the graphs.

Changing UI colours

The customising the user interface is done through the **view** menu. The colours of the various view elements are changed by selecting the property from within the view menu. A pop-up window the allows the user to select colours either from the supplied palette, or by mix their own colours. Colours can also be added to a personalised palette, useful for quick selection.

Font configuration

The font type is also changed from the **view** menu. Any standard true type font can be used. The colour and size of the graph font is also configurable.

Show/hide Directions

The default is to display all three direction of the dataset. The user can however toggle directions on and off to give more screen real estate to graphs of interest. This is done through the **view** menu, by checking or un-checking the appropriate directions.

Show/hide error bars

GDMS has the ability to show error bars. To turn error bars on or off check the Show error bars item in the **view** menu.

Show/hide the grid

The default is to have the grid enabled. To disable the grid, simply check the Show grid item in the **view** menu.

Chapter 5. Using GDMS

Introduction

This section aims to provide a reference for the functionality of the **GDMS**. The main functionality of this package is provided through the following menus.

File Menu

Opening a data set

When the application is first run, you are presented with a blank window with File and Help menus. To open a data set, open the **File** menu and select **Open**. This can also be done by using the keyboard shortcut **CTRL-O**.

Figure 5-1. The GDMS when first opened.

While a data set is being loaded, a progress window appears.

Figure 5-2. Progress bar.

Once the data set has been loaded, the application looks like:

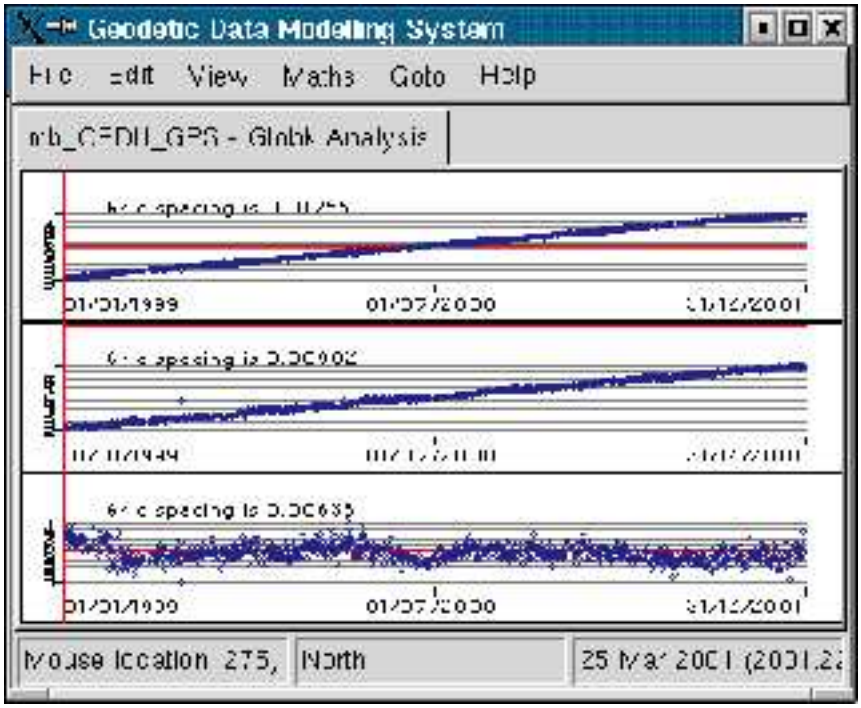

Figure 5-3. Loaded dataset.

Closing a dataset

To close a dataset, select **File** - **Close**. Note that this will not terminate the application. To do do this, see **Exit** below.

Saving a data set

To save a data set after processing, select **File** - **Save**. The following window appears.

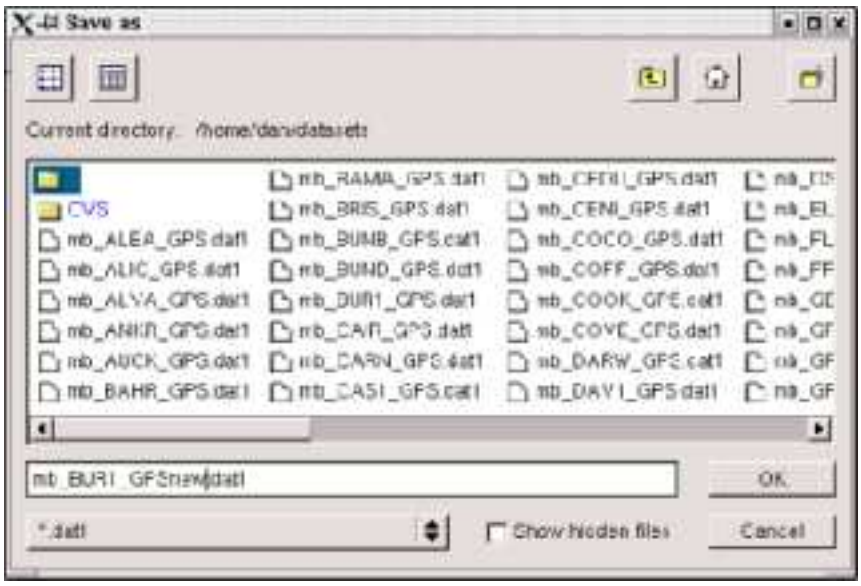

Figure 5-4. Save As window.

Choose the desired location and file name and click **OK**.

Exit

To exit the application, select **File** -> **Exit** or use the keyboard shortcut, **CTRL-Q**.

Edit menu

This functionality has not been included in this release. The Edit menu exists for future enhancements such as Undo, Redo and Delete. The undo functionality however, is inherit due to the way **GDMS** creates a new dataset after every mathematical operation.

View menu

The **View Menu**can be used to configure the look and feel of the user interface to suit individual users. Please refer to the User Interface Configuration chapter for full details on these features.

Maths

The data processing functionality provided by the **GDMS** is provided in the **Maths** menu. All mathematical operations on a data set result in at least one additional dataset being created. This enables easy reference to both the original and processed data for comparison. Furthermore, any dataset that can be viewed within the application can be saved for future reference.

Time Domain Analysis

Least Squares

The only time domain modelling currently available is Least Squares regression. This can be accessed by selecting **Maths - Least Squares**. The available options in the least squares menu are **Variance Co-variance** and **Random Walk**.

Variance Co-variance

Automatic Re-weighting

When this option is presented, you are given the option of using the automatic re-weighting feature. If you choose to use automatic re-weighting then our algorithms will weight out any outliers in the dataset, then output a least squares regression. The regression outputs two new data sets; the first shows the dataset with the least squares regression line with the weighted points rendered in a different colour. The second dataset loaded is the residuals, also with weighted out data points displayed in a different colour.

Manual Re-weighting

If **NO** is selected when prompted for automatic re-weighting, the option is given to load a weighting matrix from file for each direction. If **NO** is selected here, a data range may be specified before continuing with the VCV analysis by pressing Do VCV. Selecting **YES** to load a matrix for a file will result in a prompt request on the file's location. Once a matrix is chosen, the analysis will again provide both the least squares and residual datasets.

Random Walk

Random walk functionality has not yet been activated in the **GDMS** engine. This is mostly implemented, however no agreement has yet been reached with regard to the exact format that this function will take.

Interpolation

The available options in the Interpolation menu are **Nearest Neighbour**, **Linear Interpolation**, **Natural Spline**, **Cubic Spline** and **Divided Differences**. To carry out interpolation, select the **Maths** menu followed by the **Interpolation** menu and from here select the desired method. Enter the required sample rate when prompted and click **OK** to proceed or **CANCEL** to return to the main window.

Windowing data

The available options in the Windowing menu are **Rectangular**, **Hanning**, **Hamming**, **Blackman** and **Dolph-Chebyshev**. To window data, go to the **Maths** menu followed by the **Windowing** menu and from here select the desired method. Each method prompts for a window size and an overlap. The window size must be number satisfying

$$size=2^n$$

and the standard overlap is 50% of the window size. In addition, **Dolph-Chebyshev** prompts for the Normalised Transition Bandwidth, the values for which are restricted to the range 0.0 - 0.5. In application these numbers must be restricted to the range 0.02 -0.499 to avoid division by zero. Enter the information and click **OK** to proceed.

Window selection

When windowing is carried out on a dataset, all windows are displayed. For flexibility, the **GDMS** allows individual windows to be displayed. To do this, open the **goto** menu and navigate through the windows as desired.

Frequency Domain Analysis

Select the Maths menu, select Fast Fourier Transform which will generate a PSD plot. Note, before successfully carrying out operations in the frequency domain, the data must be interpolated. The Failure to do so will result in an error message from the **GDMS**. The error message gives the first three dates in the dataset that caused the failure.

Help Menu

In this release the Help menu contains only an About box. This is an area for future expansion.

Chapter 6. Temporary files

Introduction

GDMS needs to be able to store information in temporary files to operate correctly. The information currently stored in temporary files are the graphs used in the user interface, and active datasets. This is done to avoid the graphs having to be regenerated each time they are drawn. This technique also serves to avoid having images cached in memory, which could result in a large amount of memory being used for data that is not frequently accessed.

The **GDMS** determines when the files in the temporary graph cache are out of date. When this occurs, the graphs are regenerated as required.

Location of temporary files

Temporary files are stored by default in */tmp*.

The files have randomly generated names which match the regular expression *cep.*$*. Examples of valid temporary filenames are:

```
cep.5tgSBw

cep.7v2DRn

cep.AxSGaC

cep.d4j1at

cep.dinwwj

cep.eu4OqI

cep.HDxyXc

cep.I6U6DO

cep.k2Wweg

cep.pDpvqC

cep.qcRKds

cep.sBiOhb

cep.VqHGbW

cep.YoTRdk

cep.zbOzJ3
```

These files can amount to a non-trivial amount of space on disk. The example files totalled 808 kilobytes.

Cleanup of temporary files

The **GDMS** will automatically cleanup temporary files as required. In practise, this means that temporary files from previous sessions are deleted when the**GDMS** is run. Note that only the GUI implementation cleans the */tmp* directory. The **GDMS web** does not perform this operation as it does not create it's temporary files in this manner. For further information refer to the **GDMS web** documentation.

One limitation which this approach imposes is that is that it restricts the number of concurrent sessions to one on any single machine. The problem is that starting a new session will result in an attempt to clean any files generated by other sessions. The caches are only used during processing and are discarded, however the race condition exists and could cause problems.