Data Interrogation and Visualisation Environment

User Manual for DIVE Version 3.3.3

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Sections from DIVE 2.0 User Manual by Irshad Nainar

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1. Introduction

This document is a user manual for DIVE, the Data Interrogation and Visualisation Environment. It explains the capabilities and use of DIVE.

DIVE is a graphical application to interactively explore and visualise marine datasets. It provides users with the ability to compare datasets in space and time.

DIVE was initially developed under the Strategic Research Fund for the Marine Environment (SRFME) and is based on prior work within the CSIRO Division of Marine & Atmospheric Research (CMAR). Development has continued under funding from the Western Australian Marine Science Institute (WAMSI).

CSIRO makes DIVE available under the licence terms which can be viewed in Appendix C. These terms are based on the BSD licence. By downloading and using DIVE you acknowledge you have read and accept the terms in this licence.

DIVE uses a number of third party libraries. These libraries are installed when DIVE is installed. CSIRO distributes these libraries under the same terms on which these libraries were made available to CSIRO. The licence terms for these libraries can be viewed in Appendix D of the DIVE User Manual. Licences for the third party libraries are also available within DIVE under the Help->Third Party Library Licences menu.

By downloading DIVE you acknowledge you have read and accept the library licence terms.

Please note that DIVE was developed for research purposes only. As such, CSIRO makes no representations express or implied as to:

- The accuracy of DIVE or the absence of defects or errors in DIVE; or
- The non-infringement by DIVE of intellectual property rights of third parties.

CSIRO is not obliged to provide any support services for DIVE including providing any advice or answering any questions about the use or performance of DIVE.

1.1. Motivation

Environmental research involves the compilation of large numerical datasets that are accumulated through field programs, remote sensing and numerical model runs. Not only are these datasets large in volume but they are also diverse. They range from 1-dimensional point data (e.g. species biomass) to 4-dimensional time-varying volumetric datasets (e.g. model output).

These diverse datasets are not easily understandable without the aid of visualisation tools. An interactive graphical tool with the capability to link to data repositories is the most effective means of delivery the data to the wider scientific community and to CSIRO's partners and collaborators.

1.2. Features

DIVE provides the user with the ability to visualise datasets and compare them by overlaying data from multiple sources. DIVE supports the display of spatial maps, time-series plots, vertical profiles and cross-section plots. The spatial data is represented as coloured maps, contoured plots, vector maps or as habitat maps.

DIVE can explore and visualise datasets stored on your own computer (or network-connected file system) as well those in an established data repository.

1.3. Supported Data Streams

DIVE supports the following types for data-streams:

- Model outputs
  - Hydrodynamic models
  - Biogeochemical models

    - Wave models
    - Atmospheric models
- Climatology data
- Remote sensing data
    - AVHRR SST data
    - SeaWIFS Chlorophyll data
- Benthic habitat data
- Underway time-series and glider data
- Temperature/salinity profile data (CTD casts)
- Data measured by moored instruments

These data-streams may be stored in different file formats. DIVE support the following file formats:

- NetCDF files that conform to commonly used formats within the oceanographic community such as COARDS, CF-1.0, etc.
- ASCII files conforming to the CMAR Column File Format (CFF). This format was designed specifically to capture observational datasets such as vertical profiles and time-series.
- ASCII files conforming to the CMAR Shape File Format (SFF). This format was designed to flexibly define geometric shapes.

1.4. Website

The website for DIVE is http://software.cmar.csiro.au

1.5. User Manual

The user manual, which you are now reading, is available within DIVE under the Help menu. On Windows it is also available via the Programs → DIVE menu.

2. Requirements

2.1. Memory

512 MB or more depending on size of datasets being explored.

2.2. Software

Java Runtime Environment (JRE) 1.7 or above. DIVE will run on any platform that supports Java, such as Microsoft Windows variants, Linux, Solaris and MacOSX. The JRE is not included with the DIVE installer. This can be downloaded from http://java.com/en/download.

3. Installing and Using DIVE

A DIVE installer is available for Windows operating systems (XP and above), Mac OSX and Linux. The same installer is used for Windows, Mac and Linux operating systems. There are different versions of the DIVE installer dependent upon the organisation that DIVE is being deployed in. The first panel of the DIVE installer will say which organisation the installer is intended for. If your DIVE installer is not appropriate then contact someone listed in section 4.

After installing DIVE, delete the installation program if you wish. It is not required to run DIVE.

3.1. Windows

By default, DIVE will be installed into C:\Program Files\DIVE but you may change this during the installation process.

The normal Windows start menu shortcuts will be created, and DIVE can be run using Programs menu accessed via the Start menu button.

3.2. Mac OSX

DIVE will be installed by default into the /Applications/DIVE.app directory.

Run DIVE from the Applications folder, or via the Dock's Applications shortcut.

3.3. Linux

DIVE will be installed into your home directory, for example /home/fred/DIVE.

Run DIVE by using the script ~/DIVE/bin/dive.

4. Dive Contacts

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Uwe Rosebrock, CSIRO Oceans and Atmosphere – Hobart, Uwe.Rosebrock@csiro.au (03) 6232 5181

5. Overview of DIVE

The DIVE application consists of a dataset selection component and a data visualisation component.

The Data Selection dialog allows you to select the variables of interest. These variables can be selected from multiple datasets. Once the variables of interest are selected and submitted, they are plotted on the data visualisation window.

5.1. Dataset Selection

When DIVE is first run you are presented with a window for selecting datasets. This is known as the Data Selection dialog which is shown in Figure 1.

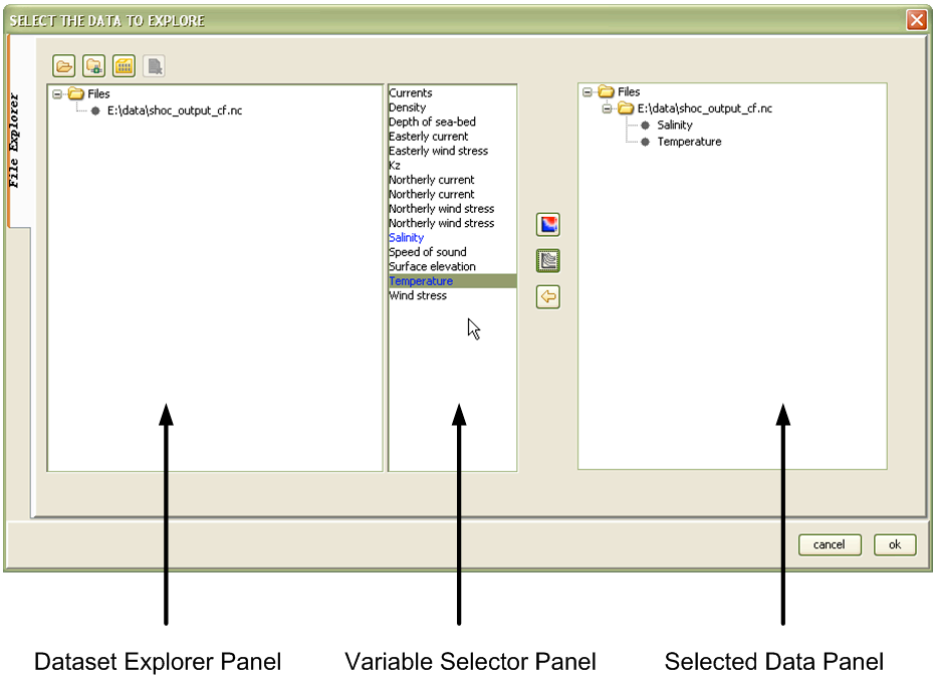


Figure 1, Dataset Selection Dialog using File Explorer

On the left hand side you will see a tab "File Explorer" for directly opening files from your computer. Depending on how DIVE is configured, you may also have access to a data repository and there will be "Repository Explorer" tab for this purpose.

Regardless of whether you are using the file or repository explorer, the process of selecting datasets and variables to display is basically the same. Many files can be open concurrently and they are added to the Dataset Explorer Panel as they are opened.

The description here focuses on using the “File Explorer” tab. The Variable Selector and Selected Data Panels in both the File a Repository Explorers function in the same manner. Further details on using a repository explorer are in Appendix B.

The File Explorer interface is used to select a file (which must be in a format supported by DIVE) from the local or from a network accessible file system. The open file button invokes a standard open file dialog that can be used to load the file.

Data available on an OPeNDAP (DODS) server is accessed via the OPeNDAP server button which invokes a dialog to specify the data’s URL. When viewing a THREDDS catalogue service data set you should copy the URL given next to the OPENDAP heading into the DIVE dialog as shown in Figure 2. OPenDAP URLs prefixed with dods:// or http:// are acceptable.

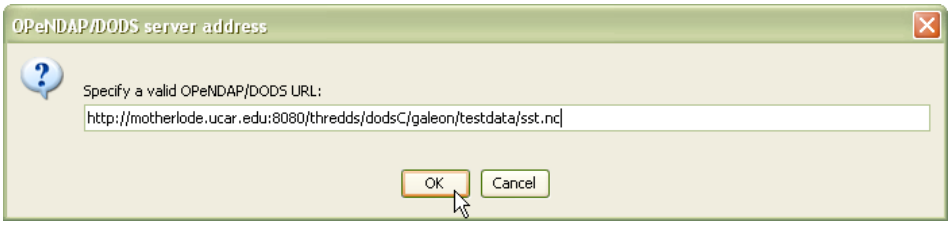


Figure 2, OPenDAP / DODS open file dialog

In special cases the same meta-data is shared in separate files, each for a different record time. For these cases the entire directory of files is treated as one data source, and these can be opened in one action. This only applies to NetCDF files and the header geometry must be exactly the same. To access files in this way the button must be used.

The Data Selection Dialog consists of three panels.

5.1.1. Dataset Explorer Panel

This is the left-most panel. This displays the selected data files on your computer or network-connected file system.

5.1.2. Variable Selector Panel

This is the middle panel. This panel displays the variables present in the dataset selected from the Dataset Explorer Panel. On selecting the dataset, the variables in the datasets are displayed in this panel.

When you select, by clicking on, a variable from the Variable Selector Panel, buttons will appear to the right of the Variable Selector Panel. The buttons will vary depending upon the nature of the variable selected. You can select the variables to be displayed as follows:

- Display variable as a colour map
- Display variable as a contour map
- Display variable as a vector map
- Toggle to display sediment variables. See section 6.16.

Clicking on one of these buttons will add the variable to the Selected Data Panel, and the variable will be ready to visualise.

5.1.3. Selected Data Panel

This is the right-hand panel. This panel displays the variables selected for visualisation.

Click “ok” to hide the Data Selection Dialog and to visualise the chosen datasets.

Datasets or individual variables can be removed from the Selected Data Panel by using the  button. If this variable has already been plotted by DIVE it will be removed from all plots.

6. Visualising Datasets and Variables

The data selected on the data selection dialog is plotted on the main application window. The variable(s) are plotted on the drawing region in the main application window. The drawing region contains a geographical map view, vertical profile view and time-series view. The selected variable is plotted onto one or more of these panels based on the type of data stream it represents. Once the data is plotted, a variety of operations can be performed on the data. These are described below.

One of the core features in DIVE is its capability to compare datasets in space and time. It allows variables from disparate data sources to be overlaid. Variables can be quickly overlaid by adding them via the Data Selection Dialog, and quickly removed or hidden as required.

6.1. Overview of DIVE Functions

The variables from the datasets chosen are displayed in a single window as shown in Figure 3.

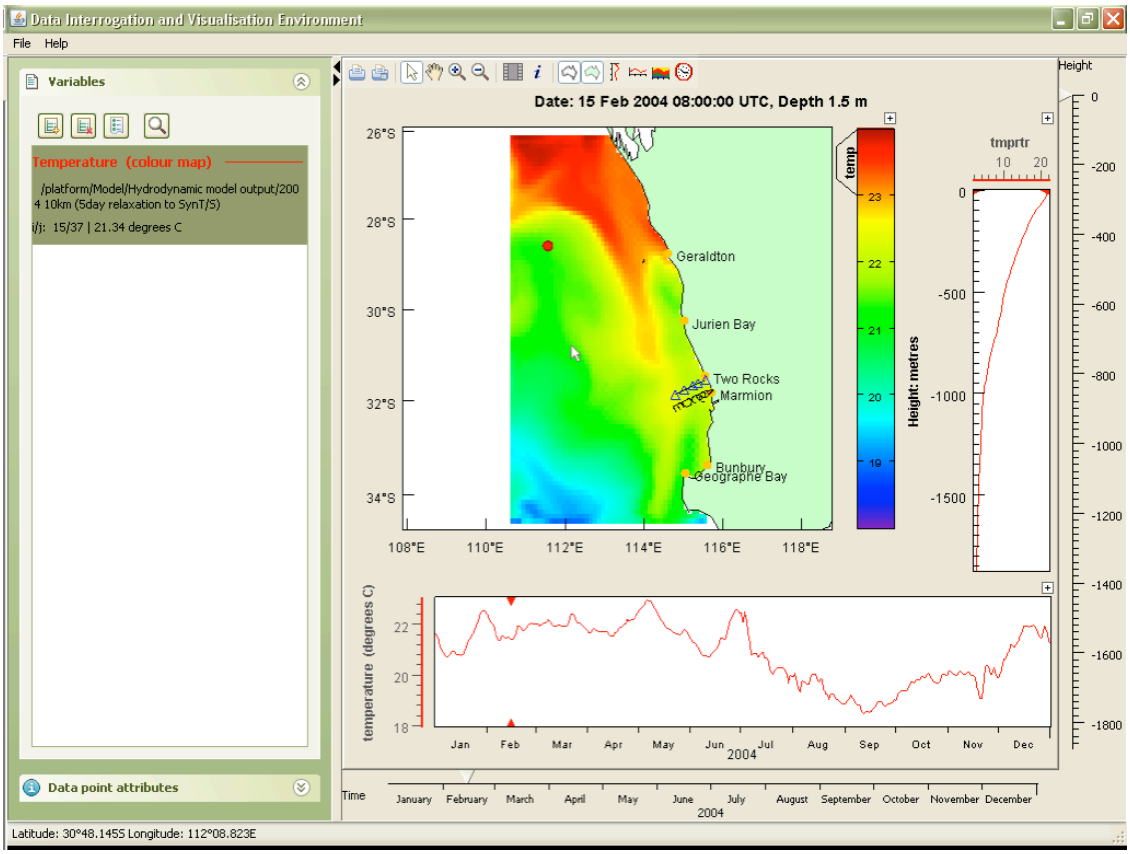


Figure 3, DIVE Visualisation Window

The variables panel (left hand side) and the main map window will always be visible. However, other panels such as the time series and profile panels will only be visible if you have chosen to display these and if the variable being displayed is suitable.

As the cursor is moved across the map window the position of the cursor is displayed on the bottom left of the DIVE window. For the map, this will be the latitude and longitude; for the time series this will be the time; for the profile plot this will be the height.

The variables' values at the cursor location are displayed on the bottom left hand side of the DIVE window under the variables' names.

6.1.1. Variables Panel Functions

These buttons are at the top left of the DIVE window. They relate to variables and datasets. Select (in the left-side panel) the variable you wish to operate on, and chose one of the following.

- Add variable. This brings back the data selection dialog. Use this to visualise additional variables and to open additional datasets.
- Remove variable. Removes the variable from the selected variables panel and all DIVE plot panels.
- Edit Properties. Allows you to set the display properties of the selected variable. There are many options - See section 6.2.
- Fit map to variable. Resizes and re-positions the map panel to show the selected variable at the maximum size possible.

6.1.2. Map Panel Functions

These buttons that appear at the top of the DIVE window are used to control DIVE. They allow you to print, export images and animations, examine metadata and control the appearance of DIVE's plot panels.

- Print tool. This invokes the printer dialog for printing the plot regions that are displayed.
- Print Preview. The Print Preview tool creates a preview of the plot regions that are displayed. From here you can change the page setup and print.
- The Select Tool. This is used for sampling variables in space and time. See section 6.5.
- Move origin. This pans the map. Select this button, and then you can drag over the map to change what is shown.
- Zoom in. Select this button, then click on the location on the map you wish to zoom into. You can also use this tool to sweep, or draw a rectangle around, the area of map you wish to view.
- Zoom out. Select this button, then click on the map. It will zoom out centred on the clicked-on location.
- Export Images and Movies. This is for exporting bitmap images and animations in a variety of formats. See section 6.8.
- Data Attributes. This is for displaying data attributes. This is used for the display of information about datasets. See section 6.9.
- Display Coastline. This is a toggle button. When selected will the coastline be drawn. When not selected coastline will not be drawn and the land will not be shaded.
- Shading of land. This is a toggle button. When selected the land will be filled with a solid colour. This shading will hide atmospheric data over land.
- Profile Plot. This is a toggle button. Hide/show the profile plot. The plot will only be displayed if there is suitable data.
- Time Series Plot. This is a toggle button. Hide/show the time series plot. The plot will only be displayed if there is suitable data.
- Section Plots. This creates cross-section plots for gridded data with a vertical (depth or height) component. See section 6.10.
- Time Zone. This allows you to view the data according to a chosen time zone. See section 6.12.

6.2. Edit Properties

Use this function to change the appearance of a plot. Select the variable, from the Variables Panel, whose appearance you wish to change, then click on  . You will see a variety of options. There are some common options for changing the visibility of plots and plot keys, and other options will appear or not depending on the nature of the data and the plot.

The properties are divided into sections – which appear as tabs:

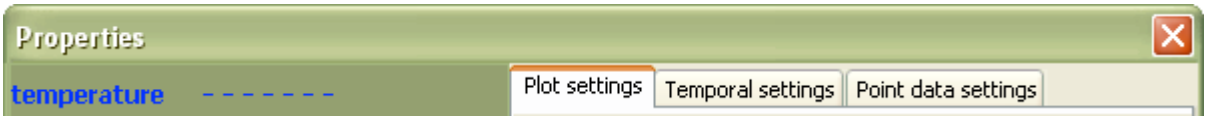


Figure 4, Property tabs

6.2.1. Plot settings

The dialogs used within Plot settings will vary depending on the plot displayed.

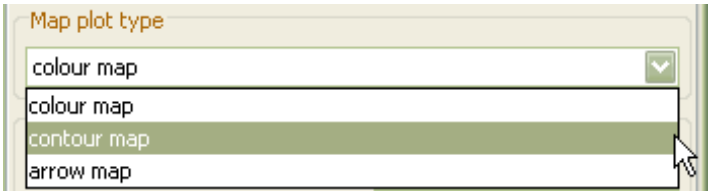


Figure 5, Map plot type dialog

Figure 5 appears for gridded data sets. It allows you to choose between a colour, contour or arrow maps (plots). To visualise a variable as both a colour map and with contours you will need to add the variable twice, making one plot contour and the other a colour map.

Arrow maps are used to display scalar variables as vectors, which implies that the value represents an angle of some sort. The unit for the value is tested has to be degrees or radians, or abbreviations of these.

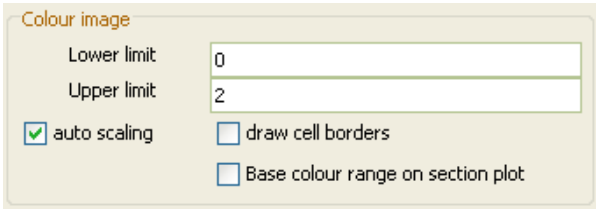


Figure 6, Colour image dialog

Figure 6 appears for colour plots. If *auto scale* is selected the lowest and highest values of the variable will be used for the range of the colour table.

You can override these automatic settings by choosing your own lower and upper limits.

Base colour range on section plot only appears when a section plot is being viewed. If it is not selected, the map plot's colour range will be used to colour the section plot. If this option is selected, the colour range of the section plot will be used to colour the map plot.

Auto scaling should be turned off when making animations. Otherwise each frame in the animation could have a different colour representation for a given variable's value from one frame to the next.

If *draw cell borders* is selected the map panel and cross-section panels will outline the cells in black as shown in Figure 7.

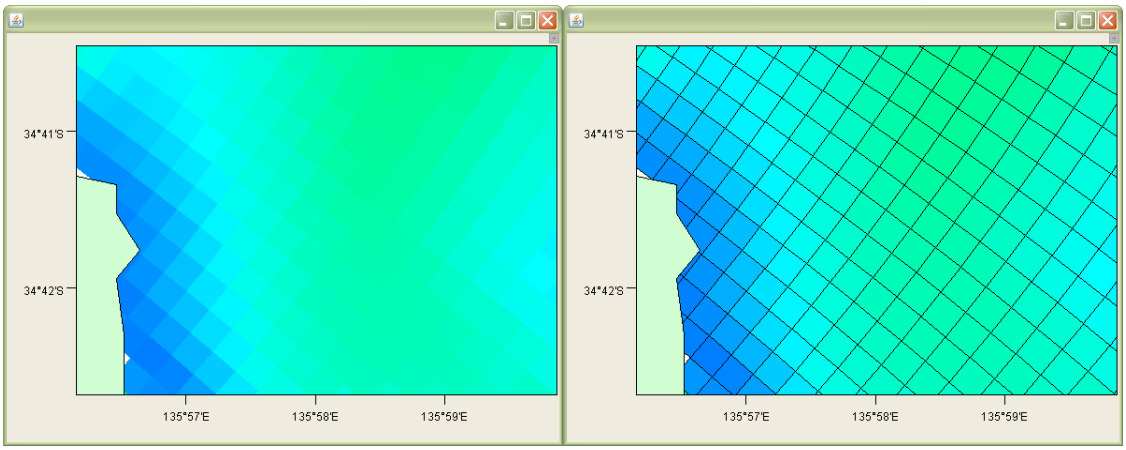


Figure 7, Map panels with and without cells borders

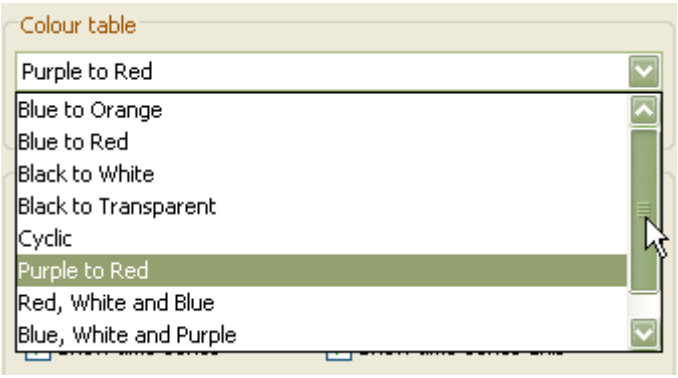


Figure 8, Colour table dialog

Figure 8 appears for all colour plots. Use this to chose the colour scheme used for the plots.

Figure 9, Contours dialog

Figure 9 appears for contour plots. DIVE can auto-scale the contours used, or you can chose your own contour levels.

If you wish to define your own contour intervals you will need to define the contour range and intervals. There are several formats for doing this:

Lower limit:contour interval:upper limit: For example 15:0.5:18 will draw contours at 15, 15.5, 16, 16.5, 17, 17.5, 18.

A series of comma separated numbers: For example 15,16,18,21 will draw contours at 15,16,18 and 21.

A combination of the above separated by commas: 15:0.2:16, 19, 20 will draw contours at 15.0, 15.2, 15.4, 15.6, 15.8, 16, 19 and 20.

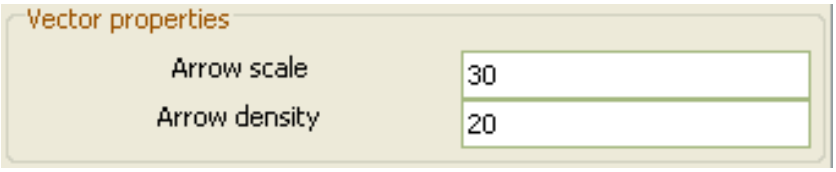


Figure 10, Vector properties dialog

Figure 10 appears for vector data. This dialog controls the size and number of arrows displaying the vector field. “Arrow scale” controls the size of the vector arrows, and “Arrow density” controls the number of arrows. You will need to experiment with these values to find a combination that suits your plot.

Figure 11, Vector Component dialog

Figure 9 appears for scalar variables when arrow maps has been selected. See section 6.2.2 for details on “Correct for rotation”. “Inverse” rotates the displayed arrows by 180°. “Toggle Nautical/Cartesian” flips between a nautical or Cartesian coordinates. By default a nautical orientation is assumed. Flipping to Cartesian assumes that the value is given in a mathematical context.

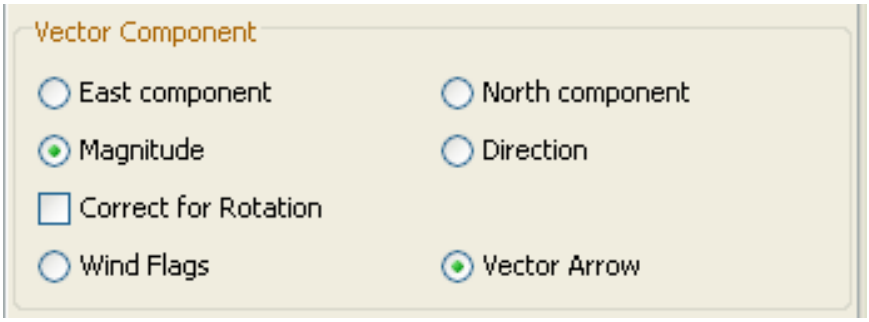


Figure 12, Vector component dialog

The Vector component dialog show in Figure 12 defines what component of the vector is displayed, and controls the appearance of the vectors.

“Magnitude” plots using the vector magnitude and direction as shown in Figure 13. The value of the variable displayed while moving the cursor over the data is the magnitude of the variable.

“Direction” plots appear the same as “Magnitude” plots. However the value of the variable displayed while moving the cursor over the data is the direction of the variable.

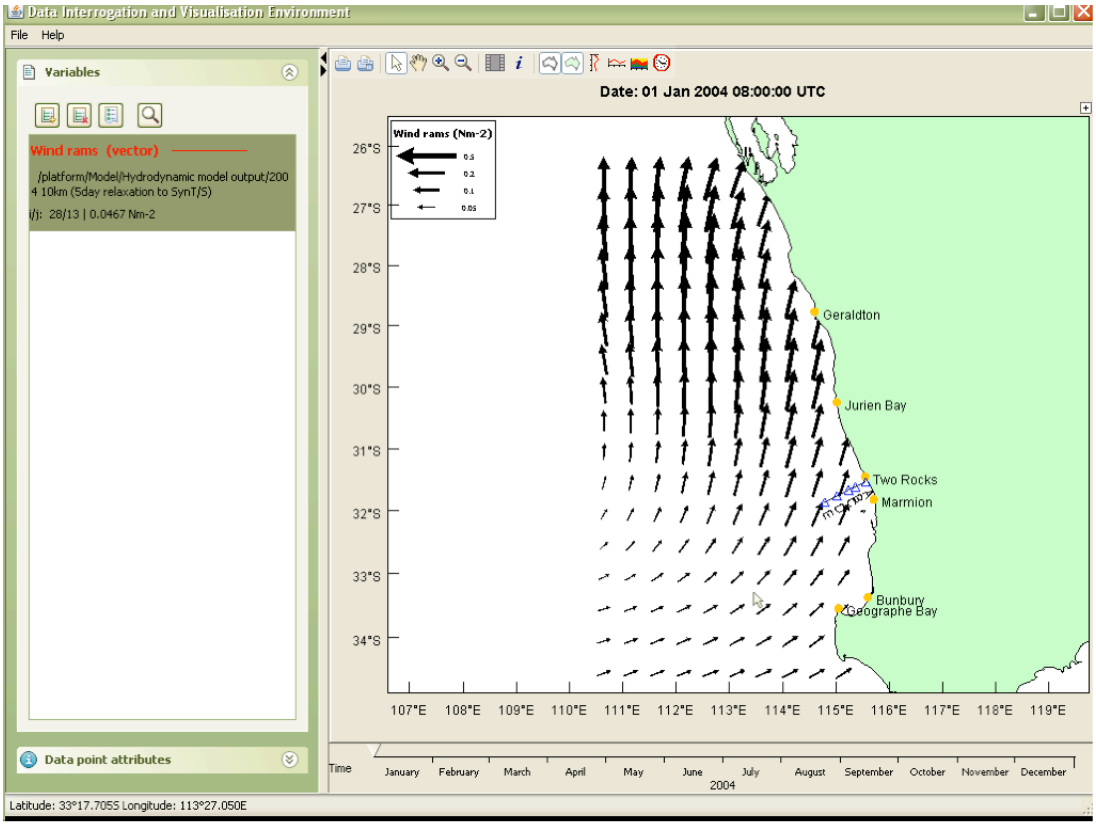


Figure 13, Magnitude vector plot

"East component" plots the east-west component of the vector as shown in Figure 14. The value of the variable displayed while moving the cursor over the data in the eastern component of the vector.

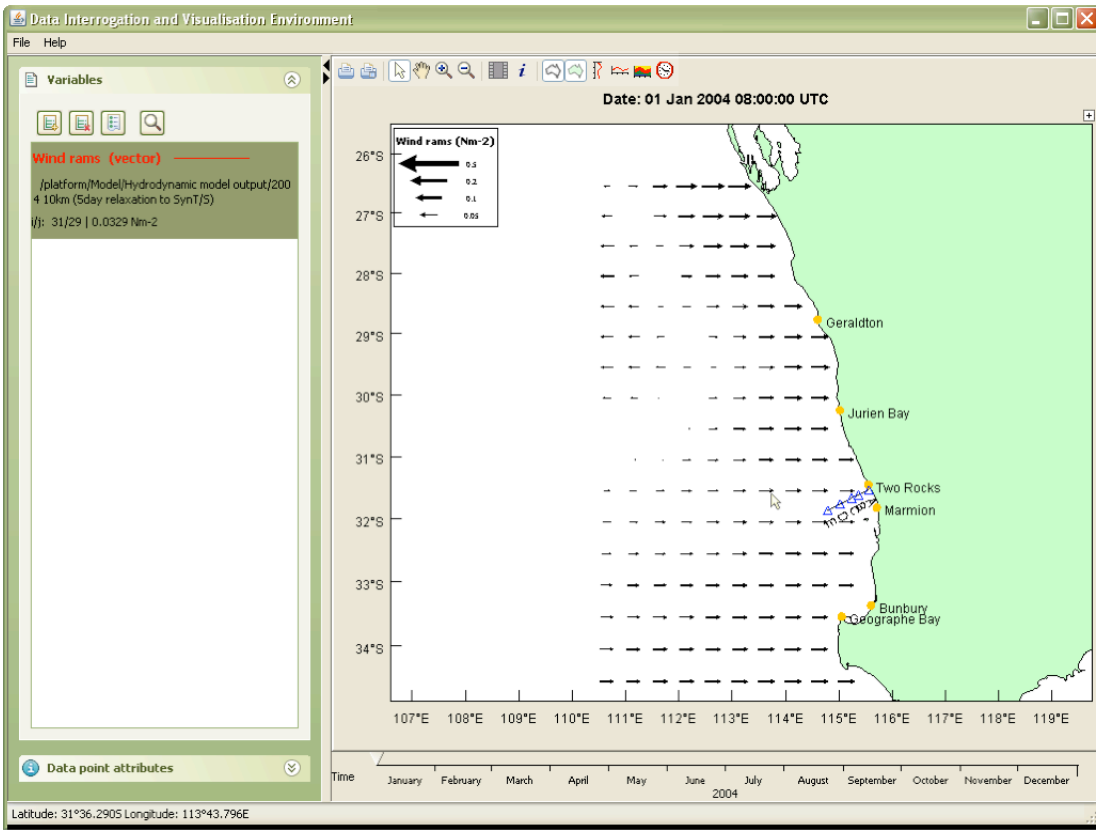


Figure 14, East component vector plot

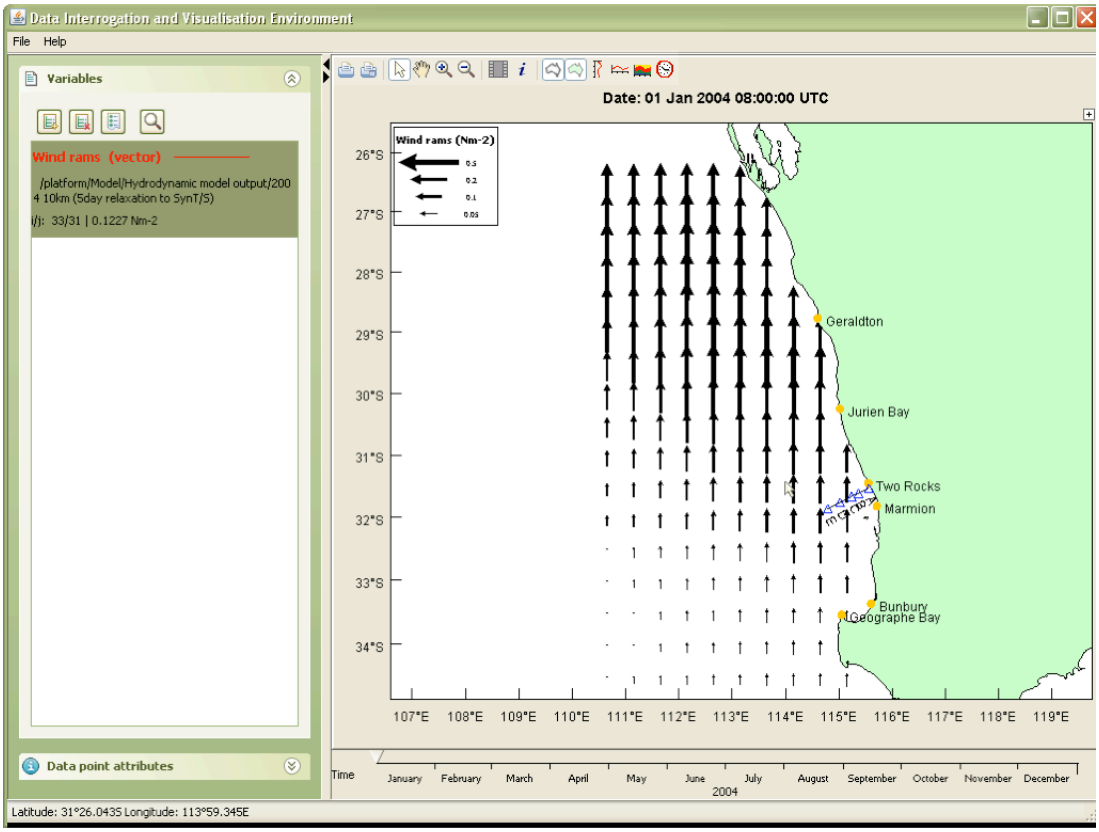


Figure 15, North component vector plot

"North component" plots the north-south component of the vector as shown in Figure 15. The value of the variable displayed while moving the cursor over the data in the northern component of the vector.

See section 6.2.2 for details on "Correct for rotation".

When selected, "Wind Flags" will:

- draw the vectors using meteorological barbed wind symbols showing velocity in knots (one full barb represents 10 knots). The barbs are on the end the wind is coming from. Figure 16 shows wind from the north west. The same plot using the default vector arrows is shown in Figure 17.
- cause the display of the vector's velocity in the variable panel to be in knots.

Note that the legend appears only for the vector presentation.

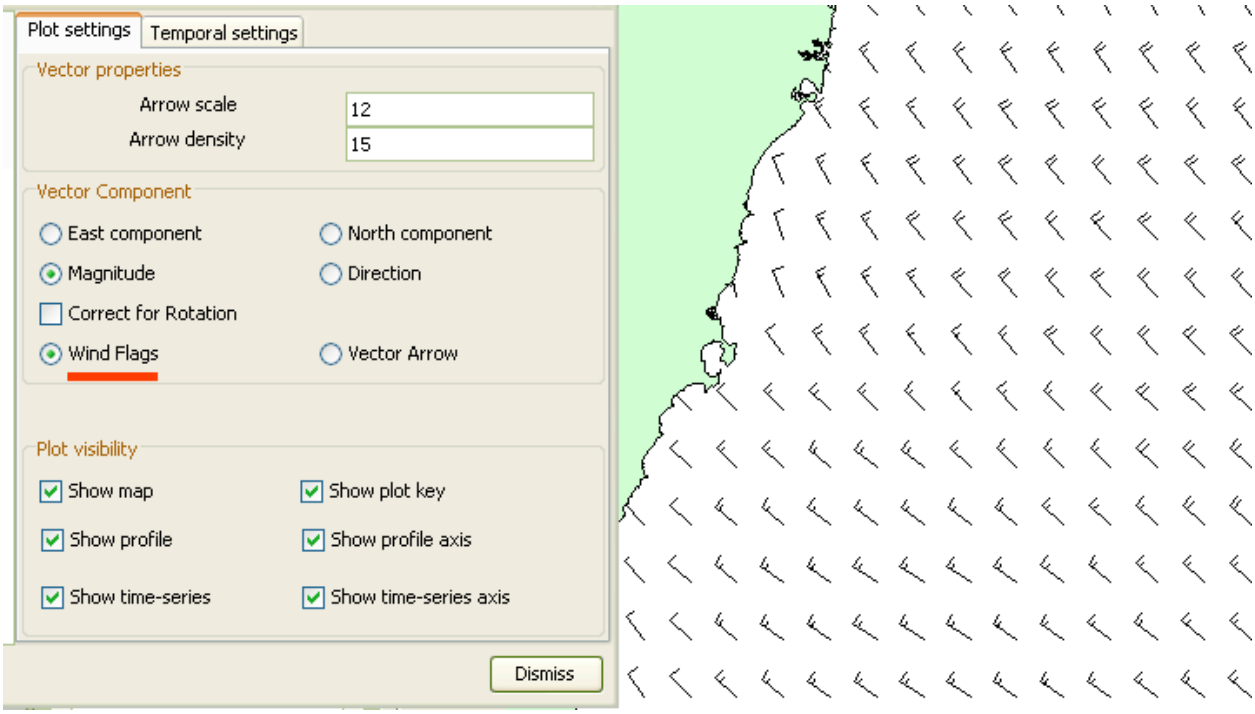


Figure 16 - Barbed wind symbol chart

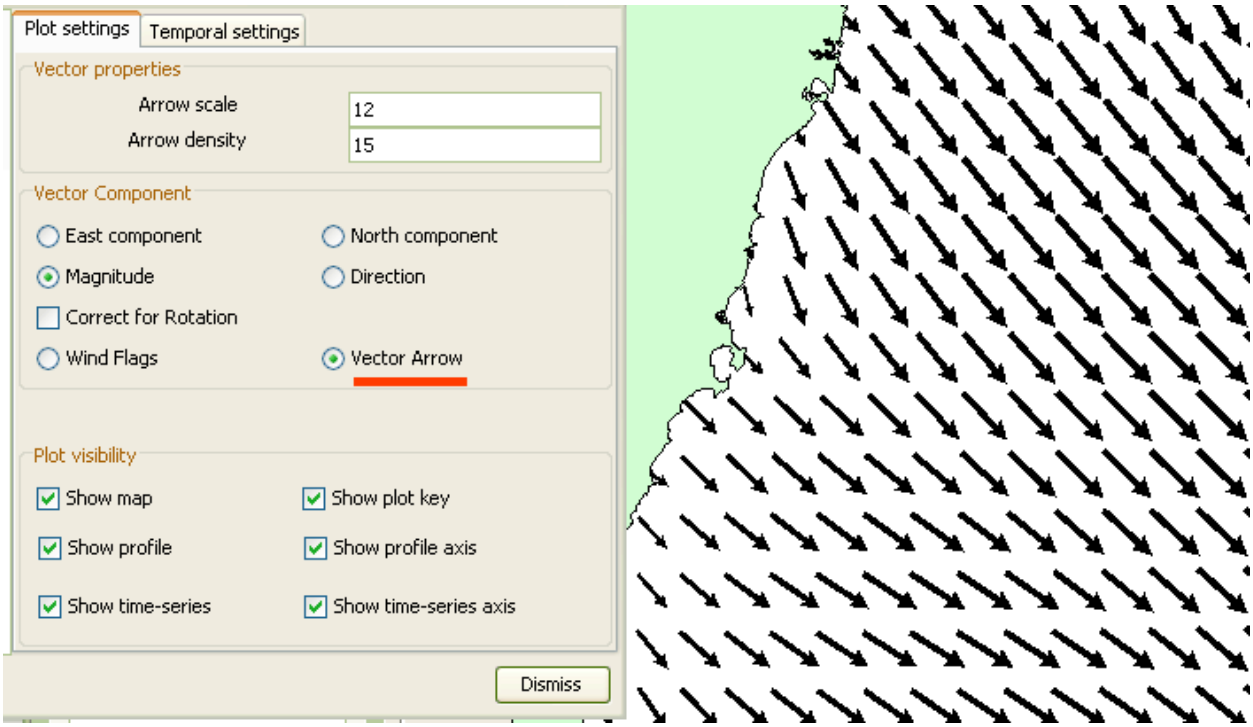


Figure 17 - Equivalent plot using vector arrows

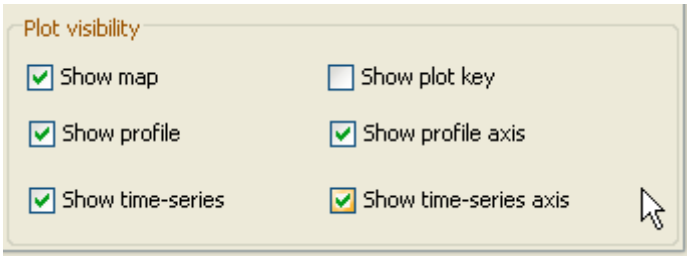


Figure 18, Plot visibility dialog

Figure 18 appears for all plots. This dialog can be used to:

"Show the map": Hides the map plot for this variable – without removing the variable. The time series, profile and section plots are still shown.

"Show profile": Show or hide the profile plot. Same function as the button.

"Show time-series": Show or hide the time-series plot. Same function as the button.

"Show plot key": Show or hide the colour scale bar as shown in Figure 3.

"Show profile axis: Show or hide the variable's scale bar in the profile plot.

"Show time-series axis": Show or hide the variable's scale bar in the time-series plot.

6.2.2. Correct for rotation

If the "Correct for rotation" check box is selected the vectors will be drawn offset by the rotation of the grid. The rotation angle must be available in the data source. In some data sources that is not the case and as a consequence the selection has no effect. This is rarely used, but is important in a case where the vectors were defined in a Cartesian grid and this grid is rotated in a geographical presentation.

6.2.3. Temporal settings

Temporal settings are used to alter the times of dataset. This is useful when comparing variables from datasets from different time periods.

Figure 19, Temporal setting dialogs

6.2.4. Point data settings

For point data sets – for example underway data or glider data, there are additional options.

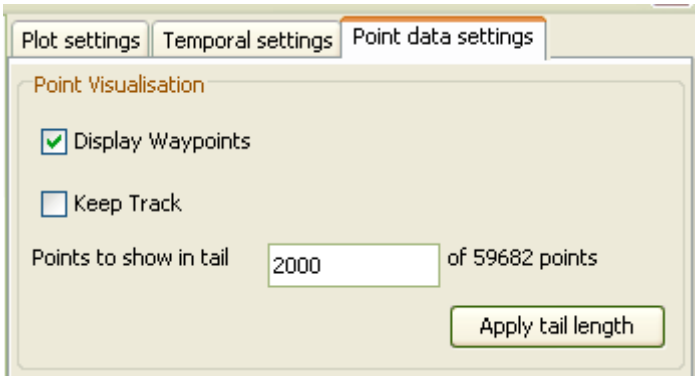


Figure 20, Point visualisation

If “Keep Track” is selected, the track is displayed from the origin to the data point at the time set by the time slider.

If “Keep Track” is not displayed then a subset of points are displayed leading up to the data point at the time set by the time slider. The number of points is definable in the “points to show in tail” field.

“Display Waypoints” controls whether waypoint data is displayed. The number of waypoints is automatically determined depending on the number of data points. An example of point data with waypoints is shown in Figure 21.

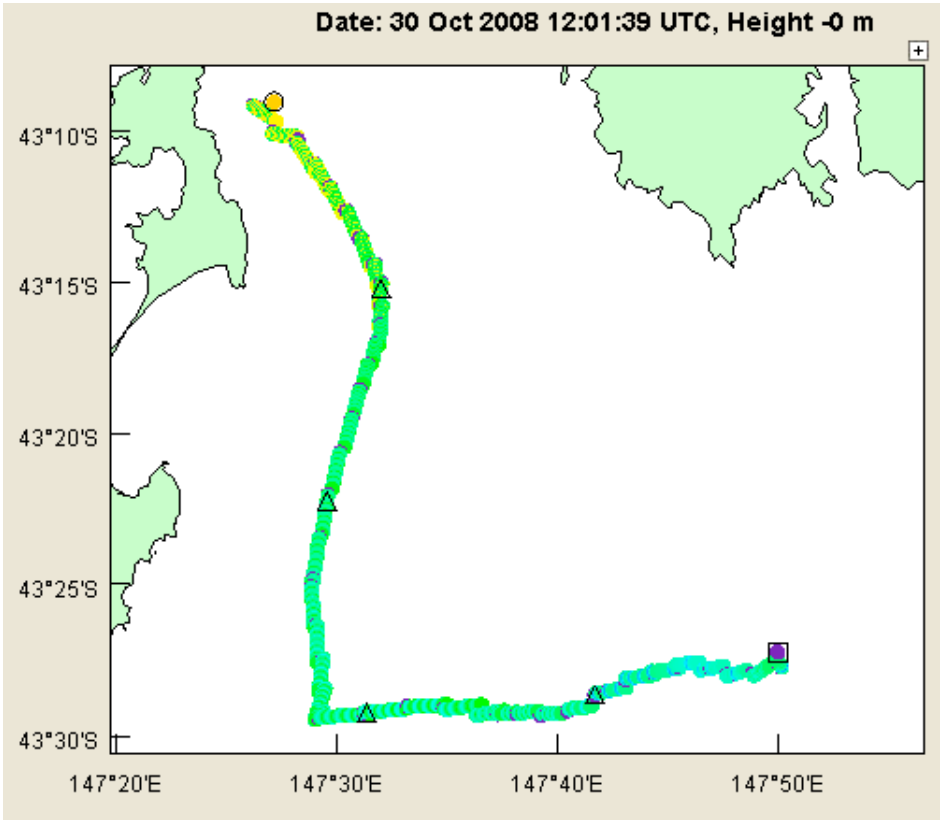


Figure 21, Glider data showing waypoints

When you “mouse over” a waypoint – data for that point is displayed for several seconds as shown in Figure 22.

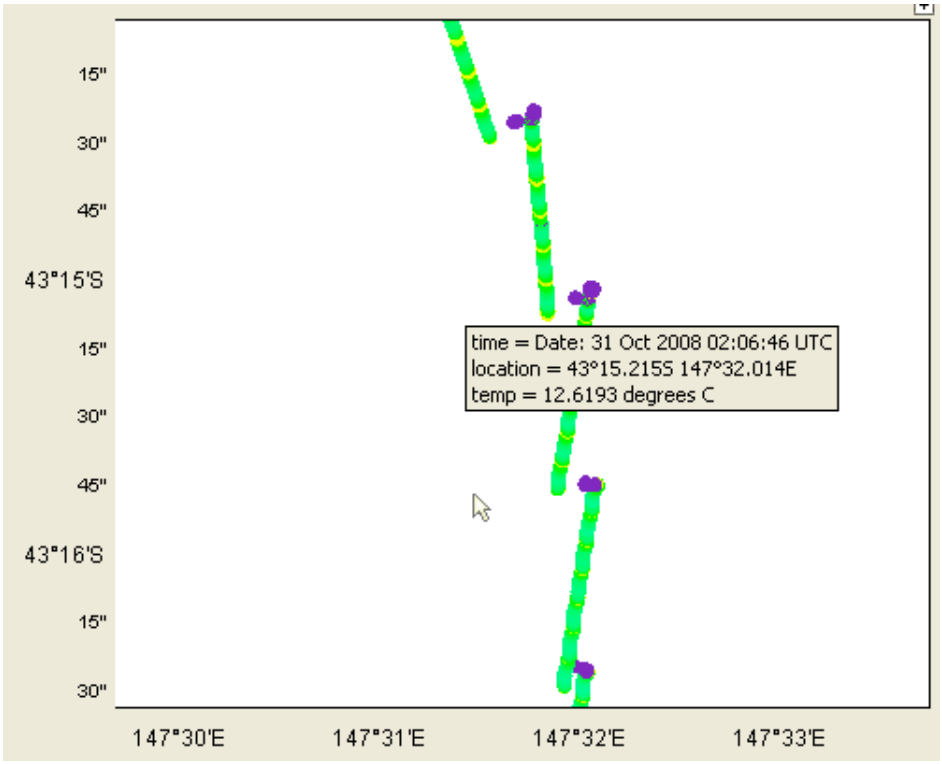


Figure 22, Pop-up waypoint data

6.3. Time Slider

When there are variables with a time-varying component a time slider with a time scale will appear at the bottom of the DIVE window. The slider can be dragged and the map (and other panels) will be updated to show data for the chosen time. DIVE will also respond to mouse clicks along side the slider as follows:

- Single clicking either side of the slider will cause the display to progress in that time-direction to the next time step in any of the datasets being displayed.
- Single right-clicking on either side of the slider will cause the display to continually progress in that time-direction, stopping briefly at the next time step in any of the datasets being displayed. The display of data will loop when the end of the time scale is reached. Another single right-click will stop the automatic progression of the slider.
- Double clicking on the slider scale will cause the slider to jump to that time and the plot panels will show data for that time.

6.4. Height Slider

When there are variables with a height- or depth-varying component, a height slider will appear on the right hand side of the DIVE window. The slider can be dragged and the map (and other panels) will be updated to show data for the chosen height or depth.

Single clicking either side of the height slider will cause the display to progress in that direction to the next height in any dataset being displayed. Double clicking on the slider scale will cause the slider to jump to that height and the plot panels will show data for that height.

Single-clicking to set heights does not work for time-varying depths gridded data – such as ROMS files.

6.5. Selecting Sample Points

In the case of multi-dimensional grid datasets, profile and time-series plots can be generated by sampling a point in space and time on the map view.

Use the select mode by choosing the button, and then click on the map plot to make a sample point. The sample point appears as a coloured dot on the map plot as shown in Figure 3.

Making a sample point generates a vertical profile and time-series plot for the selected point. However, if no height structure is associated with a variable (e.g. sea surface temperature), no profile plot can be generated for this variable.

The visibility of the time series or profile can be controlled using the and buttons respectively.

6.5.1. Selecting Multiple Sample Points

By shift-clicking (holding down shift key while clicking on the map) you can select more than one sample point as shown in Figure 23. The colour of a sample point is used for the corresponding time series and profile plots.

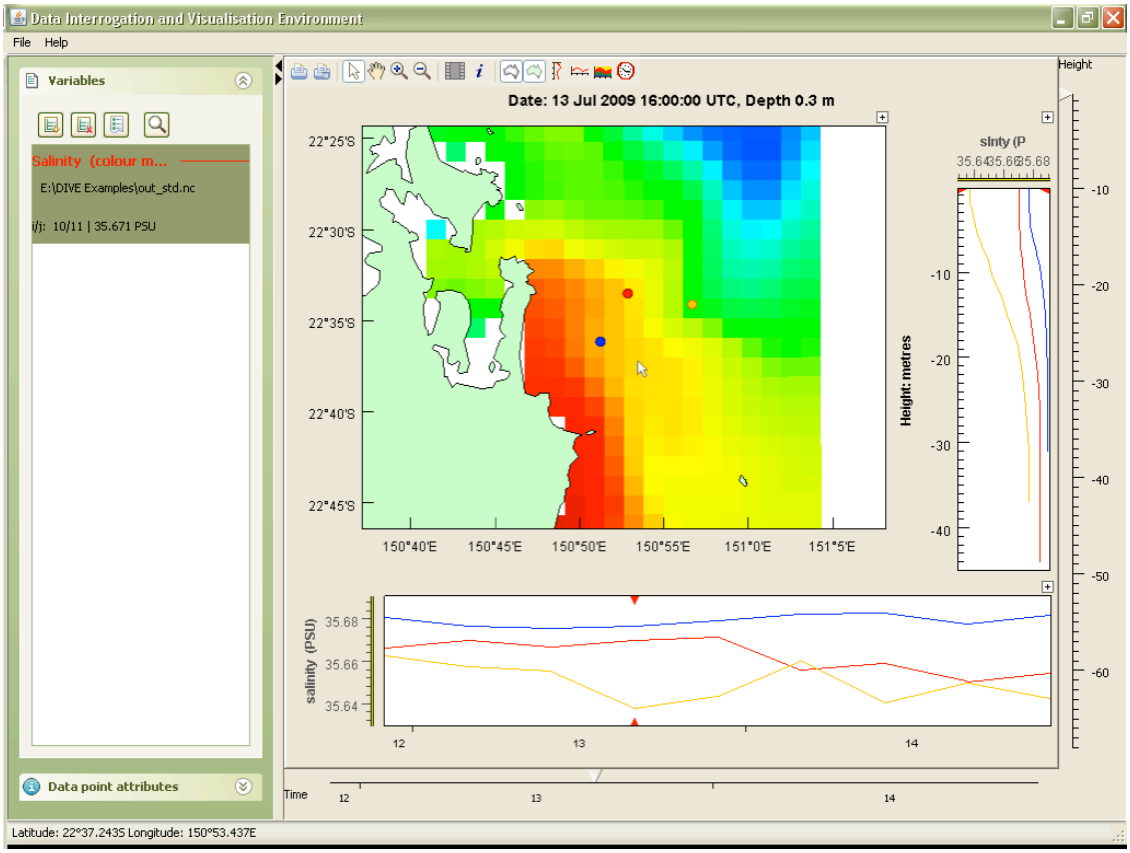


Figure 23, Multiple sample points

If there is a single sample point, but more than one variable, the time series and profile plots will use the variable's colour from the Variable panel as shown in Figure 24.

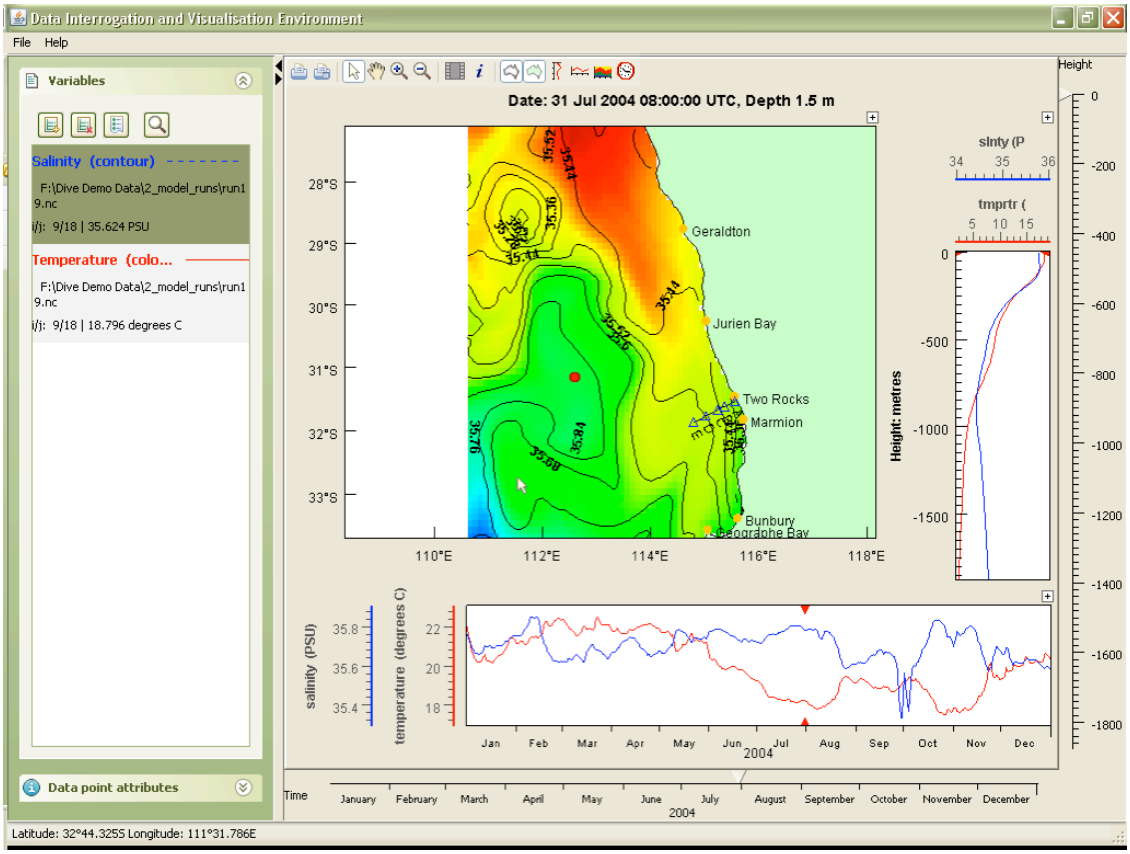


Figure 24, Sample point with multiple variables

If multiple sample points are selected and there are multiple variables being displayed the plots can become confusing. The plots lines are made from the colour of the sample point, and the line style shown for the variable in the Variable panel. This is shown in Figure 25.

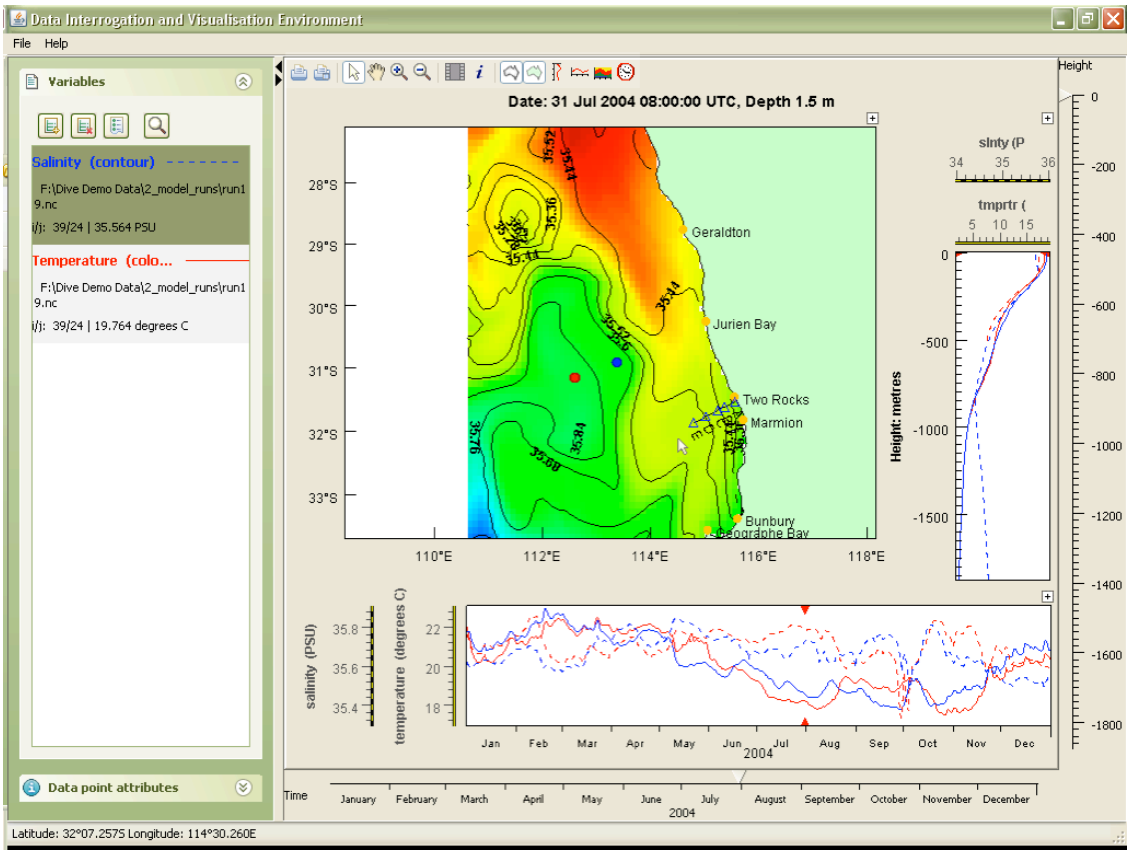


Figure 25, Multiple Sample Points and Multiple Variables

When you drag the mouse across the time series or profile plots, the value of the variable at the cursor location is displayed with the variable in the variable panel. In the case of there being multiple sample points, the value of the primary (the first) sample point will be shown.

To display the value for all sample points, hold down the shift key while dragging across the time series or profile plots. DIVE will display the value of all sample points as shown in Figure 26.

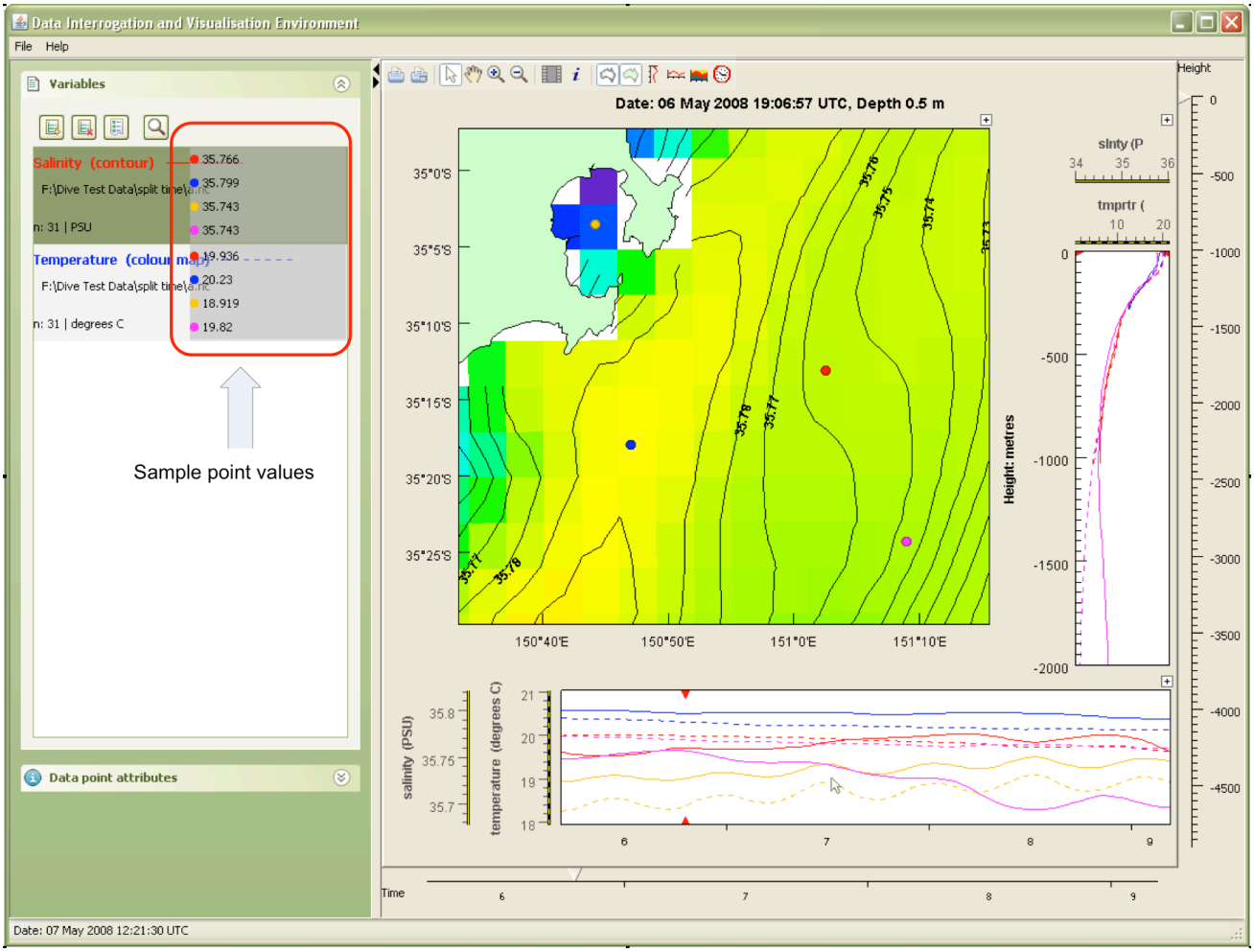


Figure 26, Time series or profile plot values with multiple sample points.

6.6. Profile Plots

Profile plots can be produced for variables that have vertical structure – such as model output and temperature and salinity profiles collected with a CTD.

The toggle button will hide or show the profile panel if possible.

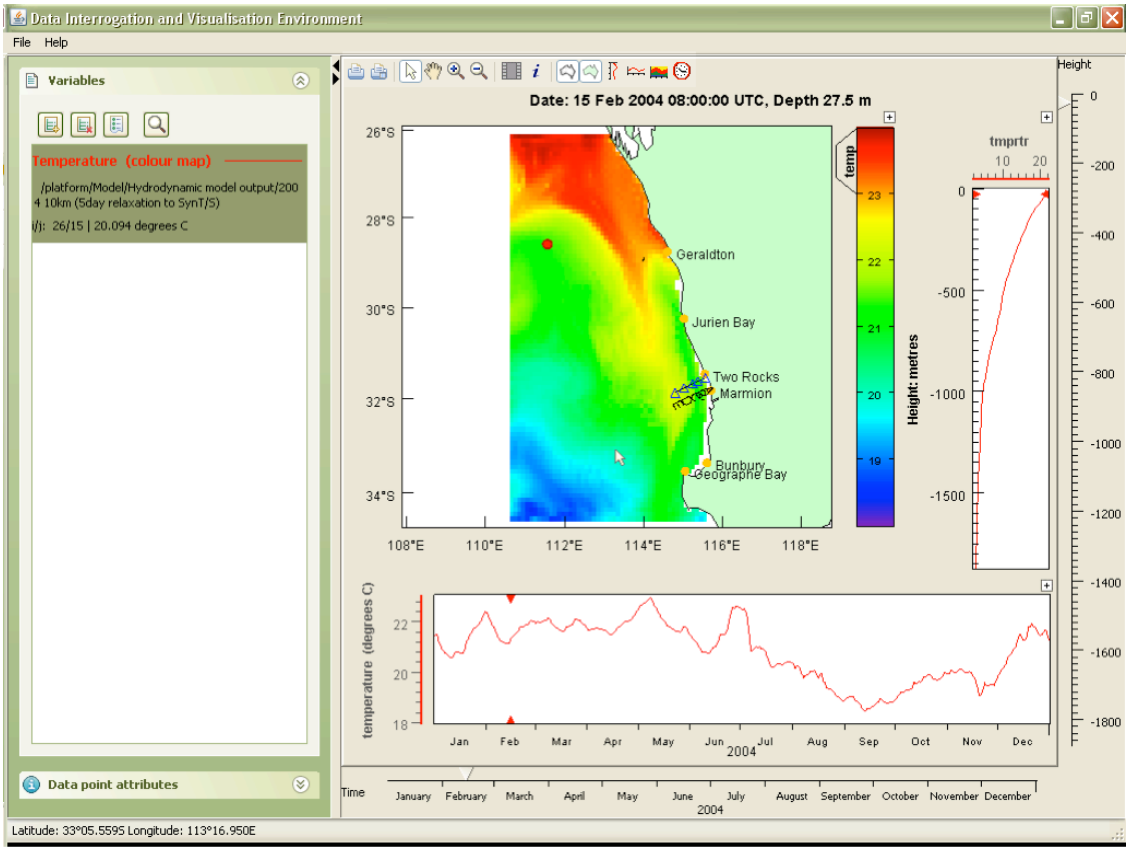


Figure 27, DIVE window showing profile plot

The slider at the right hand side of the window, shown in Figure 27 at 27.5m depth, can be dragged and released to show data at a chosen vertical level. All displayed panels – the map, time series and section plots will vary if the time displayed is modified.

The vertical level being displayed is indicated by red triangles. Blue triangles show the chosen vertical level, but not yet displayed. If the file is slow to load the blue triangles will be visible until the data for that vertical level is loaded and displayed.

6.7. Time Series Plots

Time series plots can be produced for variables with a time-varying component – such as model output or satellite data.

The toggle button will hide or show the time series panel if possible.

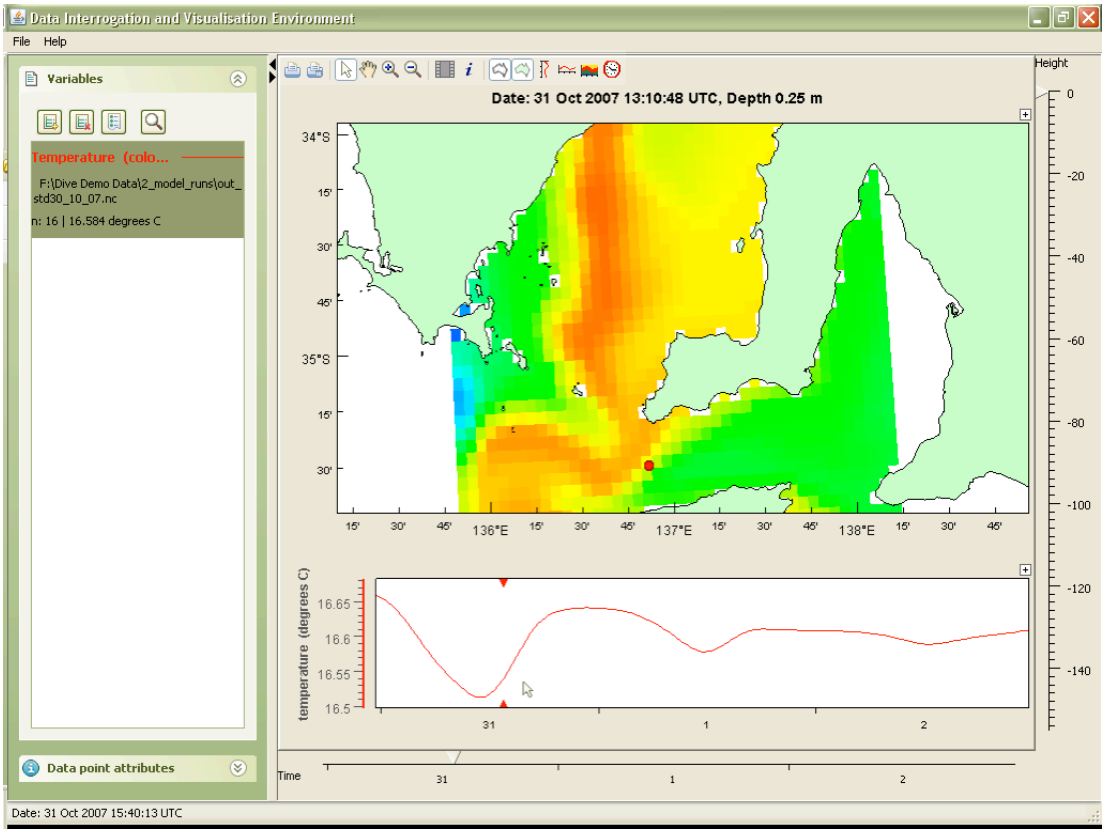


Figure 28, DIVE window showing time series

The slider at the bottom of the window, shown in Figure 28 on the 31st of October, can be dragged and released to show data at a chosen time. All displayed panels – the map, profile and section plots will adjust if the time displayed is modified.

The time being displayed is indicated by red triangles. Blue triangles show the time being selected, but not yet displayed. If the file is slow to load the blue triangle will be visible until the data for that time is loaded and displayed.

6.8. Exporting Images and Movies

The button allows you to export images in a variety of formats such as bmp, jpg and png. You can also export animations or movies of a sequence of time steps.

DIVE will export whatever you are showing on the screen – excluding the Variables panel.

Figure 29 shows the dialog that controls the exporting of images and movies.

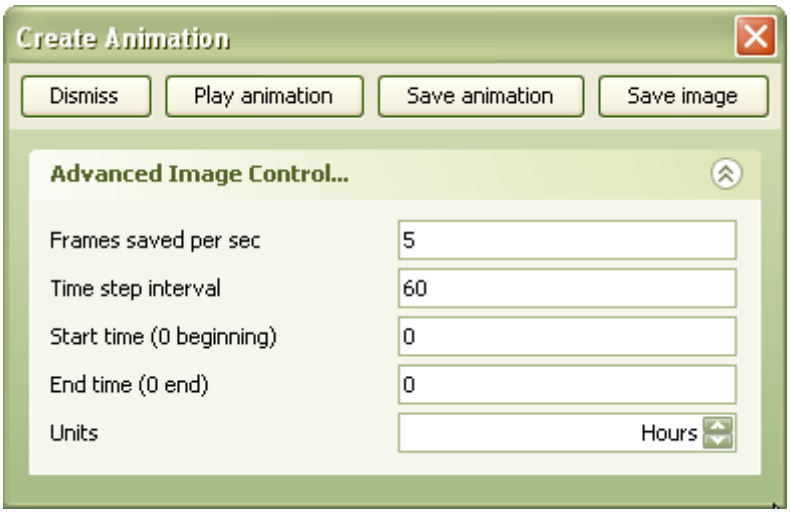


Figure 29, Movie and Image Export Dialog

6.8.1. Making Images

Select the “Save image” button. A save file dialog will appear. Name the file with the appropriate extension (jpg, bmp, png or gif) and the image will be saved in that format.

6.8.2. Making Movies or Animations

When making an animation – you should change the display properties of the variables you are viewing so the auto scaling is off (not ticked). See section 6.2.1. If you do not turn off auto scaling, each frame will be independently colour or contour-scaled. When the animation is created there will be no consistency between the frames.

Step 1

If the “Advanced Image Control...” fields shown in Figure 29 are not revealed, click on the title which says “Advanced Image Control...”. This will toggle the visibility of the additional options which control animations.

Step 2

Set the parameters for the export of the animation.

Frames saved per sec:	This is the number of frames to show per second. Note that, for large or complex images, DIVE may not be able to play animations at the requested speed if too much time is required to render each frame.
Time step interval:	This is measured in the dataset time in the chosen time unit (seconds, minutes, hours or days).
Start time (0 beginning):	This is the time to start the animation. This is measured in the chosen time unit.
End time (0 end):	This is the time to end the animation. This is measured in the chosen time unit.

Step 3

To save an animation to a file, select the “Save animation button”.

The format of the animation saved is based on the file extension you provide.

- .gif will produce an animated gif.
- .avi will produce an avi movie. Avi files come in many codecs, so it may be difficult to find a player. These avi files works with Apple’s QuickTime player and with VLC media player.
- .swf will produce an animation in Macromedia’s shockwave flash, also known as a small web format.

6.9. Data Point Attributes

This function is used to obtain further information about a dataset.

6.9.1. Biological Point Data

DIVE can show details about biological datasets. As you move the cursor around the map, the ***i*** cursor will turn into a red ***i*** when it is above a *hot spot* at which there is point data.

If you click on a *hot spot* an “**i**” icon will appear at that location. Clicking on the title bars of the Variables panel or the Dataset attributes panel toggles between showing the Variables and Dataset attributes panels. When a point is selected, data attributes for the selected location will be displayed as shown in Figure 30.

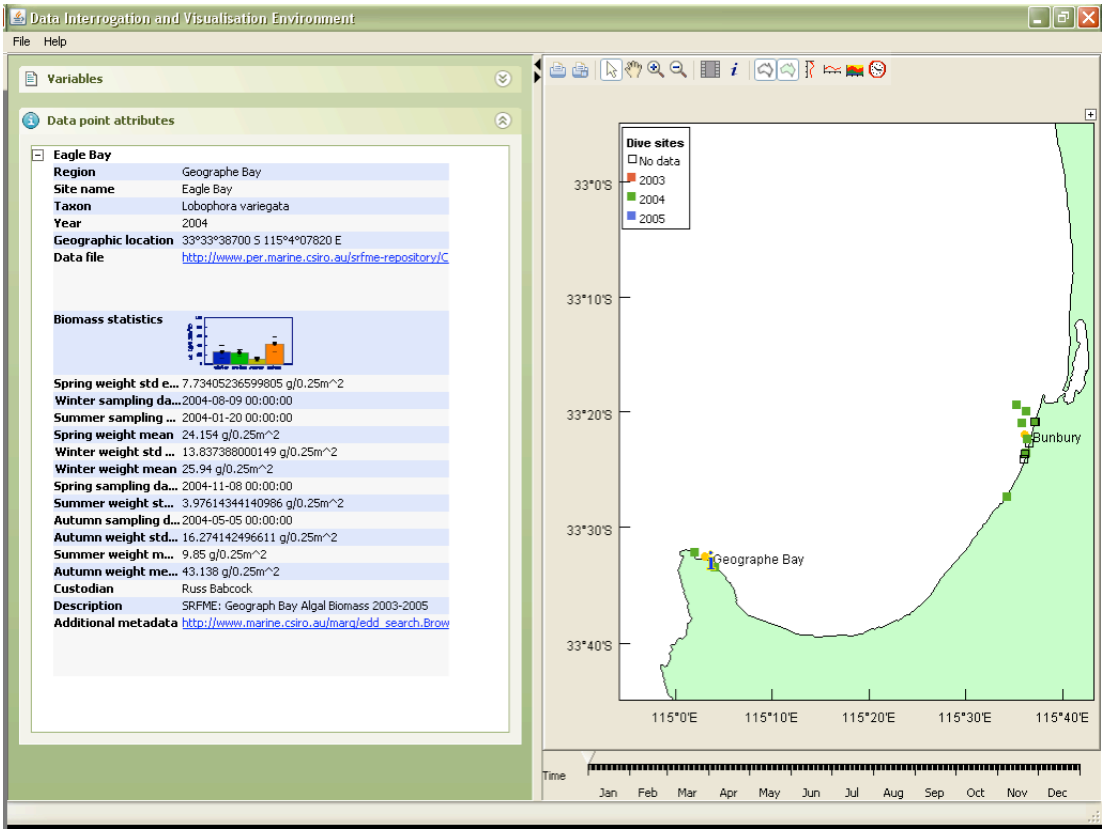


Figure 30, Data Attributes for Dive Site

6.9.2. Gridded Data Sets

You can also click on gridded data to reveal information about that dataset and location. Click on the map where there is data and an "i" icon will appear. The datasets point attribute panel will show attributes about the selection as shown in Figure 31.

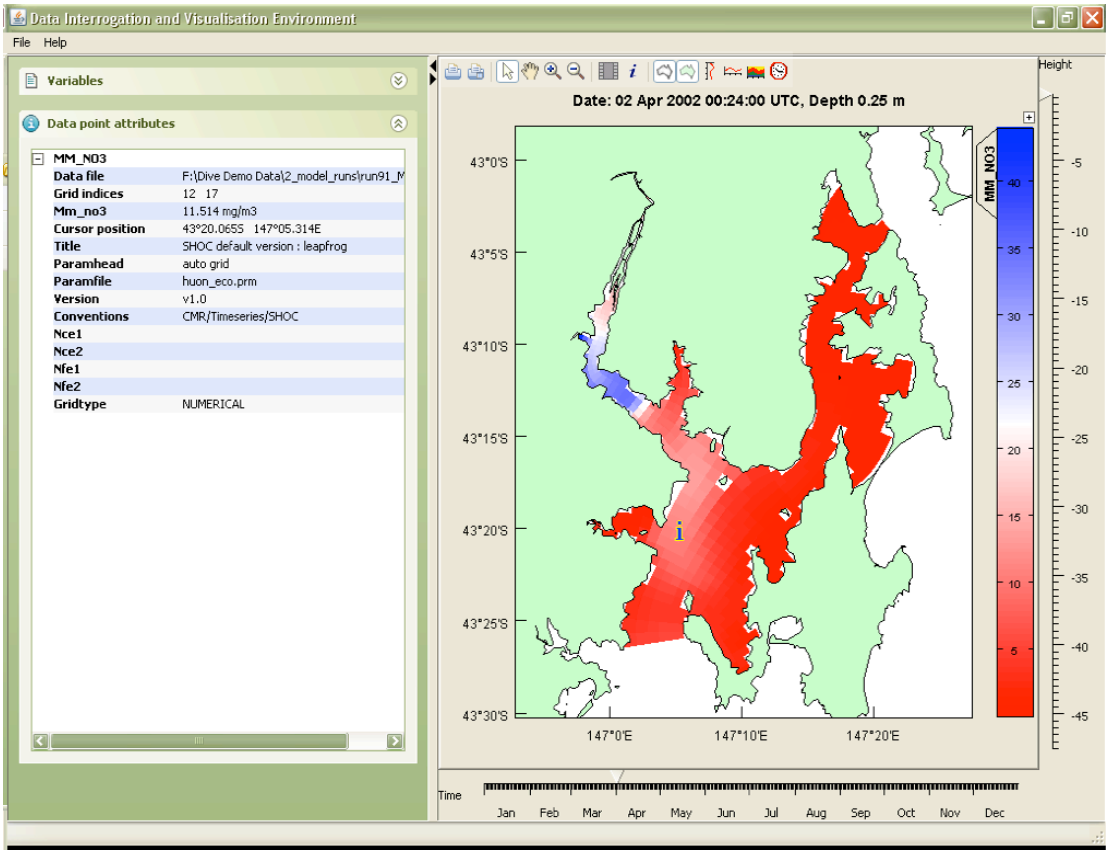
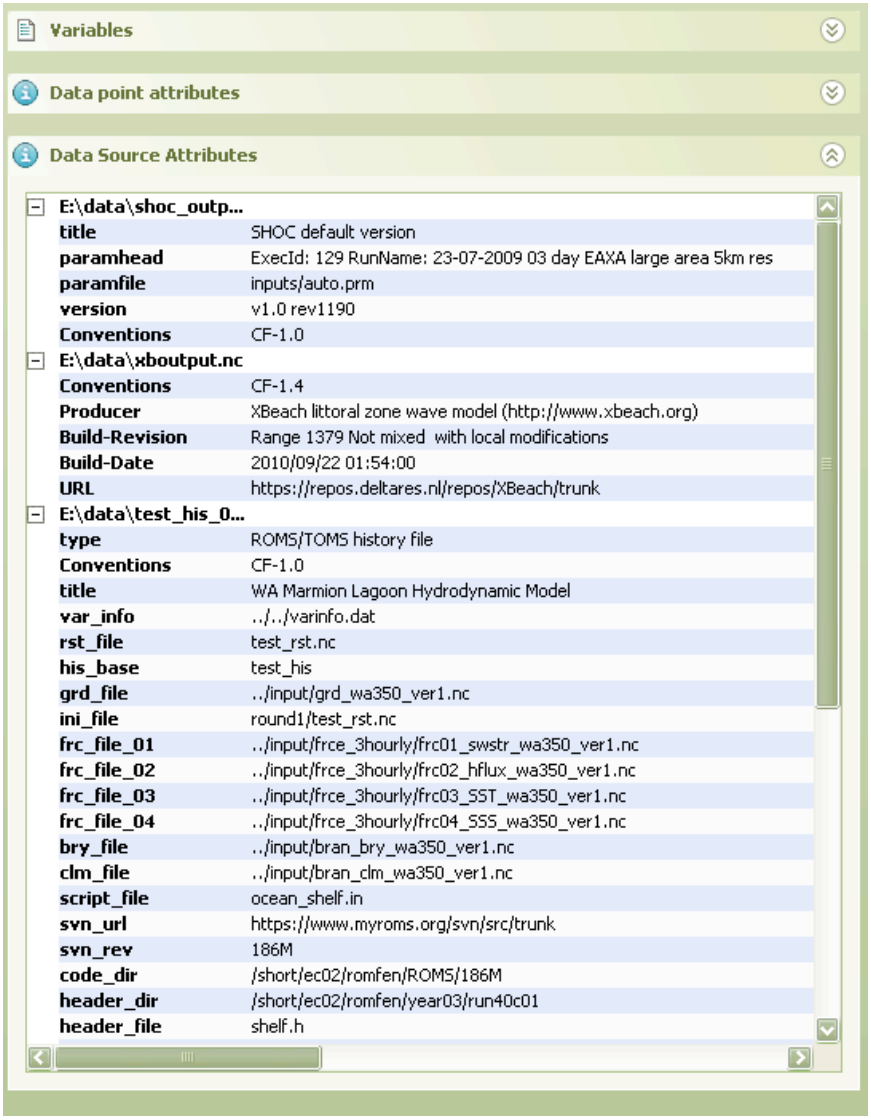


Figure 31, Data Attributes for Gridded Data

6.10. Data Source Attributes



The Data source attribute panel shown in Figure 32 shows attributes for the data sources currently being viewed. If the Data source attributes are not currently visible, they can be revealed by clicking on the title for the Data source attribute panel. Data source attributes can be horizontally resized by dragging the right hand side of this panel.

Figure 32, The Data source attribute panel

6.11. Section Plots

In the case of 3-dimensional gridded or point-data datasets, cross-section plots can be produced using the button. When you wish to remove the cross section plot click on the button to toggle off the cross-section.

6.11.1. Gridded Data Section Plots

When you chose the button, the cursor will turn into a crosshair. You define the transect for the cross section by clicking in a sequence on the map. Where you click, a dot will be drawn. When you have finished drawing your transect select the Apply button (or press the letter x on your keyboard). A cross-section will be drawn as shown in Figure 33. Note that the dots on the transect are coloured and that the same colours appear on the top axis of the cross section plot.

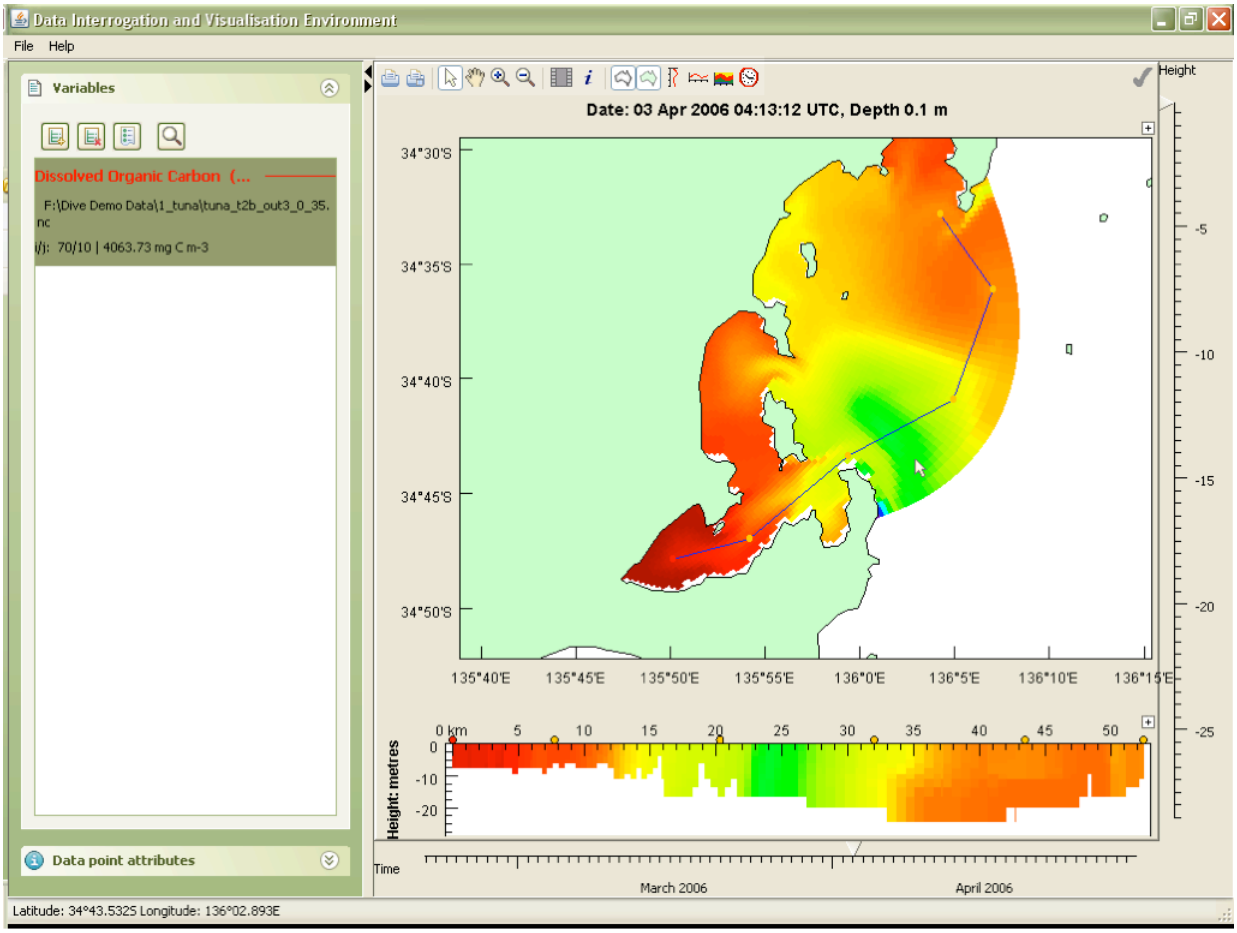


Figure 33, Cross Section Plot

If you wish to change the transect defining the cross section you should remove the cross section and redefine the transect.

Cross sections for vector plots are not yet implemented. The colour range and table used for the cross section are initially taken from the main plot panel. You can override the automatically defined colour or contour range, or whether to base these on the map or section plot by changing the plot properties as described in section 6.2.1.

6.11.2. Point Data Section Plots

Select the button and the section plot will be shown immediately as in Figure 34.

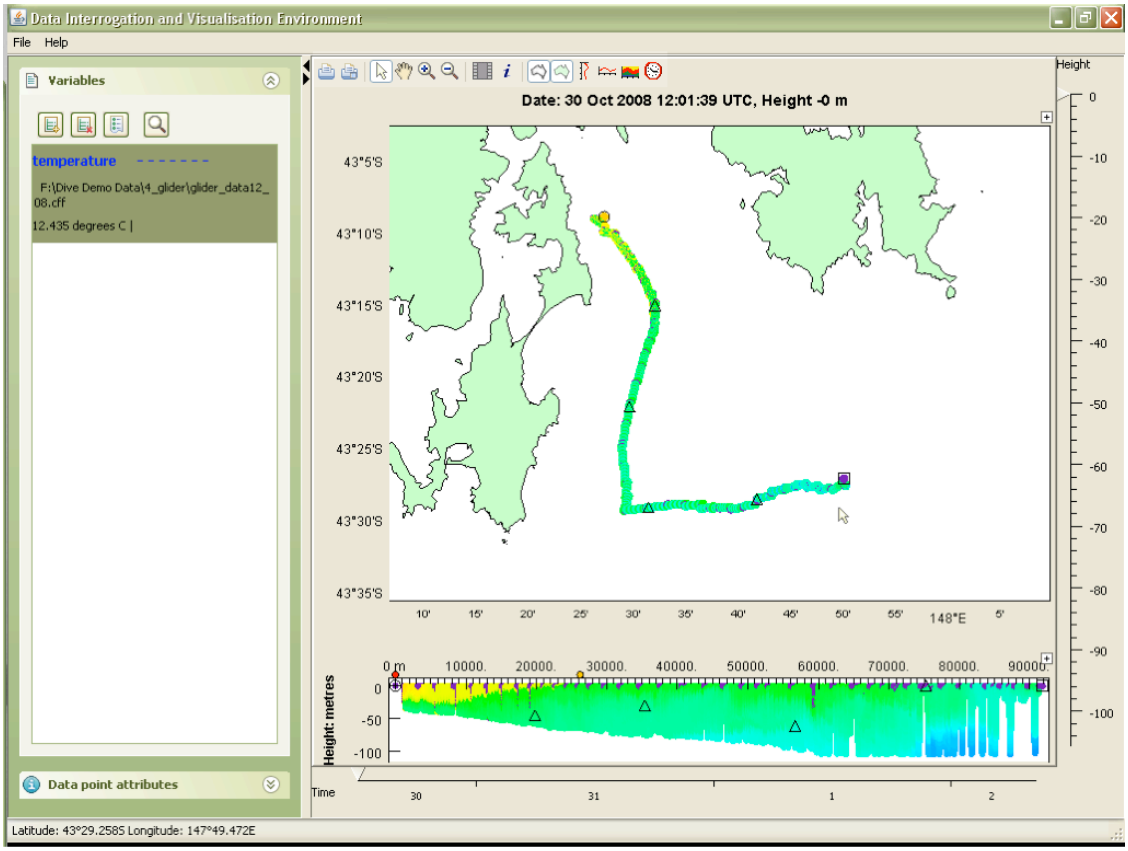


Figure 34, Point-data section plot

6.12. Time Zones

The button icon allows you to chose the time zone that the data is displayed in. When you chose this option the following dialog appears:

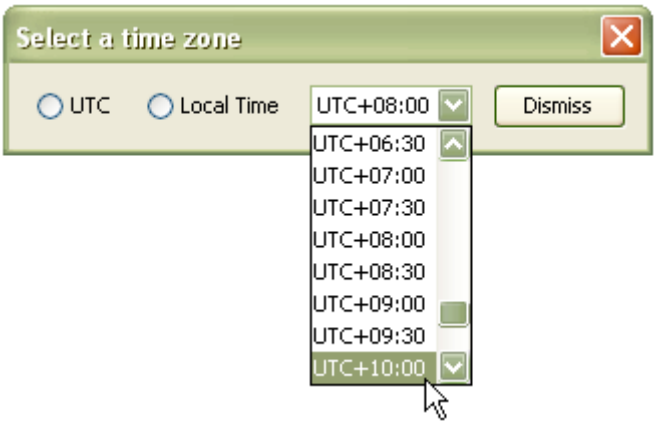


Figure 35, Time Zone Dialog

The first and default radio button shows the data in Coordinated Universal Time (UTC).

The second option shows the data in the time of computer you are using DIVE on. If you computer in set for daylight savings DIVE will also use daylight savings.

The third option allows you to chose any time zone. The time zones are displayed using a standard rather than naval convention. Time zones are represented by UTCsHH:MM (s = sign, HH =hours, MM = minutes) offset from UTC. So east is positive. Standard time for Sydney is UTC+10:00.

The time zone in use is displayed in the title of the plot. For example:

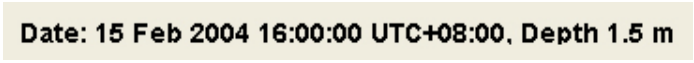


Figure 36, Plot heading showing time zone

6.13. Changing order of variables

The depth order of the plots can be adjusted. The order that the variables are listed in the Variables panel is the order that the plots will be “stacked” in. Another way of thinking of this is that the last variable listed at the bottom of the list is plotted first, the second last variable is plotted second and drawn over any previous plots and so on.

As an example, in Figure 37 the colour map for pressure is overlying and obscuring the vectors for wind.

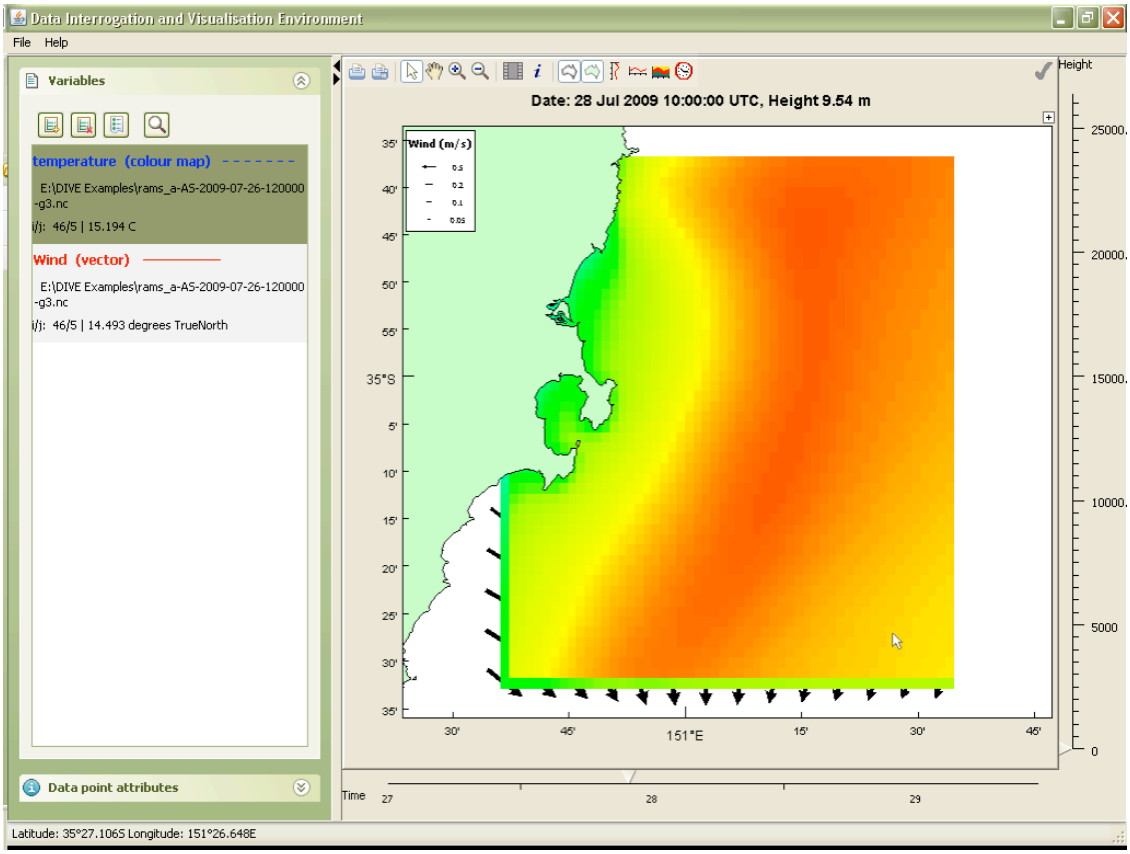


Figure 37, Obscured Layer

To correct this, select a variable in the Variable panel and it will be highlighted as shown in Figure 37 for pressure, although the colour of the highlighting will vary depending upon your computer. Once selected, the variable can be dragged to the required position in the Variables panel. The layers are then shown as required in Figure 38. Note – this is a two step operation. You must select, then drag the variable to the desired position.

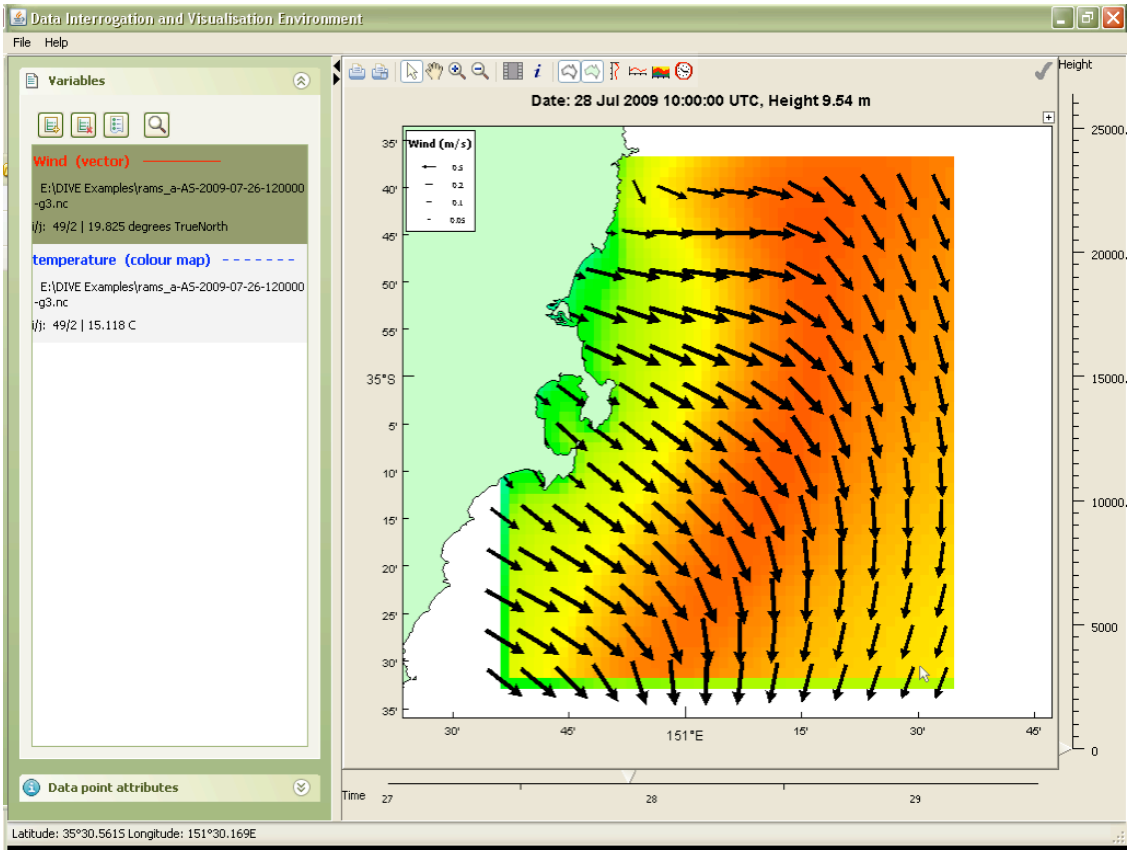


Figure 38, Corrected layers

6.14. Displaying a Plot in a Separate Window

Some plot panels in DIVE, such as time series, profiles and sections, have a small symbol on the top right as shown in Figure 39. If you click on this symbol the plot will be taken out of the main DIVE window and redrawn in a separate window, which can be expanded to the full screen size. If you close the external window, the panel will be redrawn inside the main DIVE window in its normal position.

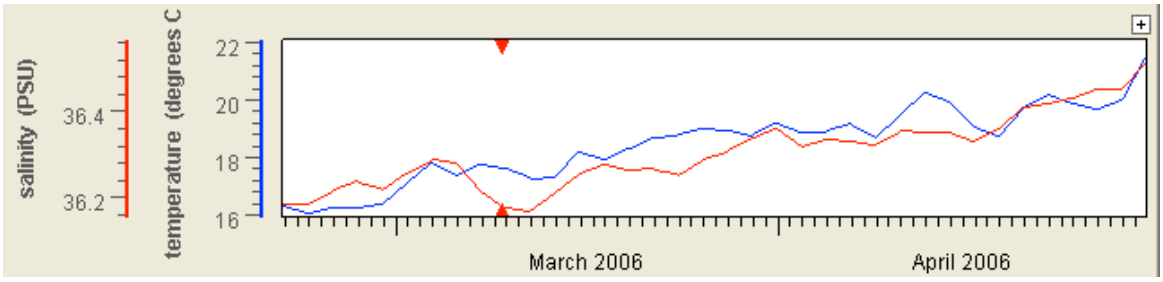


Figure 39, Panel with + icon

6.15. Changing Your View of a Plot

The move and zoom tools & can be used with all plot panels.

If you right-click in a plot panel a menu will pop up as shown in Figure 40.

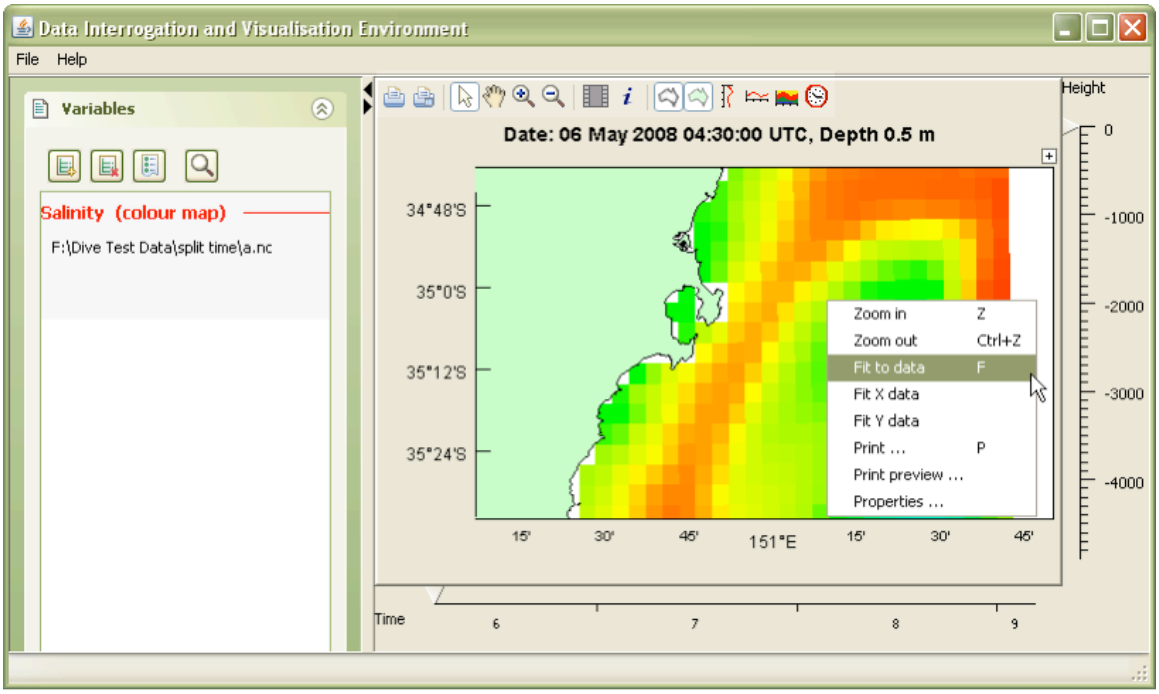


Figure 40, Right-click menu

Some of the menu options have keyboard equivalents. For example pressing the letter F will change the view so the data fits into the window. This works for all plot panels.

6.15.1. Manually setting axis properties

You can manually set the properties of plot axes by left-clicking on any of the axis scales, such as those highlighted in red in Figure 41.

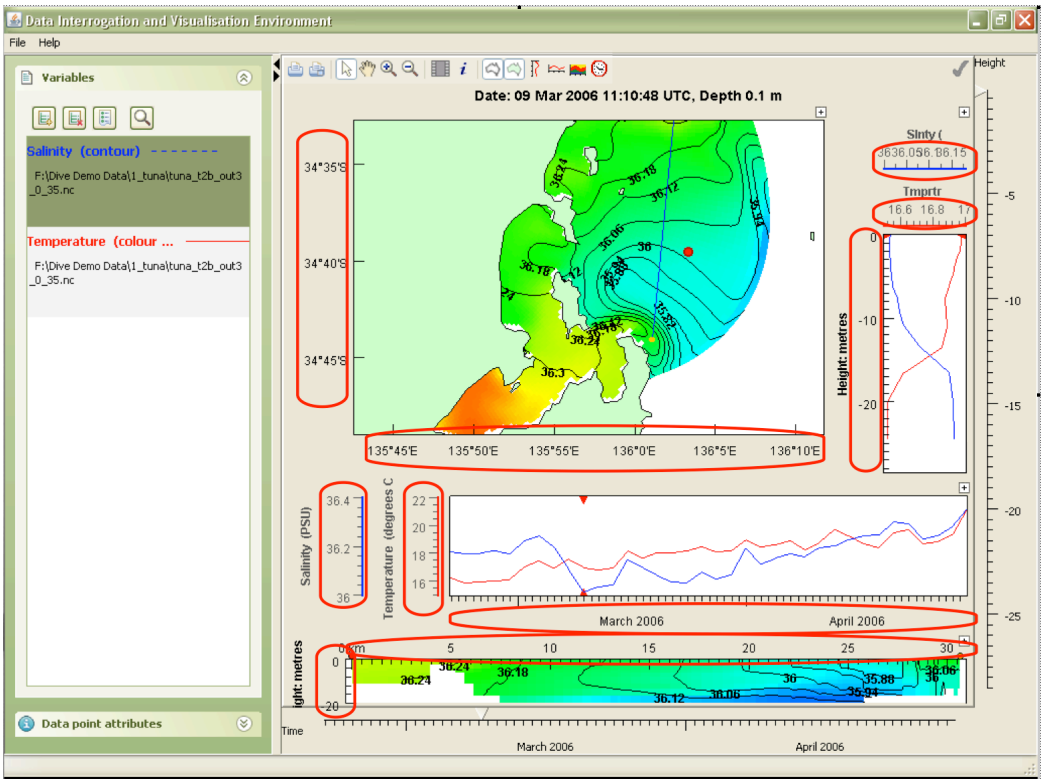


Figure 41, Plot axes

After left-clicking on the axis you will see a dialog like that in Figure 42 which will allow you to set attributes of that axis.

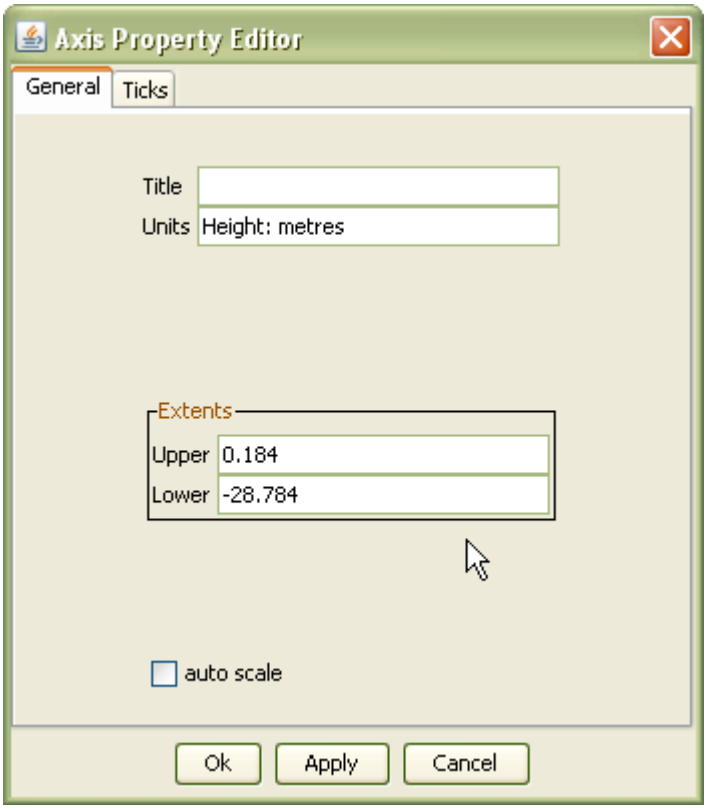


Figure 42, Axis Property Dialog

6.16. Changing the format of cursor latitude and longitude

As described in section 6.1 as you move the cursor across map window, the latitude and longitude of the cursor will be displayed in the bottom left of the DIVE window. You can change the format of that display by clicking in the area that the location is displayed, as shown in Figure 43.

Figure 43, Where to click to change the latitude and longitude format

There are two formats available, showing decimal degrees or decimals minutes as shown in Figure 44

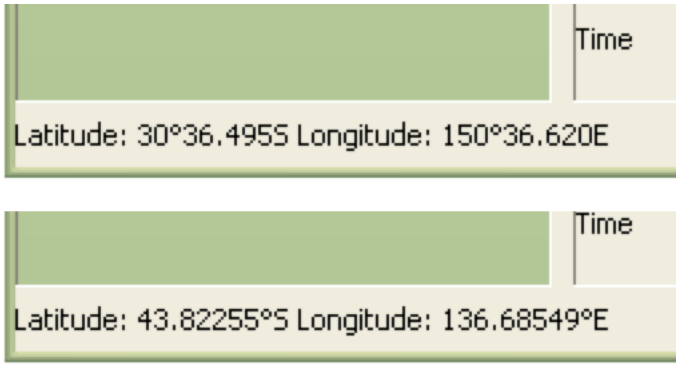


Figure 44, Available formats for the display of the cursor location.

7. Sediment Plots

Gridded biogeochemical data can contain in-sediment variables. If a variable has sediment data available, the Dataset selection dialog will show a button as shown in Figure 45.

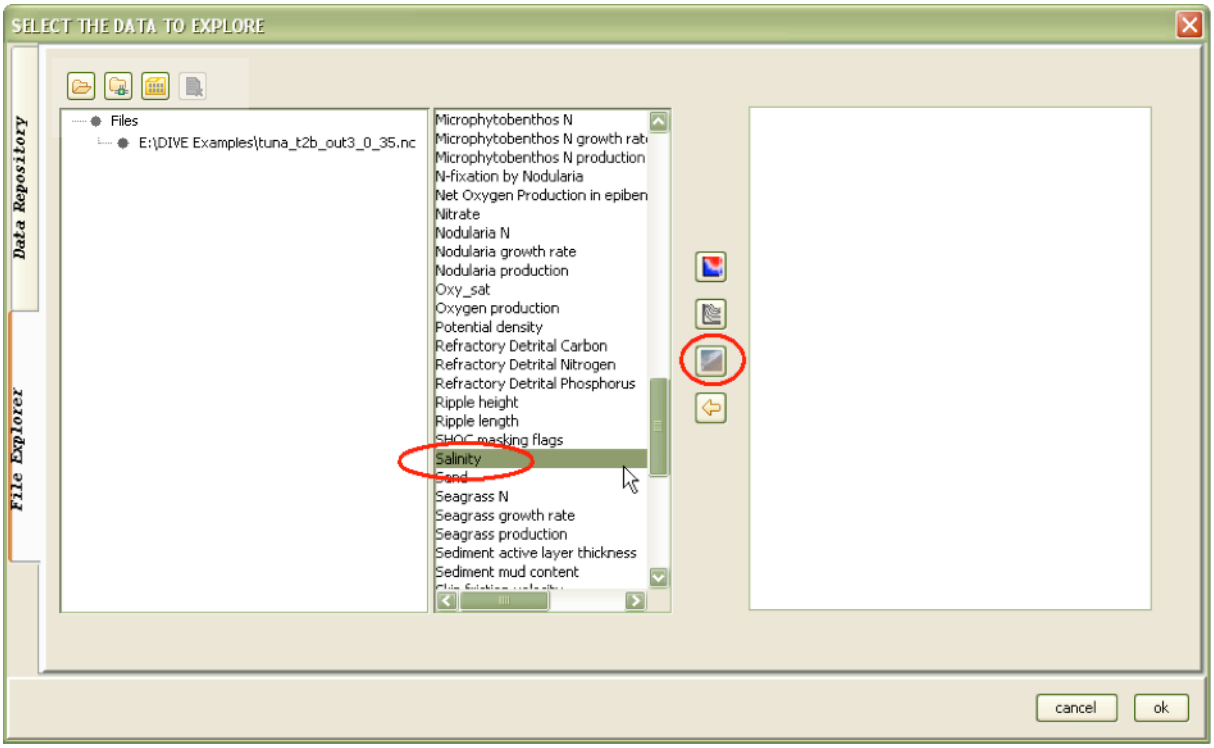


Figure 45, Dataset Selection Dialog with water/sediment button

After pressing the button, the name of the variable has SED appended as shown in Figure 46.

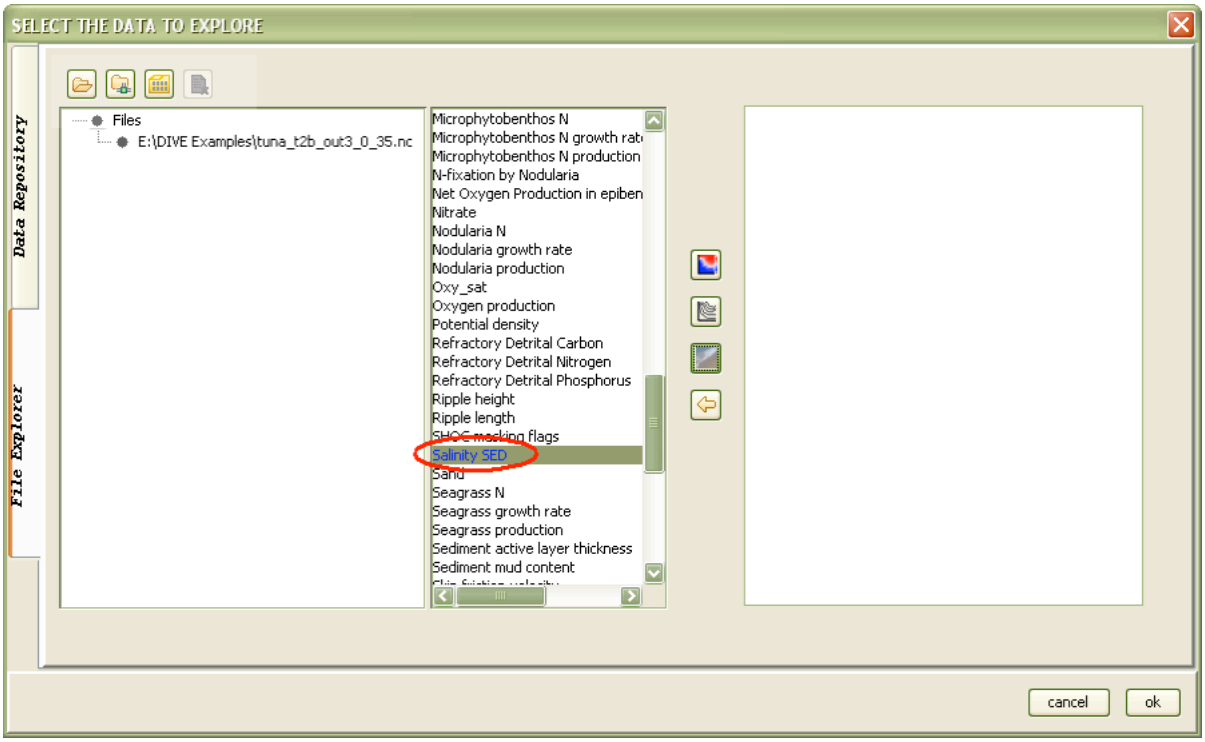


Figure 46, Dataset Selection Dialog with variable toggled to sediment

When visualised, the SED-appended variables will appear in their own profile plots as shown in Figure 47. The height and Sed Depth sliders can be controlled individually.

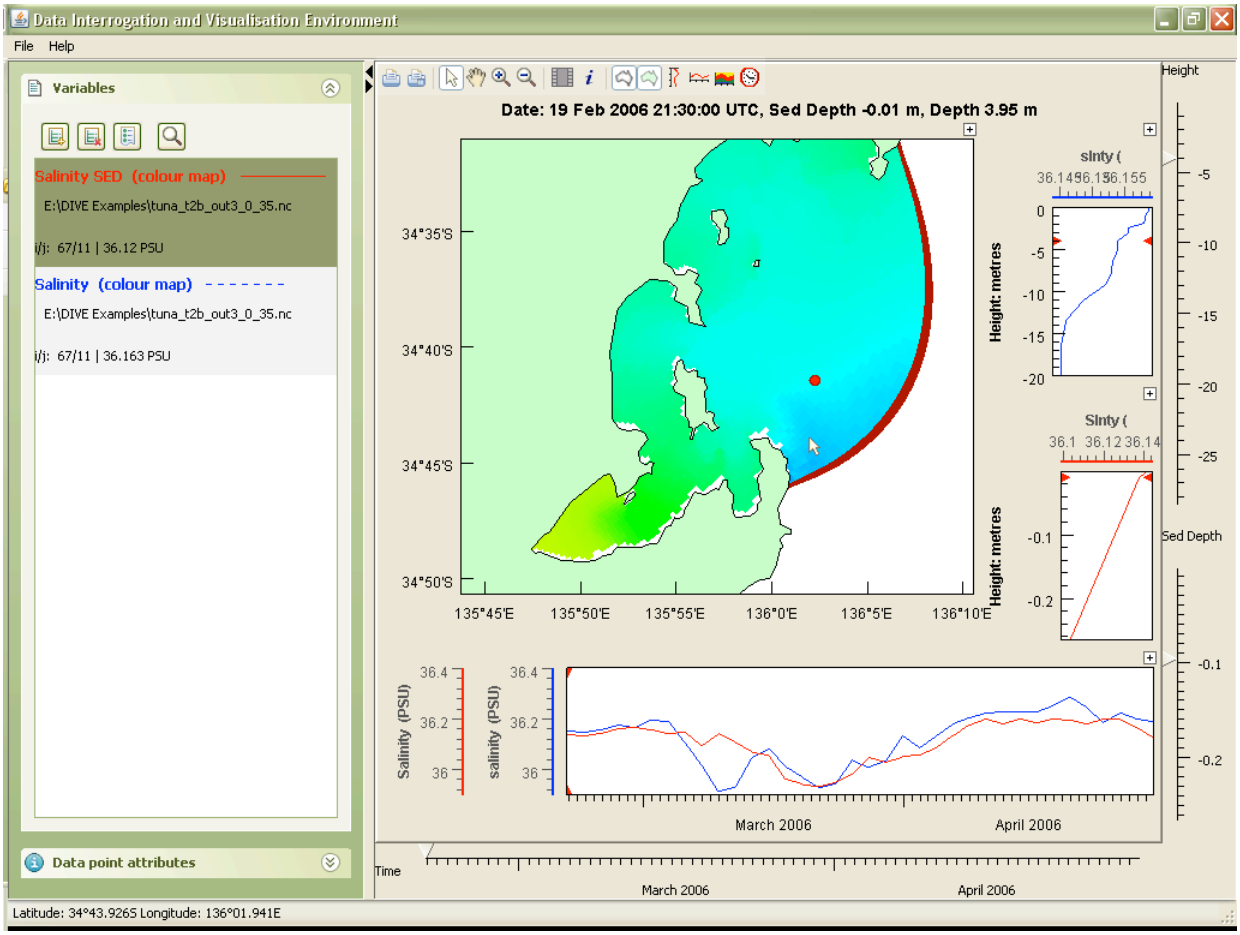


Figure 47, DIVE Window showing water and sediment profile plots

8. NCML Files

DIVE supports NcML (NetCDF Markup Language) files, which are an XML representation of NetCDF meta data. NcML files allow you to combine multiple NetCDF files, which DIVE will treat as a single data source. See http://www.unidata.ucar.edu/software/netcdf/ncml

This simple example combines NetCDF files that contain single time steps into a NcML file which is a time series.

```
<netcdf xmlns="http://www.unidata.ucar.edu/namespaces/netcdf/ncml-2.2">
  <aggregation dimName="time" type="joinExisting">
    <scan location="." suffix=".nc" />
  </aggregation>
</netcdf>
```

NCLM files should be suffixed with .ncml.

9. MNC Files – Multiple NetCDF Files

DIVE will normally handle a given variable from each dataset separately. For example salinity from different datasets will plotted in different colours on profile and time series plots. DIVE will also display map (colour, contour, vector) plots separately for that variable for each dataset.

An MNC file defines a collection of NetCDF files. When combined using an mnc file the variables from the component NetCDF files are handled as if they have come from the same dataset.

For DIVE to read an MNC file it must have the extension .mnc.

If there is temporal overlap in the component files, the data from latter declared file will be used.

The format of an MNC file is as follows:

```
multi-netcdf-version 1.0
nfiles n
file0.filename /path/to/file/filenameA.nc
file1.filename /path/to/file/filenameB.nc
.
.
file[n-1].filename /path/to/file/filenameZ.nc
```

An example:

```
multi-netcdf-version 1.0
nfiles 4
file0.filename /path/to/file/fileA.nc
file1.filename /path/to/file/fileB.nc
file2.filename /path/to/file/fileC.nc
file3.filename /path/to/file/fileD.nc
```

Appendix A. Column File Convention, Version 2.02

Prepared by Irshad Nainar, CSIRO Marine and Atmospheric Research.

Updated by Gary Carroll, CSIRO Marine and Atmospheric Research.

A.1. Introduction to CFF

This document describes the CMAR column file format convention that holds profile and time series data. This convention is applicable for, but not limited to, the following streams of data:

- Profile data acquired from CTD, ARGO, XBT.
- Underway timeseries data acquired from net tows.
- Moorings data acquired from ADCP, Tide gauges.
- Time series from model outputs

This file format will be referred to as Column File convention. Version 2 extends the convention developed by Jason Waring and Stephen Walker, but allows:

- Global attributes
- Coordinate Bindings
- Data Types
- Multi line text

Column file format files should have the extension .cff .

A.2. Column File Format Layout

The column file format is described below:

```
version:CF-2.0

block:<block-name>
    info:<tag>
          <text>
          <text>
          ......
    variable:<tag>
          long_name = <text>
          units = <text>
          data_type = <text>
          coordinate_type = <text>
          missing_value = <text>
          <attribute> = <text>
          ..........
    variable:<tag>
          long_name = <text>
          units = <text>
          data_type = <text>
          coordinate_type = <text>
          missing_value = <text>
          data = <value>
          <attribute> = <text>
          ..........
    variable:   ....
    ......
    data:[whitespace|tab|semicolon|colon|hash]
          <filename> |
          <tag>       <tag>       <tag>
          <value>     <value>     <value>

block:<block-name>
    info:<tag>
          <text>
          ......
    variable:<tag>
    ..................
    ..................
```

A.3. Features

The CFF version 2 convention handles:

- Global attributes
- Data types
- Coordinate mapping between variables. This mapping is established through coordinate type and coordinates attribute.
- Multi-line text strings for comments.

A.4. Description

There are four “keywords” in this format which the input file should conform to. These keywords are used to delimit the different sections in the file.

- block
- info
- variable
- data

A.4.1. BLOCK

A block contains the attributes and data for a specific data stream, such as a CTD cast. Each dataset/block of data is delimited by the keyword block. This allows the flexibility to have multiple sets of data within a single file.

```
block:SS001_CTD001
```

A.4.2. INFO

The info keyword is used to specify certain key information about the file such as a description or convention.

```
info:description
     This was a cast done aboard the Southern Surveyor on ...
     blah.. blah... blah
info:convention
     cmr/columnfile/profile
```

A.4.3. VARIABLE

The variables (and their attributes) are prescribed within the variable keyword section.

```
variable:temp
     long_name = temperature
     units = degrees_celcius
     data_type = double
     coordinates = time, z, latitude, longitude
     missing_value = 999
     scale_factor = 0.25
```

The actual data for the variable can either be specified in this section or in the data keyword section. If the data is repeated for a variable, it can be specified in this section. The data is delimited by white space.

```
variable:eta
     long_name = surface elevation
     units = metre
     data_type = double
     coordinates = time, latitude, longitude
     missing_value = -32767
     data = 0.25 0.25 0.25 0.5 0.5 0.5
```

If the variable is a global/non-column variable, then it is prescribed in this section as follows:

Example (of a global/non-column variable):

```
variable: latitude
      long_name = temperature
      units = degrees_north
      data_type = double
      data = -30.71
```

In addition to the standard set of global attributes, additional attributes can be specified to describe the data.

A.4.4. DATA

This section contains the data for the variables specified under the variable keyword section. The data is represented as columns with the column header being the variable name/tag. The delimiter between the columns can be specified. The default delimiter is white space.

The delimiters permissible are: space, comma, colon, whitespace or tab. Whitespace data cannot include tabs. Note that the column header also needs to be separated by the same delimiter as the data. The header refers to the 'variable tag'.

```
data:tab

Depth     temp      salt
50        21.9      35.64
500       21.3      35.61
200       20.8      35.52
```

A.4.5. ATTRIBUTES

Attributes are descriptive text information. This information appears in the Data Source Attributes within DIVE.

```
attributes:voyage
      name=MC200202
```

A.5. Column File Format For "Profile" Data

```
version:CF-2.0
block:CTD13
    info:convention
          cmr/columnfile/profile/ctd
    attributes:device
          name=ctd instrument
    attributes:voyage
          name=MC200202
    variable:lat
          long_name =latitude
          units =degrees_north
          data_type =double
          coordinate_type =lat
          data =-31.53633333
    variable:lon
          long_name =longitude
          units =degrees_east
          data_type =double
          coordinate_type =lon
          data =115.5705
    variable:time
          long_name =time
          units =days since 1990-01-01 00:00:00
          data_type =double
          coordinate_type =time
          data =4470.14741898146
    variable:depth
          long_name =depth in salt water
          units =m
          data_type =double
          coordinate_type =z
    variable:SAL
          long_name =salinity
          units =PSU
          data_type =double
          coordinates =time,lat,lon,depth
```

```
        missing_value =-999
    variable:TEMP
        long_name =temperature
        units =degrees C
        data_type =double
        coordinates =time,lat,lon,depth
        missing_value =-999
    data:tab
        depth SAL   TEMP
        0     -999  -999
        2     36.2201     22.0845
        3     36.2156     22.0426
        4     36.2272     21.9978
        5     36.2235     21.9604
        6     36.229      21.9313
        7     36.2536     21.9064
```

The variables time, lat and lon are the global variables whose values are specified along with the variable definition.

The attribute coordinates binds the variable to the appropriate coordinate types. For profile data, the coordinates types of time, z, lat and lon are the minimum set of information that should be specified in order to make the file conform to this convention.

A.6. Column File Format For "Underway"Data

```
version:CF-2.0

block:NA200410_TSG_100m
    info:convention
        cmr/columnfile/underway
    info:description
        This file contains underway timeseries data
    attributes:voyage
        name=NA200410
    Variable:time
        long_name = WAST Time
        units = days since 1900-01-01 00:00:00 +08:00
        data_type = double
        coordinate_type = time
        missing_value = -999
    Variable:Lat
        long_name = Latitude
        units = degrees_north
        data_type = double
        coordinate_type = lat
        missing_value = -999
    Variable:Lon
        long_name = Longitude
        units = degrees_east
        data_type = double
        coordinate_type = lon
        missing_value = -999
    Variable:temp
        long_name = temperature
        units = degrees C
        data_type = double
        coordinates = time, depth, lat, lon
        missing_value = -999
    Variable:sal
        long_name = Salinity
        units = psu
        data_type = double
        coordinates = time, depth, lat, lon
        missing_value = -999
    data:comma
time,Lat,Lon,temp,sal
38336.35477,-31.9677,115.512,21.71,35.897
38336.35501,-31.9676,115.511,21.7,35.902
38336.35525,-31.9674,115.51,21.7,35.903
38336.35553,-31.9673,115.5088,21.68,35.909
38336.35577,-31.9671,115.5078,21.68,35.908
38336.35602,-31.967,115.5068,21.68,35.906
```

The attribute coordinates binds the variable to the appropriate coordinate types. For underway time series data the coordinate types of time, depth, lat and lon are the minimum set of attributes that should be specified in order to make the file conform to this convention.

A.7. Column File Format For “Mooring”Data

```
version:CF-2.0
block:Mooring001
    info:description
          This is a multi-line description
          of data in this file
    info:convention
          cmr/columnfile/mooring
    variable:depth
          long_name = depth
          units = m
          data_type = double
          coordinate_type = z
          data = 100
          missing_value = -999
    variable:time
          long_name = time
          units = days since 1900-01-01 00:00:00 +08:00
          data_type = double
          coordinate_type = time
          missing_value = -999
    variable:lat
          long_name = latitude
          units = degress_north
          data_type = double
          coordinate_type = lat
          data = -30.70
          missing_value = -999
    variable:lon
          long_name = longitude
          units = degrees_east
          data_type = double
          coordinate_type = lon
          data = 114.18
          missing_value = -999
    variable: temp
          long_name = temperature
          units = degrees Celsius
          data_type = double
          coordinates = time, z, lat, lon
          missing_value = -999
    variable: salt
          long_name = salinity
          units = PSU
          data_type = double
          coordinates = time, z, lat, lon
          missing_value = -999
    data:whitepace
          time  temp  salt
          37739.19  21.9  35.64
          37739.27  21.3  35.61
          37740.28  20.8  35.52
```

The attribute coordinates binds the variable to the appropriate coordinate types. For moorings data, the data the coordinate types of time, depth, lat and lon are the minimal set of attributes that should be specified in order to make the file conform to this convention.

Appendix B. SRFME Repository

Some installations of DIVE will display the SRFME Repository Explorer pane. This is a hierarchical file-based data storage system that manages the processed and calibrated data collected within SRFME.

The data repository is a hierarchical directory structure organized into categories based on the type of data.

The meta-data for the datasets in the repository is captured in a database. DIVE and the data repository are linked through this meta-database. The meta-information contained in the database is used by DIVE to provide different views of the data, by platform, device or data-stream as shown in Figure 1.

The data repository contains the following types of data:

- Output of hydrodynamic (SHOC) model runs
- Output of wave (SWAN) model runs
- CTD casts
- Underway time-series
- Data gathered from moorings
- Remote sensing data
- Re-analysis products (climatology, in particular)
- Benthic habitat data

B.1. SRFME Repository Explorer

DIVE provides a hierarchical view of the datasets in the SRFME data repository. The data can be accessed in the dataset explorer panel of DIVE using 3 alternative views.

Platform view. This view lists the platforms used for data collection. An example of a platform is a *vessel*. Selecting a platform and navigating through its hierarchy displays the datasets associated with that platform.

Device view. This view lists the devices and instruments used for the data collection. An example of a device is an *underway deployment system*. Selecting a device and navigating through its hierarchy displays the datasets associated with that device.

Data-stream view. This view lists the different streams of data that has been collected. An example of a data-stream is an *underway time-series data*. Selecting a data-stream and navigating through its hierarchy displays the datasets that conform to that stream.

When adding benthic habitat data, there are no variables associated with the dataset. Instead of seeing the colour map, contour or vector icon you will see a plain arrow  icon to add the data.

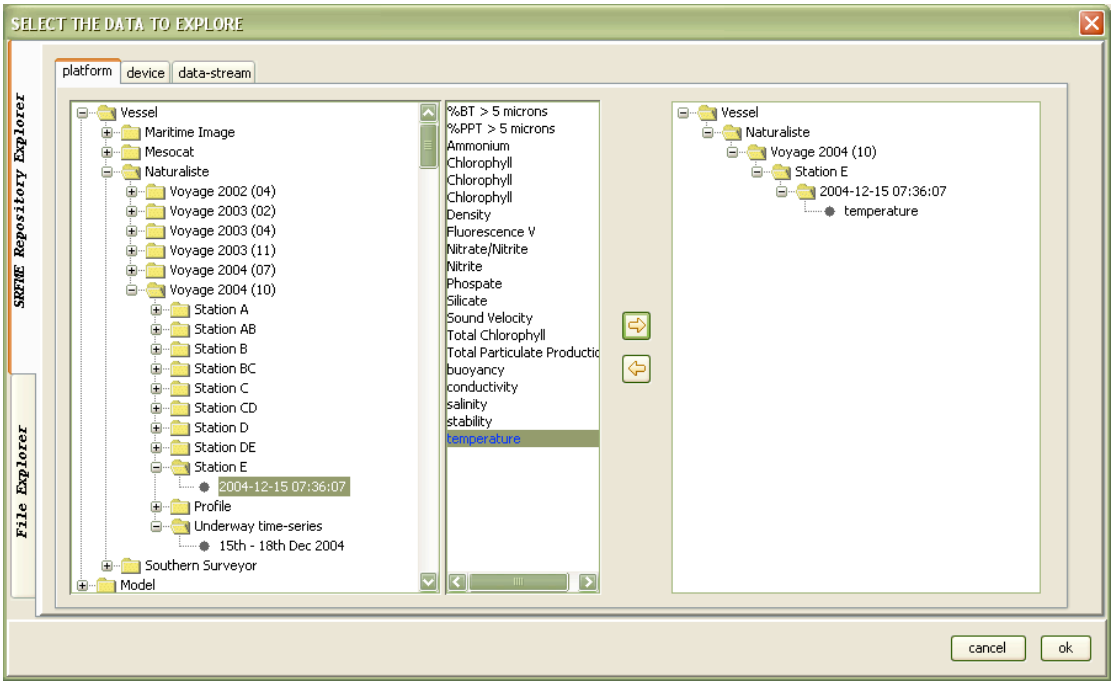


Figure 1, SRFME Repository Explorer pane

Figure 1 *shows* the *platform* view. This view shows how to traverse the hierarchy to access a dataset collected during a particular voyage. The variables can then be added / removed using the ⇨ and ⇦ buttons.

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Appendix D. Third-Party Software Component Licences

DIVE depends upon third-party libraries. This appendix lists those libraries and their licence conditions.

D.1. Apache Software Foundation

The libraries used are commons-logging-api, httpclient and httpcore.

http://commons.apache.org.

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```
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D.3. Simple Logging Facade for Java Organisation

The libraries used are slf4j-api and slf4j-jdk14.

http://www.slf4j.org . Licence at http://www.slf4j.org/license.html

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LICENSE.TXT contains:

```
/*--

 $Id: LICENSE.txt,v 1.11 2004/02/06 09:32:57 jhunter Exp $

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 */
```

D.5. Java.net

The library used is swingx-all.

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D.8. The Open Source Geospatial Foundation

The library used is *Proj4J*.

http://trac.osgeo.org/proj4j. The licence is BSD-styled referenced at http://trac.osgeo.org/proj4j

Licence is Apache 2. See appendix D.1.

D.9. Coverity

The library used is the Coverity Security Library - coverity-escapers, which is a dependency of OPenDAP.

https://www.coverity.com. The licence is at https://github.com/coverity/coverity-security-library.

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D.10. Joda Organization

The library used is joda-time, which is a dependency of OPenDAP.

http://www.joda.org/joda-time.

The licence is Apache 2.0 at http://www.joda.org/joda-time/license.html. See appendix D.1.