Applying Filters in Oasis montaj

Filters are usually applied to geophysical data in order to remove noise/errors, remove regional trends and/or enhance certain geological features. The objective is to select a filter and parameters that do not introduce additional noise into the data.

1D filters are applied to a channel of data in a database, while 2D filters are applied to gridded data and are commonly used during image processing.

This How-To Guide walks you through the basic steps for applying a 1D filter to a channel in a database and a 2D filter to a gridded dataset.

Filter Menus

There are two main Filter menus included with theOasis montaj system . The database filters can be found on the *Database Tools|Filters*menu, and the grid filters can be found on the *Grid and Image|Filters* menu, as shown below.

Database Tools|Filters menu	Grid and Image|Filters menu
Non Linear Filter...	3x3 Convolution...
Convolution Filter...	5x5 Symmetric Convolution...
Rolling Statistics...	7x7 Symmetric Convolution...
Linear Regression...	9x9 Symmetric Convolution...
	Vertical Derivative Convolution...
	Shaded Relief...
	Horizontal Gradient...
	Trend...
	Automatic Gain Correction...
	Analytic Signal...

Apply a Filter to a Database Channel

Removing spikes or noise from data, while preserving significant or relevant geological features, is the most common application of Database Filters. The objective is to select the filter and filter parameters that accomplish this, while not introducing any artifacts into the data.

In this section you will apply the Non Linear Filter which can be used to remove very short wavelength, high amplitude features from the data.
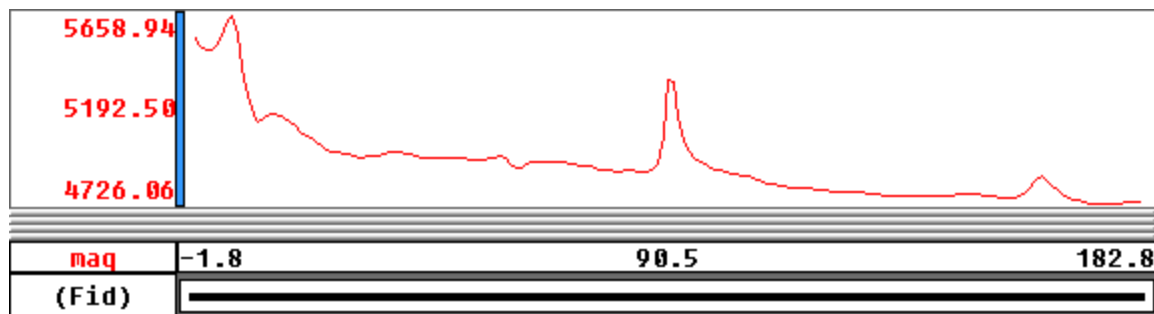
Displaying a Profile

After you open a spreadsheet and display one or more channels, you have the option of displaying them in graphical (profile) form in a *Profile* window. The Profile window is composed of sub-windows called panes, which appear directly below its corresponding database. You can display up to five separate panes with 32 channels of data in each pane.

To Display a Profile

1. Select (highlight) the profile window pane you want to display a profile in. The vertical bar on the left will be highlighted.

2. Select (highlight) the *Channel Header Cell* in your database you wish to profile, right-click and from the popup menu select, **Show Profile**.
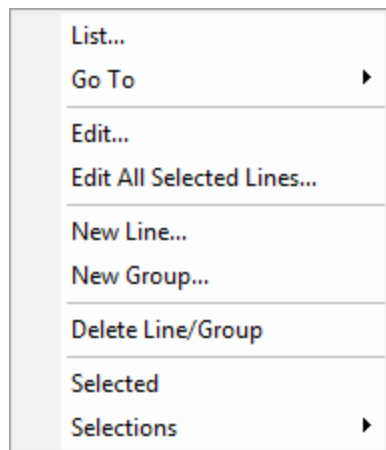   The channel data will be displayed in the profile window.

Displaying a Profile of Different Line

If you have line data, you will probably want to look at multiple lines of your data.

To Display the Profile of Different Line

1. Select (highlight) the *Line Header Cell* in the top left corner of the spreadsheet.

2. Right-click and select **List** from the popup menu.

A list of all the line numbers in the current database will be displayed. You can think of each line number as a worksheet in the Spreadsheet window.

3. Click the line to display. The *Profile* window now displays the selected line.

💡 *When the Line Header Cell is highlighted, you can use the Database Tools Bar to scroll through the lines by selecting **Previous Line/Group** or **Next Line/Group**. You can also use the **Page Up** and **Page Down** keys on your keyboard to scroll through the lines.*

Applying a Non-Linear Spatial Domain Filter

The Non-Linear Spatial Domain Filter is a particularly effective way to remove spikes from magnetic data, but it can also be effective for removing short wavelength features, such as signal arising from unwanted near surface geological or cultural features. The non-linear filter is always applied before the linear filter.

To Apply the Non-Linear Filter

1. From the *Database Tools* menu, select *Filters*, then select **Non Linear Filter**.
   The *Non-linear Filter* dialog box appears.
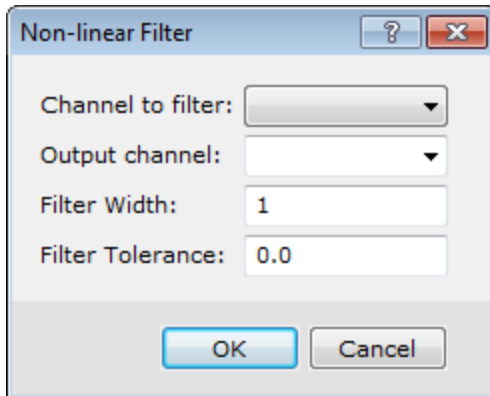
2. Use the dropdown list to select the *Channel to filter*.

3. Specify (type) the *Output channel* name, or select a channel using the dropdown list.

4. Enter a *Filter Width*. Note that, this is the maximum width of the noise measured in data points. Features that are wider than this width will not be altered by the filter.

5. Specify the *Filter Tolerance*. Only noise of greater amplitude than this tolerance value will be altered.

6. Click the **OK** button.

Now you can compare the filtered and unfiltered channel profiles.

To View the Profile of the Filtered Channel

1. Right-click in the header cell of the channel containing the filtered data, and select **Show Profile**.
   The filtered profile along with the original data profile will be displayed in the profile window.
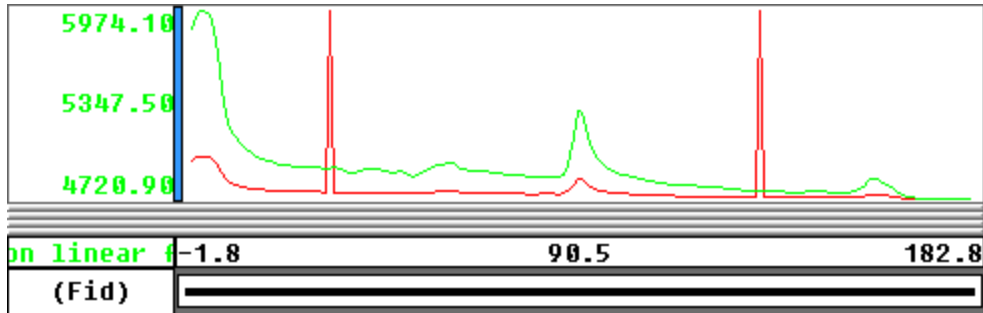
Applying a Filter to a Grid

Grid filters are commonly used to smooth a grid before contouring in order to improve the appearance of the contours. In this application, 1 to 3 passes are usually sufficient. Another useful application is filtering to remove regional data trends by producing a curvature grid. To do this, a 3x3 Convolution (Hanning) filter is passed once over a gridded dataset and the ouput curvature grid is then subtracted from the original grid. This creates a residual gridded dataset, where the residual is proportional to the curvature in the original grid, with zero values indicating inflection points. The curvature grid may also be subsequently filtered to smooth noise.

Applying Grid Filter

In this section you will apply the 3x3 Convolution (Hanning) filter to remove the high frequency component of your data. You can then subtract this "smoothed" grid from the original grid to create a residual grid.

To apply a filter to a grid

1. From the *Grid and Image* menu, select *Filters*, and then select **3x3 Convolution**.
   The *Grid Filters* dialog appears.
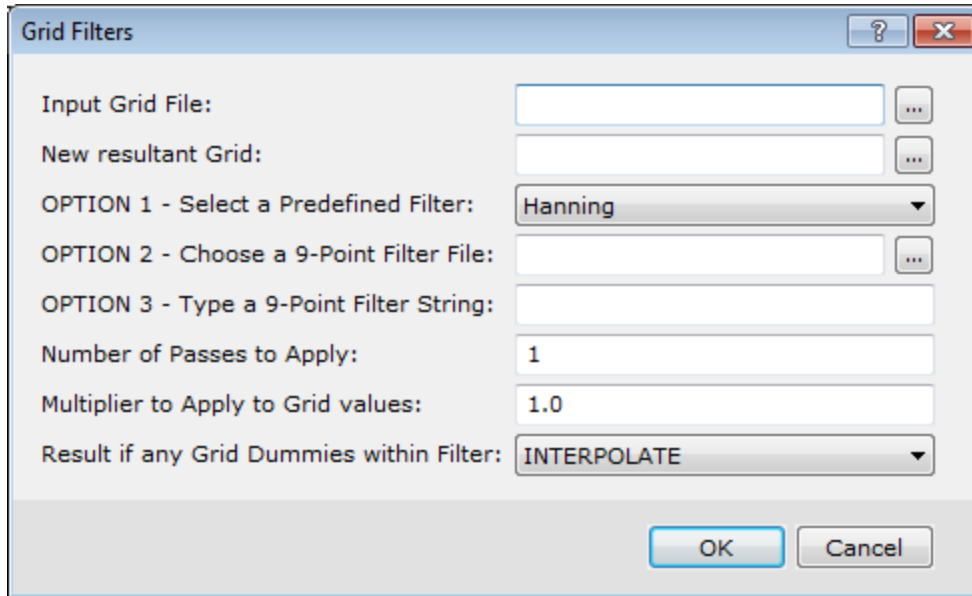
2. From the *Input Grid File* list, select your input grid.

3. For the *New resultant Grid*, enter the name of the new filtered grid.

4. From the *OPTION 1 - Select a Predefined Filter* list, select **Hanning**.

5. Click the **OK** button.
   The new smoothed mag grid opens in a display window.
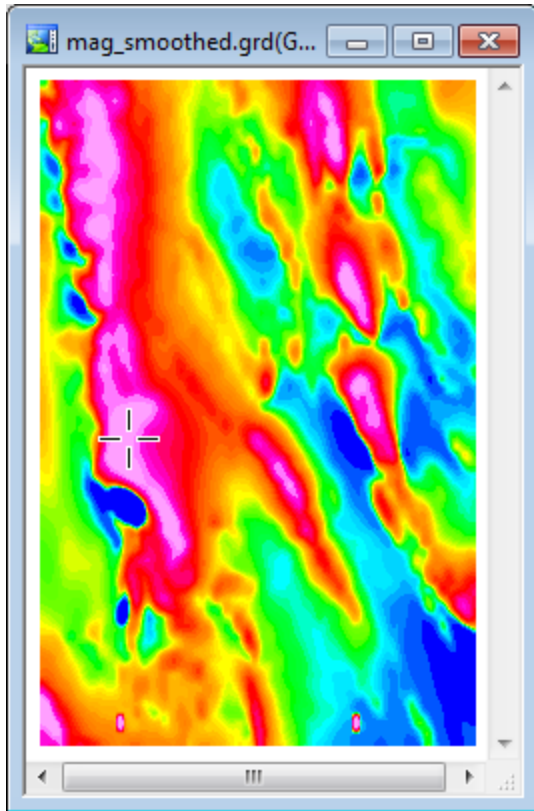
Applying Grid Math

With the Grid Math Expression Builder, you can create, save, load and apply mathematical expressions involving one or more grids in your project.

In this section you will create a residual grid by subtracting the filtered grid from your original grid.

To Subtract Grids

1. From the *Grid and Image* menu, select **Grid Math**.
   The *Grid Math Expression Builder* dialog appears.
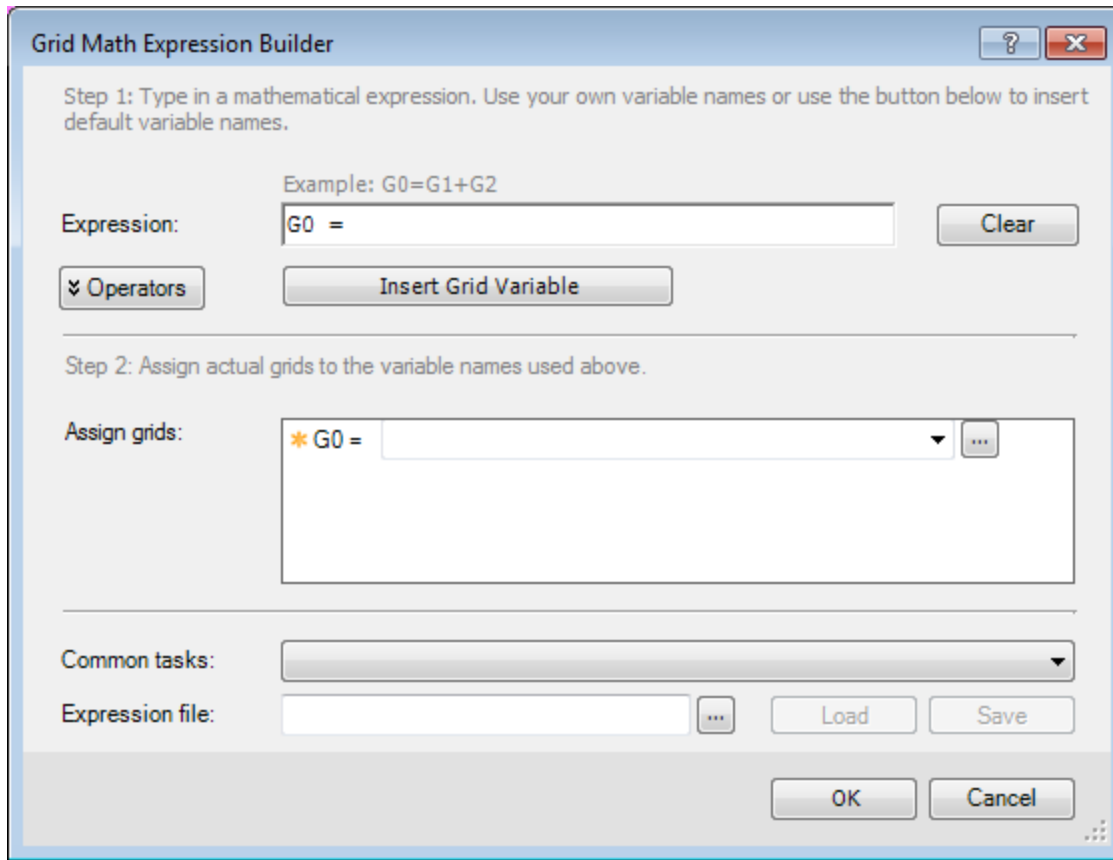
2. In the *Expression* box, enter **G0= G1– G2**.

3. In the *Assign grids* box, click in the list beside the **G0** channel and type the name of the new residual grid.
   A new grid, with this name, will be created when this expression is computed.

4. From the list beside **G1**, select the original grid.

5. From the list beside **G2**, select the filtered grid.

6. Click the **OK** button.
   A new residual grid is created and opens in a display window.
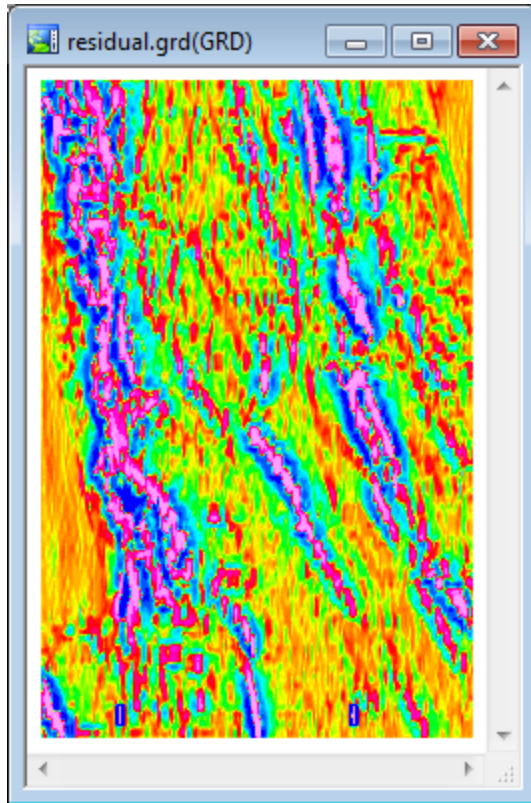
⚠ *The residual grid represents the high frequency information in the magnetic data, which represents very shallow geological or cultural features. Note the shape and orientation of individual features is now evident within the larger areas of anomalous high magnetic intensity.*

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