

Interactive Filtering Method in MAGMAP

This *Interactive Filtering Method in MAGMAP* guide describes how to use the MAGMAP Interactive Filtering tools. This process includes the following steps:

The interactive spectrum filtering process enables you to display a radially averaged power spectrum of an FFT2 Transform image, a selected filter profile, and the resultant (filtered) power spectrum profile, in an interactive window. The filters can be selected from a dropdown list or from a predefined control file. Filter parameters can be interactively modified to obtain the best results.

Prepare Grid

Before transforming a grid to the wavenumber domain (applying the forward FFT), the grid must be properly conditioned to conform with the fundamentals of Discrete Fourier Domain processing. This topic is extensively covered in the signal processing literature and is outside the scope of this Guide. In a nutshell, the conditioning helps minimize the processing artifacts.

In MAGMAP's Step-by-Step and Interactive approaches, the grid is preconditioned by executing the *Prepare Grids* menu item. In the 1-Step process, grid preparation is handled automatically in the background.

The basic grid preparation steps consist of:

- Enlarging the grid to a square of permissible dimensions **. The FFT process only accepts specific dimensions. The expansion serves the secondary purpose of ensuring an adequate gap for establishing the periodicity.
- Optionally removing the regional trend. The intent is to minimize the introduction of long wavelength high amplitude behaviour in the expansion areas.
- Replacing all the dummies in the expanded grid with plausible values, while maintaining the power and frequency content in the data at about the same level.
- Ensuring periodicity along opposite edges.

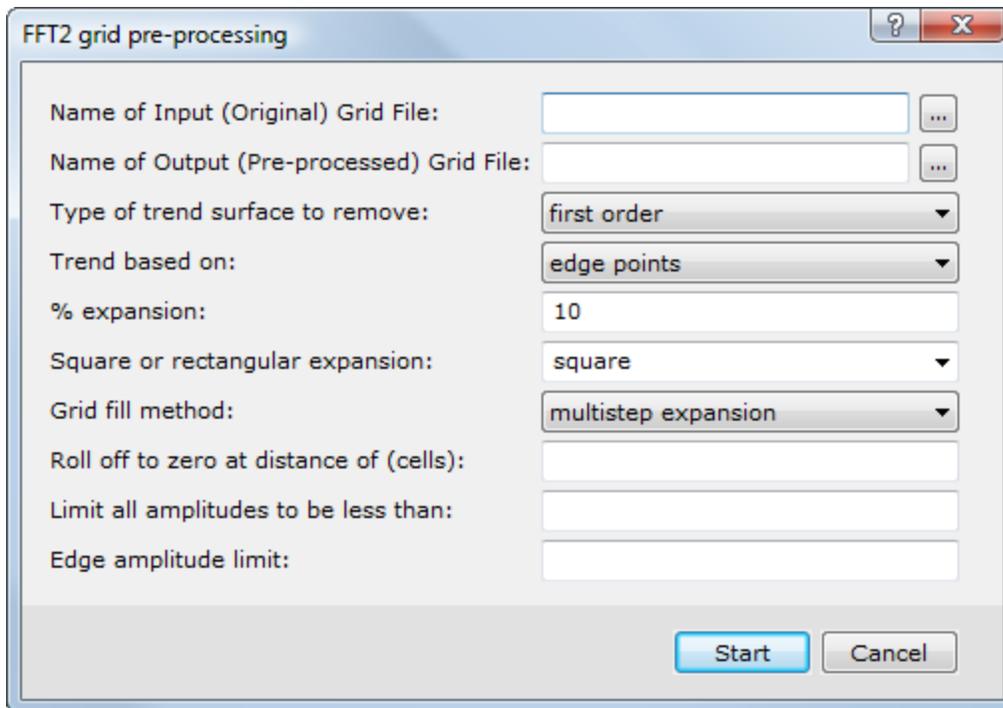


For more information on preparing grids for FFT processing, see the "Preparing Grids for MAGMAP FFT Processing" How-To Guide.

To Prepare a Grid for FFT Transformation

1. From the *MAGMAP* menu, select *Interactive Filtering* and then select **Prepare Grid**.

The *FFT2 grid pre-processing* dialog appears.



2. Select the *Name of Input (Original) Grid File*.
3. Specify the *Name of Output (Pre-processed) Grid File*.
4. You can leave the remaining parameters to the intelligent default values, as shown above and click the **Start** button. The system prepares the grid and displays it in your current project in a temporary map file.



The square of permissible dimensions are developed by Winograd and are:
 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30, 36, 40, 42, 48, 56, 60, 70, 72, 80, 84, 90, 112, 120,
 126, 140, 144, 168, 180, 210, 240, 252, 280, 336, 360, 420, 504, 560, 630, 720, 840, 1008, 1260, 1680, 2520

Apply Forward FFT

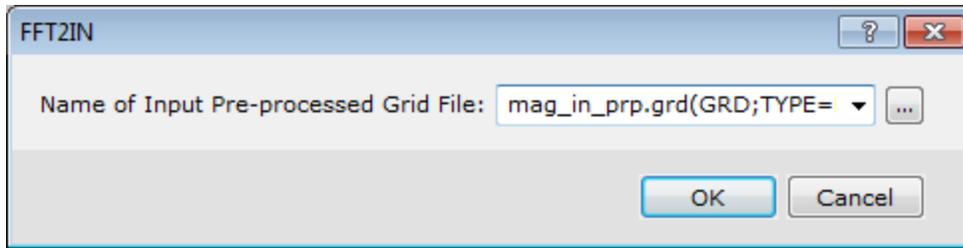
The interactive process enables you to visualize the data power spectrum waveform as well as the filter operator. You can interactively refine the filter parameters to yield optimal results.



For more information on applying forward FFT, see the "Applying the Forward Fast-Fourier Transform" How-To Guide.

To Apply the Forward Fast-Fourier Transformation

1. From the *MAGMAP* menu, select *Interactive Filtering* and then select **Forward FFT**. The *FFT2IN* dialog appears.



2. The *Name of Input Pre-processed Grid File* is pre-populated from previous step, by default.
3. Click the **OK** button.

The system computes the transform. It also creates a new Input Transform File, the name you supplied appended with "_trn" to which you will calculate the Radially Averaged Spectrum and later apply the Filters and Inverse Transform.

Calculate Radial Averaged Spectrum

To better understand the filter operator, calculate a radially averaged power spectrum in the wavenumber domain and display the filter superimposed with the actual data signal.

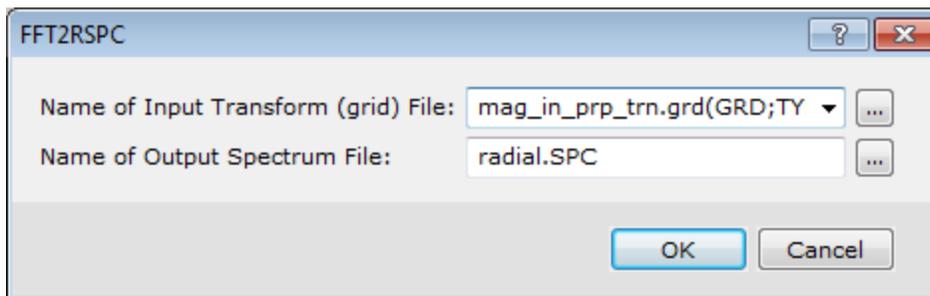


For more information on calculating the Radial Averaged Spectrum, see the "Calculating the Energy Spectrum in MAGMAP" How-To Guide.

To Calculate the Radially Averaged Spectrum

1. From the *MAGMAP* menu, select *Interactive Filtering* and then select **Radial Average Spectrum**.

The *FFTRSPC* dialog appears.



2. Select the *Name of Input Transform (grid) File*.



The Input Transform grid file is created when you apply the Forward FFT to your prepared grids and is automatically populated.

3. Specify the *Name of Output Spectrum File*. Note that a default file name, "radial.SPC" is provided.
4. Click the **OK** button. The system computes the spectrum.



For more information on calculating the radial averaged spectrum, see the "Calculating and Displaying the Energy Spectrum" How-To Guide.

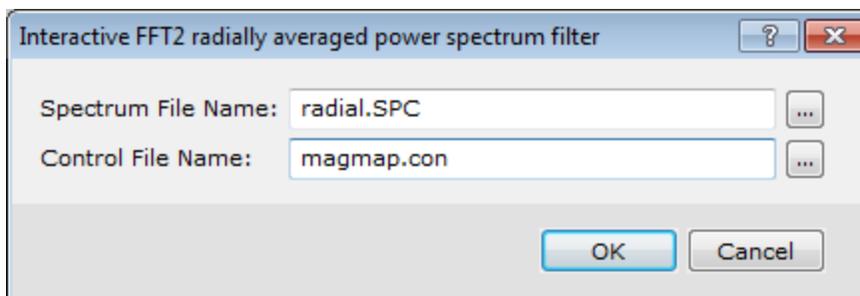
Specify Interactive Spectrum Filters

Interactive filtering displays the radial signature of a filter in wavenumber domain, along with the radially averaged power spectrum of the data before and after filtering. As a result only the radially symmetrical MAGMAP filters are available through the interactive filtering tool. The radial signatures are displayed in a real-time profile window specifically to help you adjust your filter prior to applying it to the entire dataset. To proceed with interactive filtering you must first produce the radially averaged power spectrum.

To Specify Interactive Spectrum Filters

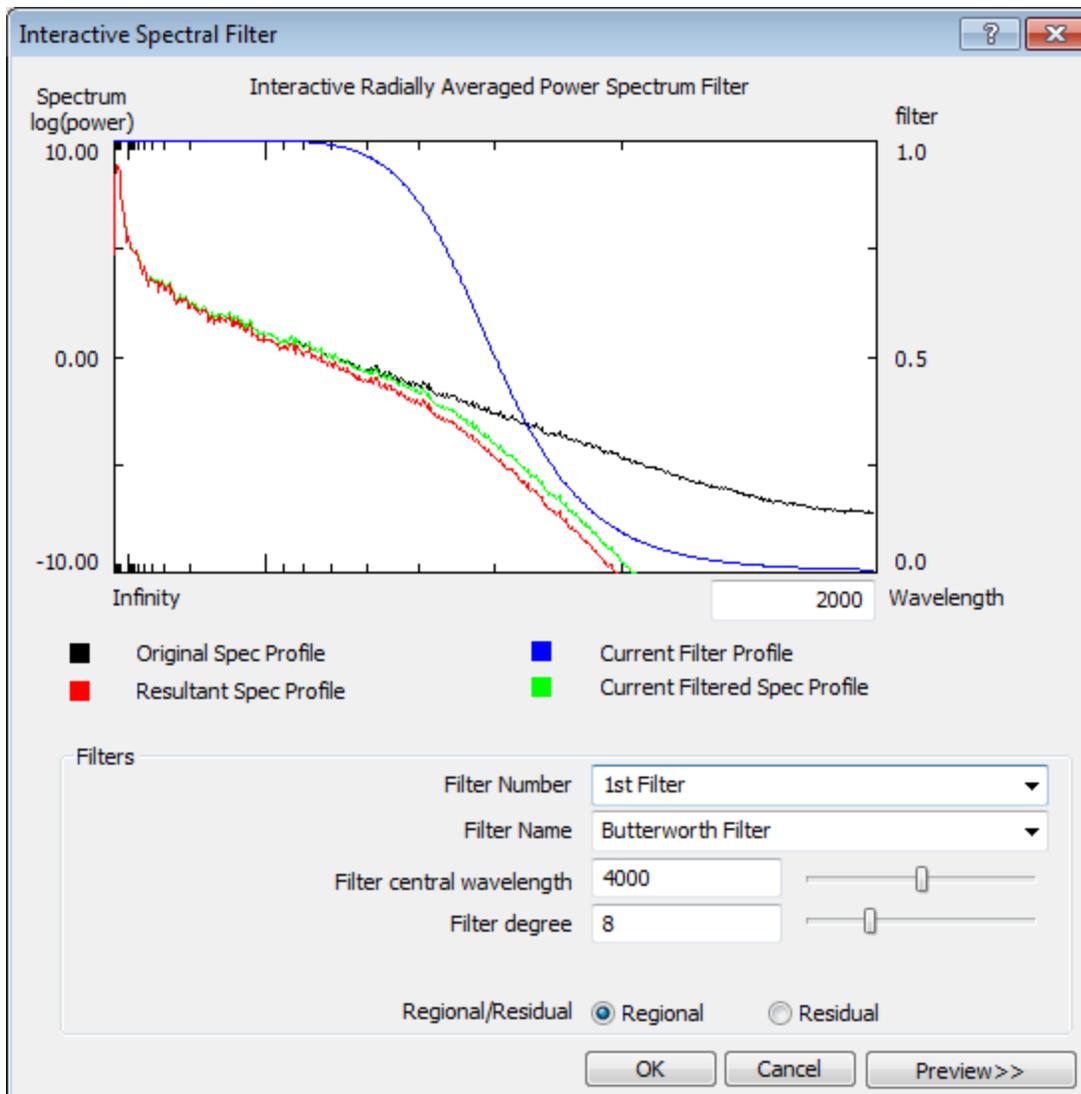
1. From the *MAGMAP* menu, select *Interactive Filtering* and then select **Interactive Spectrum Filters**.

The *Interactive FFT2 radially averaged power spectrum filter* dialog appears.

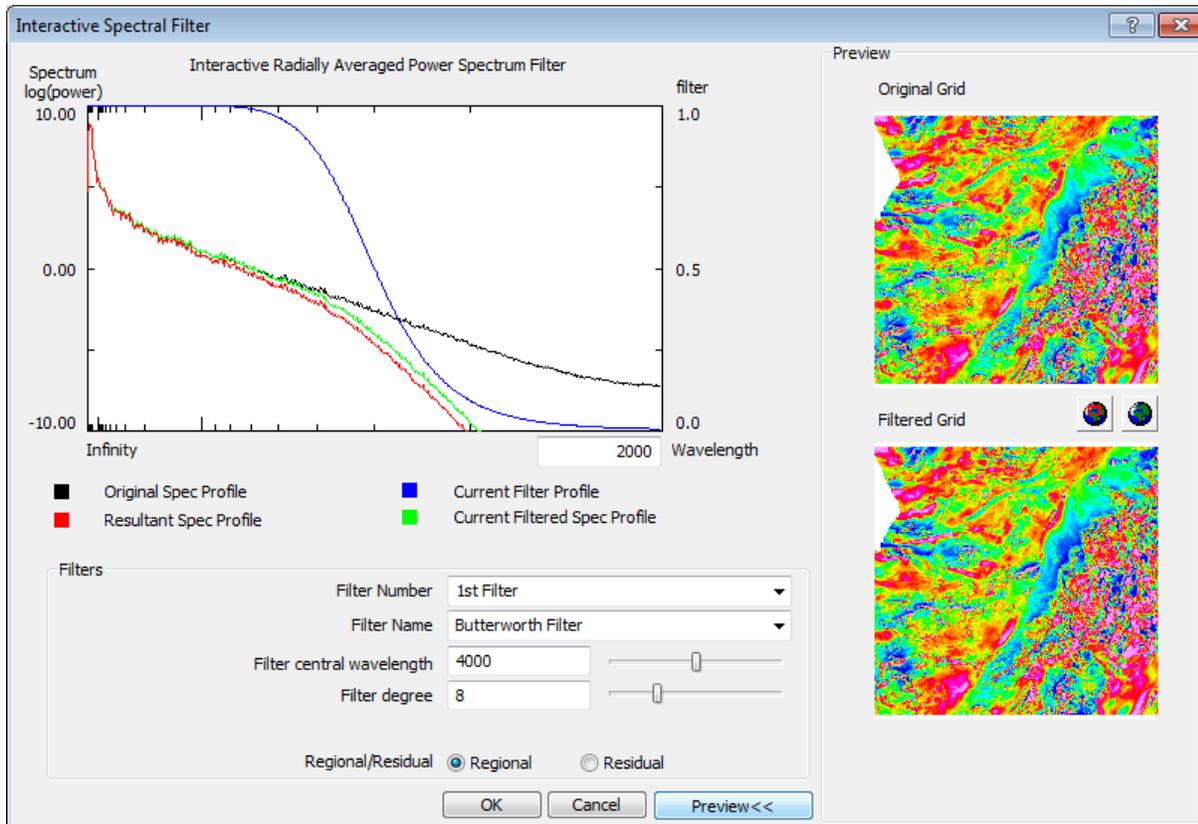


2. Select the *Spectrum File Name*, created when using the *Interactive Filtering | Radial Average Spectrum* option.
3. Specify the *Control File Name*.
4. Click the **OK** button.

The *Interactive Spectral Filter* window appears.



5. Select the spectral filter number from the *Filter Number* dropdown list.
The selected *Filter Name* and parameters are displayed..
6. Modify the filter parameters by moving the parameter sliders or by typing values in fields and then pressing **Enter** key on your keyboard.
The filter profile and filtered spectrum profile are updated and re-displayed accordingly.
7. Optionally, to preview the impact of filtering on your grid, click the **Preview** button.
The *Preview* section is appended to the right of the window.



The *Original Grid* image shows the unfiltered grid. The *Filtered Grid* image shows the effect of the currently displayed filters. You can adjust the filter parameters in real-time and observe the filter signature changes in the radially averaged spectrum window along with the effect of the filter on the original Grid in the preview window.

8. When satisfied with the adjusted filter(s), click the **OK** button to save the selected filter along with its parameter values to the output control file.

Apply Filters and Inverse FFT

All MAGMAP processes are carried out by the application of filters in the Fourier (wavenumber) domain. Once a Fourier transform has been created, the application of filters is straightforward. Filters are simply multiplied by the transform of the grid on an element-by-element basis.

When using the Interactive filtering method, you select the *Interactive Spectrum Filters* menu option to create a control file and set the parameters of the filter. When you are ready to proceed, you select the *Apply Filters* menu option to apply filters according to instructions defined in your new or existing MAGMAP control file.

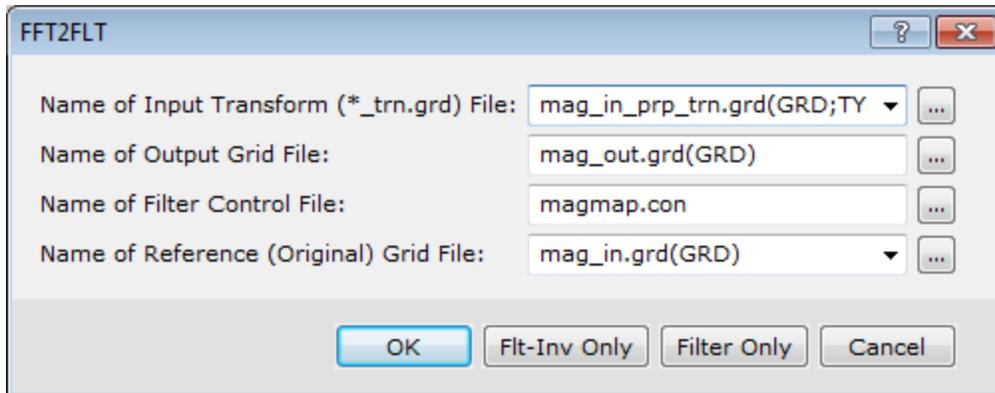


For more information on applying Filters and Inverse FFT, see the "Defining and Applying Filters and Inverse FFT in MAGMAP" How-To Guide.

To Apply Filters and Inverse FFT

1. From the *MAGMAP* menu, select *Interactive Filtering* and then select **Apply Filter**.

The *FFT2FLT* dialog is displayed.



2. Select the *Name of Input Transform (*.trn.grd) File* (default file is pre-populated).



The Input Transform grid file, Filter Control file and the Reference (original) grid file, was created during previous steps and are automatically populated.

3. Specify the *Name of Output Grid File*.
4. Select the *Name of Filter Control file* (default file is pre-populated).
5. Select the *Name of Reference (Original) Grid File* (default file is pre-populated).
6. Depending on the post-processing option you would like to apply to your data, you can click **OK**, **Fit-Inv Only** or **Filter Only**.



For more information on the post-processing options, see the table below.

7. Click the **OK** button to choose the post-processing option. The system computes a post-processed, filtered, space-domain grid, and displays that grid in your project.

The three options for controlling the final results you obtain following the *Apply Filters* option are detailed below:

	Processing Option	Selection	Result
1	Filtered grid with post-processing	OK	Filtered, space-domain GRD file with original grid dimensions and trend information restored (i.e., post-processing is added to output file).
2	Filtered grid with no post-processing	Fit-Inv Only	Filtered, space-domain GRD file as output file with grid-filled dimensions and trend information NOT restored (i.e., no post-processing is added to output file).
3	Filter only – no inverse transform	Filter Only	Filtered transform (*.TRN) file as output file.

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