GSpecDisp 1.4
User Manual

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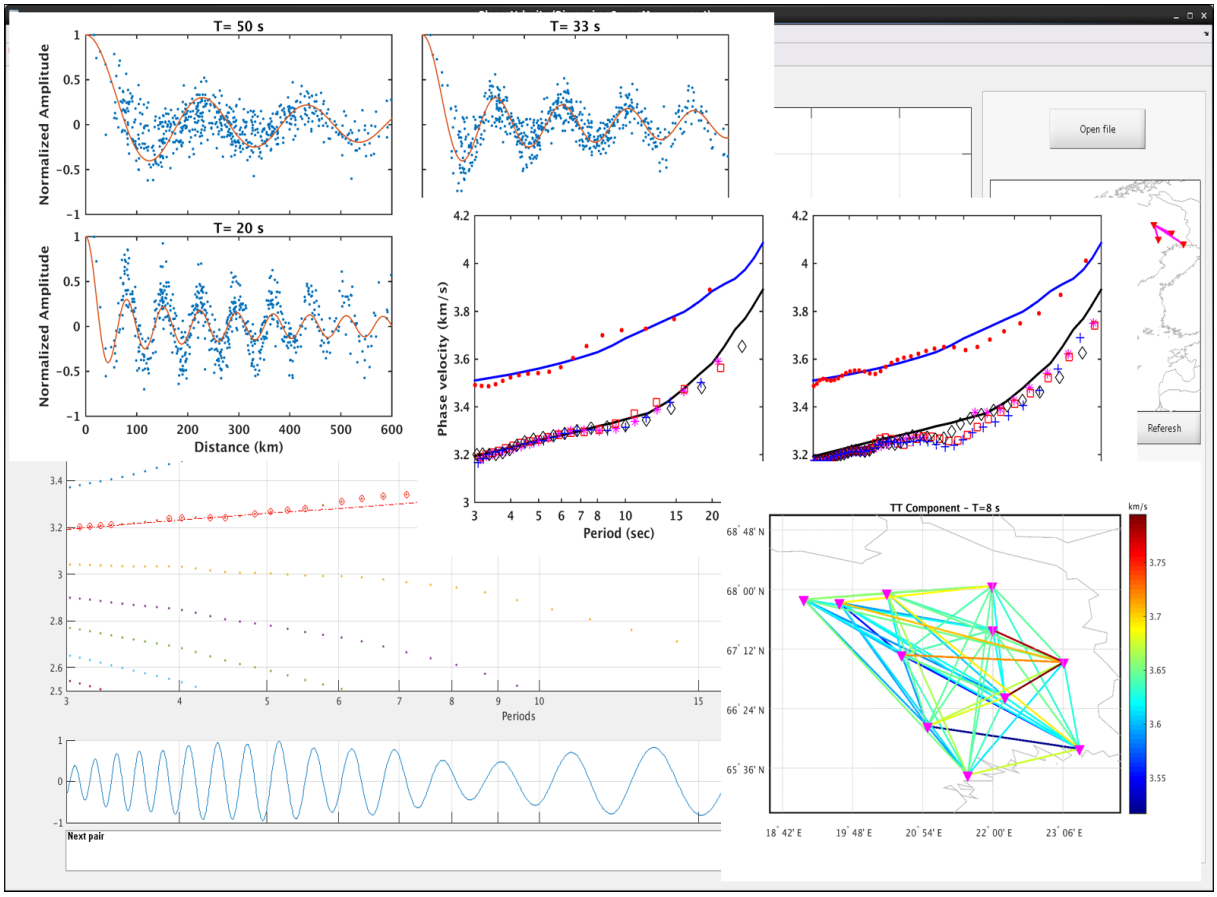

Contents

1 Introduction

GSpecDisp is a package to make phase-velocity dispersion measurements from ambient-noise correlation traces. As its name indicates it measures phase-velocity dispersion curves in the frequency domain. Two types of dispersion curves are measured: (1) average velocity of a region, and (2) single-pair phase velocity for an individual station pair. Both measurements are done by matching the real part of the cross-correlation spectrum to a Bessel function. It measures the phase velocity of Rayleigh and Love waves from all possible components of the correlation tensor. Inputs of GSpecDisp are the time-domain correlations, and the outputs are phase-velocity dispersion curves. GSpecDisp features can be summarized as:

- GspecDisp estimates the average phase-velocity dispersion curve of a region following the approach proposed by Prieto et al. (2009).
- It measures the phase-velocity dispersion curve of individual cross correlations based on the method of Ekström et al. (2009) in the frequency domain, but the inputs are the time-domain correlations.
- The average velocity can be used as a reference dispersion curve for automatic dispersion-curve selection of the phase velocity for a single station pair.
- GSpecDisp allows the user graphically to refine measurement selections.
- All possible components of the correlation tensor can be used for the dispersion measurements, i.e., the ZZ, RR, ZR and RZ components for Rayleigh waves, and the TT component for Love waves.
- Viewer modules plot and print or save both the average phase velocity of a region and the phase-velocity curves of individual station pairs.

1.1 Requirements

GspecDisp can be run on any operation system with Matlab and also its Mapping toolbox. It is written based on the new Matlab Graphics which are introduced in Release 2014b.

1.2 Citation

If you use this code for your work, please cite one of the following articles:

1- Sadeghisorkhani, H., Gudmundsson, O., 2017. GSpecDisp: a Matlab GUI package for phase-velocity dispersion measurements from ambient-noise correlations, submitted to Computers and Geosciences.

2- Sadeghisorkhani, H., Gudmundsson, O., Roberts, R., Tryggvason, A., 2016. Mapping the source distribution of microseisms using noise covariogram envelopes. Geophysical Journal International, 205(3), 1473-1491.

1.3 License

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1.4 Contact

To report bugs, suggestions and comments, or to get help, you can send an email to gspecdisp@gmail.com. When you get errors in Matlab, please include some of your SAC files and your "user_values.mat" file (path is: "./GSpecDisp1.4/defaults/user_values.mat") in your email. Please also copy and paste the complete error message in the email, i.e. with everything in the Matlab's command window in red.

1.5 Running GSpecDisp

To run GSpecDisp after unzipping the package into a desired directory, you should run "GSpecDisp.m" by pressing F5 in the Matlab editor or typing in the Matlab command window (path is: "./GSpecDisp1.4 /GSpecDisp.m"). It automatically adds the paths that it requires, and the Main Window appears. No other installations are needed. All parameters can be set within the Main Window and all Modules can be run by the Main Window.

2 Cross-Correlation Preparation

The standard way of measuring travel time (and velocity) in the ambient noise method is from the long-term cross-correlations in the time domain. GSpecDisp uses these time-domain correlations and Fourier transforms them into the frequency domain to make the phase-velocity measurements. For preparation and calculation of cross correlation, you can, e.g., follow the procedure described by Bensen et al. (2007).

Important Points:

1. GSpecDisp uses both positive and negative lags of the cross-correlations. Therefore, it must contain the two sides of the cross correlations and be symmetric around zero time lag (e.g., between -2000 and 2000 sec). The correlation parameters can be set in the "Cross Correlation" menu of the Main Window.
2. I recommend you to use many time samples in the time domain cross correlation for higher resolution of the cross-correlation spectrum. For example, in my data set where the maximum travel-time of the signal is around 500 sec, I have prepared the cross-correlations between -2000 to 2000 sec with a time interval of 0.5 sec (N=8001 time samples). Therefore, I have 4000 samples between 0 and the Nyquist frequency (1 Hz).
3. Check the headers of the correlation SAC files to make sure that they have the correct values. Especially distance is vital.

3 Main Window

The Main Window of GSpecDisp is used to manage the parameters that are used in the measurements, to display the results, and for calling different modules. 5 individual modules can be called by the buttons that are located in the lower part of the Main Window. The Main Window has 5 menus (left panel - Fig. 1) that are explained in the following subsections.

Each of the menus has 3 buttons for saving and calling the latest or default parameters. Notice that each of these buttons only works in the current menu, and therefore, if you change some parameters in each menu, you should save them in that particular menu. If you forget to save, your changes will not be applied in the later processes. You can change the default parameters by running a script which is explained in section 6.

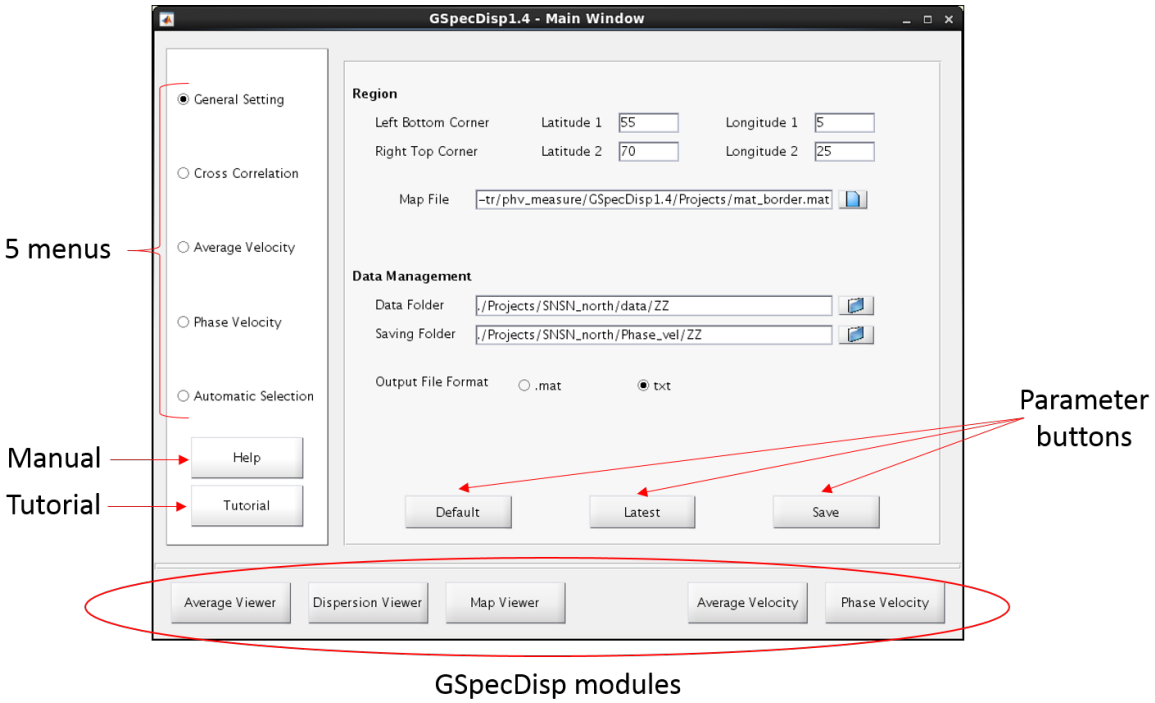

Figure 1: *Main Window elements*

3.1 Brief explanation of parameters

General Setting:
Latitude1: Latitude of the left bottom corner of the region (map)
Longitude1: Longitude of the left bottom corner of the region (map)
Latitude2: Latitude of the right top corner of the region (map)
Longitude2: Longitude of the right top corner of the region (map)
Map File: A file containing data for the regional map
Data Folder: Folder of data (SAC files)
Saving Folder: Folder that the measurements are saved in
Output File Format: Saving format of the phase-velocity measurements

Cross Correlation:
Component: Cross correlation component
tmin: Minimum time of cross correlations in sec

tmax: Maximum time of cross correlations in sec
dt: Time interval of cross correlations in sec
Velocity filter: For time windowing (cosine taper) before Fourier transformation
Taper interval: Cosine taper roll off in km/s
Whitening: Applying spectral whitening after Fourier transformation

Average Velocity:
Existing Dispersion: Enable reading a pre-existing dispersion curve for reference
File Format: Format of the pre-existing dispersion curve
Delimiter: Columns delimiter of the text files (dispersion curves)
Rayleigh Wave: The file contains the pre-existing Rayleigh wave dispersion curve
Love Wave: The file contains the pre-existing Love wave dispersion curve
Component: Cross correlation component for the average-velocity measurement
Cmin: Minimum phase velocity, where the grid search over velocity starts
Cmax: Maximum phase velocity, where the grid search over velocity stops
dC: Velocity increment in the grid search
Norm: Minimization norm of the residual
Velocity filter: For time windowing (cosine taper) before Fourier transformation
Interval: Cosine taper roll off in km/s
T: The measurement periods of the average velocity of the region

Phase Velocity:
Cmin: Minimum phase velocity to be measured
Cmax: Maximum phase velocity to be measured
T1: Minimum period of the measurements
T2: Maximum period of the measurements
Period Axis Scaling: Logarithmic or linear axis for period in the plots
r/λ: The distance over wavelength ratio that defines maximum measurable period
Phase velocity periods: The periods of the phase-velocity measurements (interpolation periods)
SNR Criteria: Signal-to-Noise Ratio to reject correlations with low energy
SNR Threshold: SNR threshold for rejection
Noise Window: A window after signal which contains noise in the SNR calculation
Colorful Points ...: Color of dispersion curves of different cycles

Automatic Selection:
Automatic Selection: Enable the automatic selection option
Max deviation: Maximum deviation from the reference dispersion curve
Cycle: Maximum cycle deviation from the reference dispersion curve
Energy: Minimum amplitude ratio of the real-part spectrum around each zero crossing
Slope: Comparison of the slope with the previous slope (m/s^2)
abs slope upward: Absolute slope (m/s^2) upward (negative)
abs slope downward: Absolute slope (m/s^2) downward
Using Anchors: Using 2 periods for stabilizing automatic selection between these periods
Pr1: Period 1 (lower period)
Pr2: Period 2 (upper period)
Slope: Comparison of the slope with the previous slope (m/s^2) between Pr1 and Pr2
SlopePr2-Pr1: Comparison with the slope connecting Pr1 and Pr2
SlopePr2: Comparison with slope to Pr2

SlopePr1: Comparison with slope to Pr1
Slope: Comparison of the slope with the previous slope (m/s^2) for periods less than Pr1

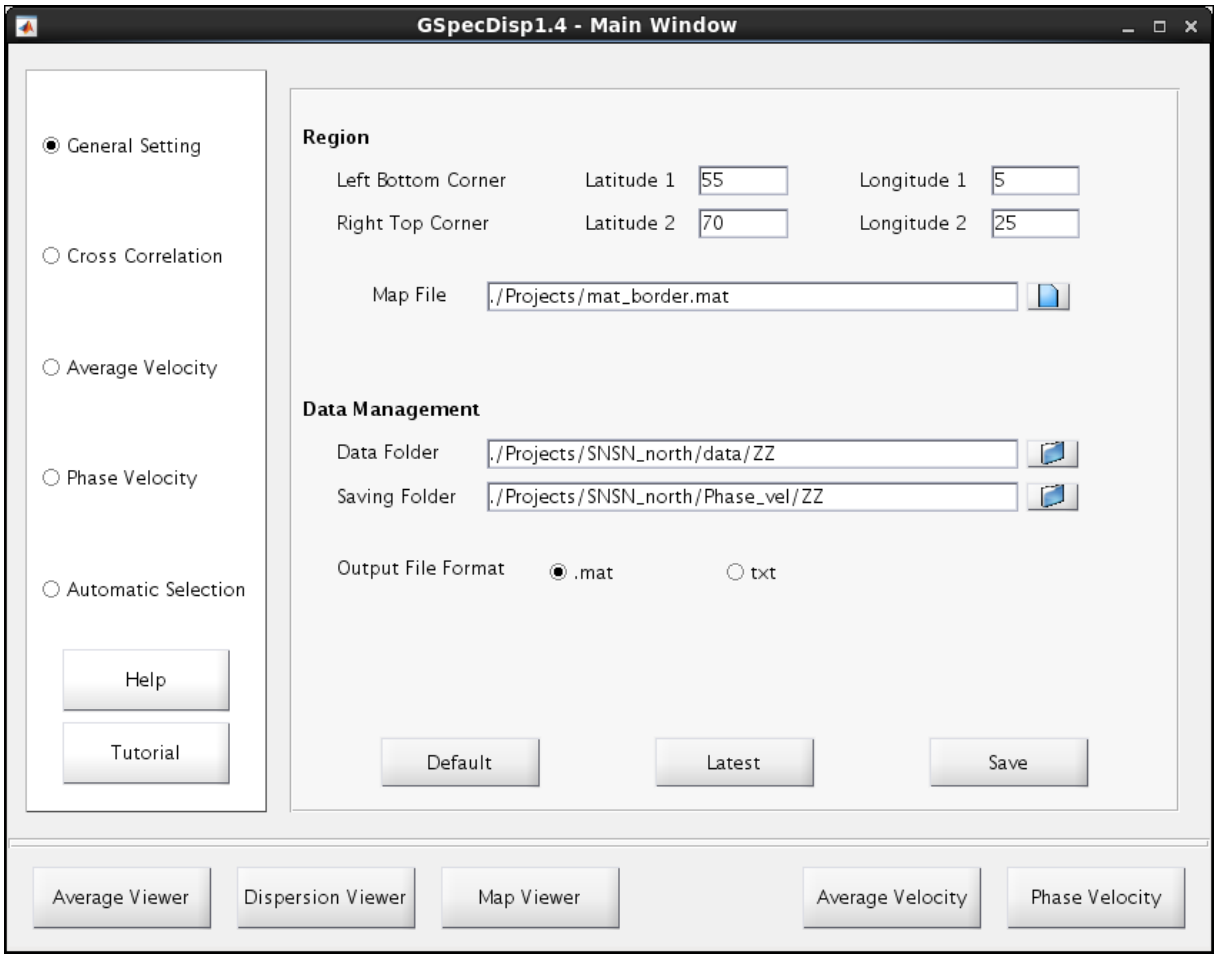

Figure 2: *Main Window - General Setting menu*

3.2 "General Setting" Menu

- In the "Region" section of this menu (Fig. 2), you can set the coordinates of the region that you want to work on. You can read a map file of your region and it will be the base map for all map presentations in the package.
- If you do not define a map file, GSpecDisp automatically uses a default map, which contains borders of countries (low resolution). In this case the coordinates of the region should be in degrees.
- If you define a map file, 1- it must be a tab delimited ".txt" file or ".mat" file; 2- it must have two columns. The first column is latitude and the second column is longitude. Each segment of the map data should be separated by [nan, nan] in order to not be continued in plots.
- In the "Data Management" section of this menu, you can choose the paths for reading data and saving results. If you choose ".mat" as the output format, all measurement results will be saved in ".mat" format only, but if you choose ".txt", they will be saved as both ".mat" and ".txt" file. More information about output as ".txt" files is given in section 5.
- For defining folders or files you can click on the buttons which are next to text-boxes or you can type in the text boxes.

- Do not forget to save your parameters.

3.3 "Cross Correlation" Menu

- In this menu you can set parameters for the time-domain correlation (Fig. 3). GSpecDisp uses these parameters to Fourier transform and make phase-velocity measurement.
- You can set the correlation component by choosing one of the options: ZZ (vertical-vertical), ZR (vertical-radial), RR (radial-radial), TT (transverse-transverse), and RZ (radial-vertical) correlations.
- tmin is the minimum (negative) time lag of the correlation, tmax is the maximum time lag, and dt is time interval.
- You can choose to apply a velocity filter (cosine taper windowing) and its roll off before measurement. The flat part of the velocity filter is bounded by the minimum and maximum phase velocities of the measurement, which can be define in the Phase Velocity menu (Cmin and Cmax) (see section 3.5). I strongly recommend that you use a velocity filter in order to reduce the effects of noise in the correlations.
- By selecting Whitening, spectral whitening is applied to each correlation before measurement. It does not change the phase information (velocity), instead it equalizes the amplitude of the spectrum.
- Do not forget to save your parameters.

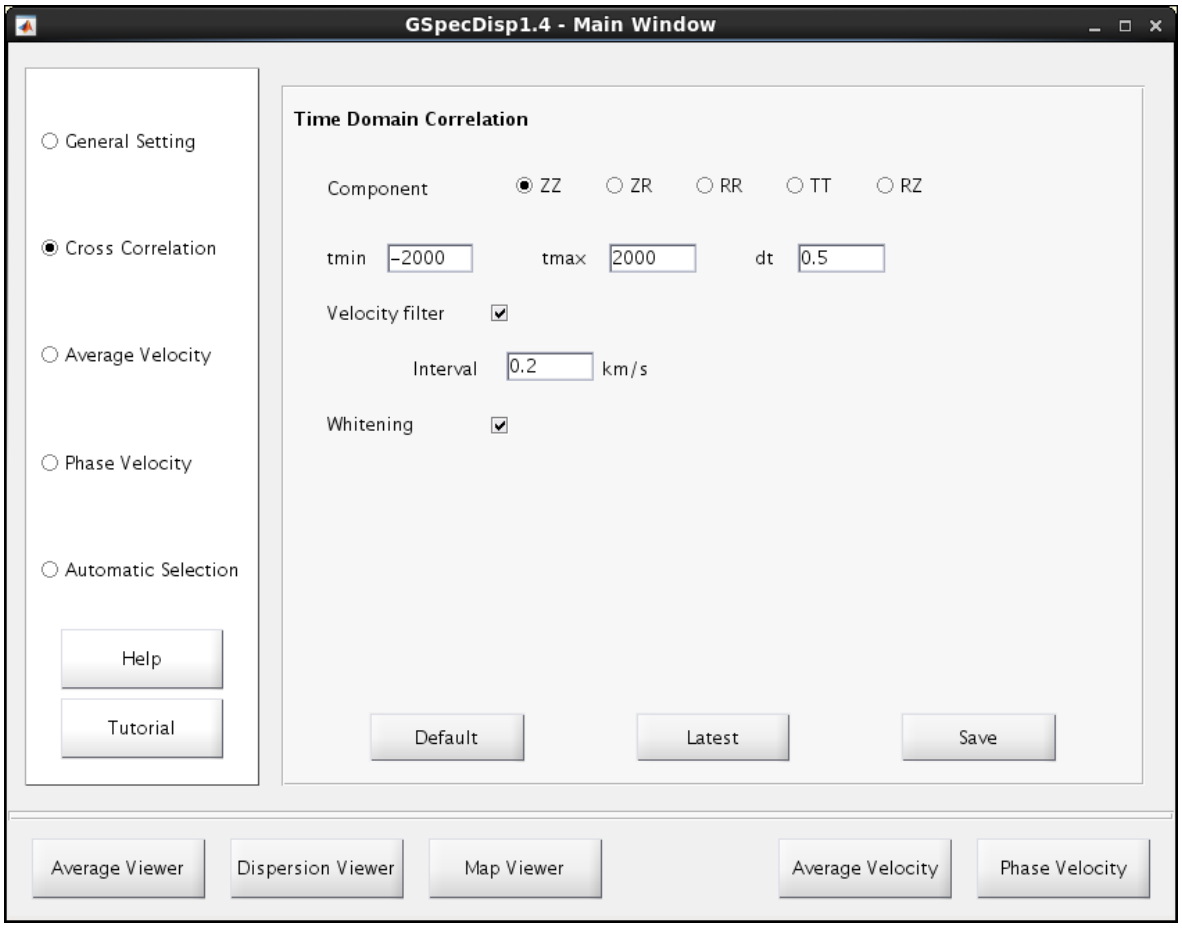

Figure 3: *Main Window - Cross Correlation menu*

3.4 "Average Velocity" Menu

- This menu is for reading a pre-existing dispersion curve or for calculating a new average-velocity dispersion curve. The average-velocity dispersion curve can be used as a reference dispersion curve for automatic dispersion curve selection for individual station pairs. If you unchecked the Existing Dispersion check-box (Fig. 4), GSpecDisp will not automatically select the dispersion points. You can define the file names of the reference dispersion curve for Rayleigh and Love waves in the existing text boxes, either by typing or using the file buttons. The format of the files can be set from the radio buttons, and if it is a text file, you can choose the Delimiter. The files must have two columns. The first must be period, the second must be velocity.
- For calculating the average velocities of different components, you can set the parameters in the second part of this menu. First, choose the component that you want to work with. Second, choose the minimum (Cmin) and maximum (Cmax) phase velocity, and the velocity interval for the grid search. Then, you can choose a norm for minimization of the residuals. It must be an integer number larger than 0. 2 is often appropriate (L_2 norm). A velocity filter can be chosen. The periods at which the calculation will be done can be set. I recommend to calculate the average-dispersion curve in a broad period range, e.g., if you need to have the average-dispersion curve between 3 and 30 s, it is better to estimate the average velocity from 2 to 34 s.
- Do not forget to save your parameters.

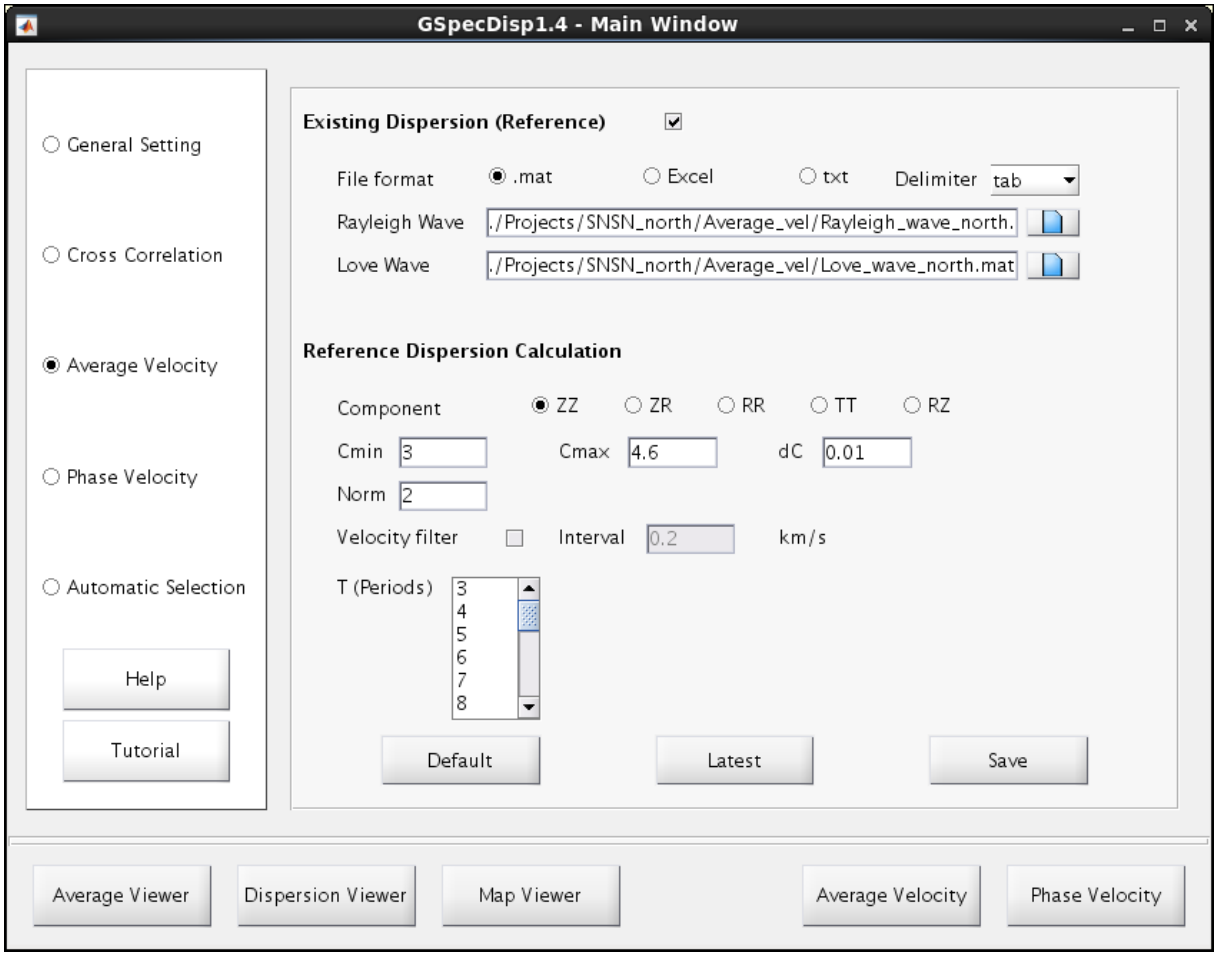

Figure 4: *Main Window - Average Velocity menu*

3.5 "Phase Velocity" Menu

- In this menu you can set the parameters that are used for the phase-velocity dispersion measurements (Fig. 5). The minimum (Cmin) and maximum (Cmax) phase velocity, and minimum (T1) and maximum (T2) period can be set.
- The period axis for displaying the phase-velocity dispersion curve can be linear or logarithmic. One important parameter for the measurements is the maximum measurable period, which can be defined from the r/λ ratio (distance/wavelength). For the method that we use in this package we can measure down to a ratio of 1. Because the package uses the average velocity of the reference dispersion curve for calculation of a wavelength, the minimum value of this parameter (r/λ) should be 1.2-1.5. Do not choose a value less than this range. The maximum measurable period will be displayed in the Phase Velocity module (will be explained later).
- You can define the periods at which you want to measure phase velocity in the "Measure Phase ..." part. After selection of the dispersion curve and finishing the measurements by pressing the Done button in the Phase-Velocity module (explained later), the program interpolates to find the velocity at the specified periods in this part. It does not extrapolate, and thus you can define the period range as broad as you like.

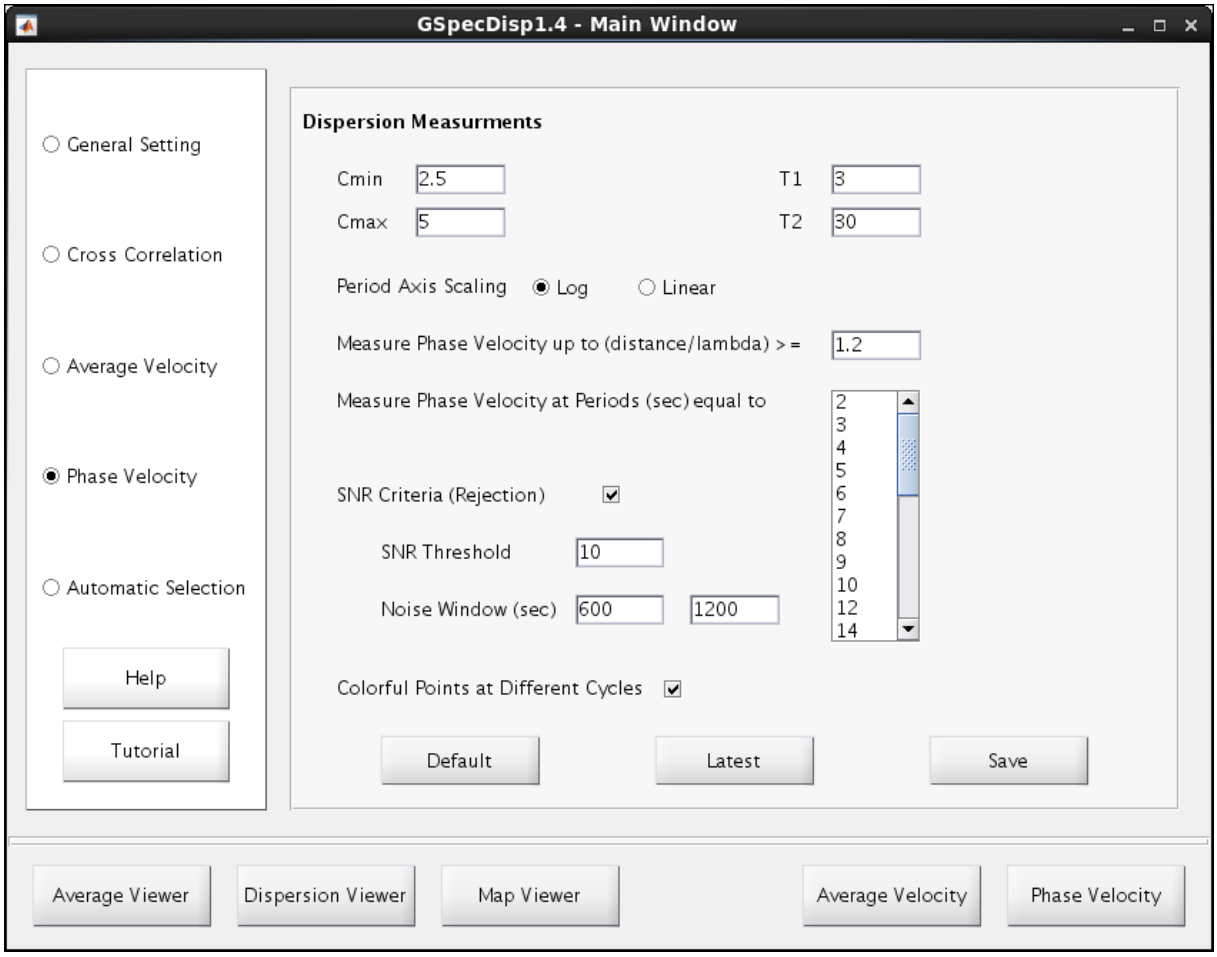

Figure 5: *Main Window - Phase Velocity menu*

- You can use a signal-to-noise ratio (SNR) to reject correlations with low energy. The signal window is between Cmin and Cmax, and the noise window can be set by you. The threshold can be any positive number (e.g., 10 or 20).

- The last check-box is for displaying purposes. Do you prefer that different cycles of measurements are indicated with different colors (checked) or all be displayed as blue (unchecked)?
- Do not forget to save your parameters.

3.6 "Automatic Selection" Menu

- This menu is used to set the parameters for automatic selection of dispersion curves (Fig. 6). If the automatic selection check-box is checked, a reference-dispersion curve in the Average Velocity menu should be defined, If not, the program does not work and gives an error.

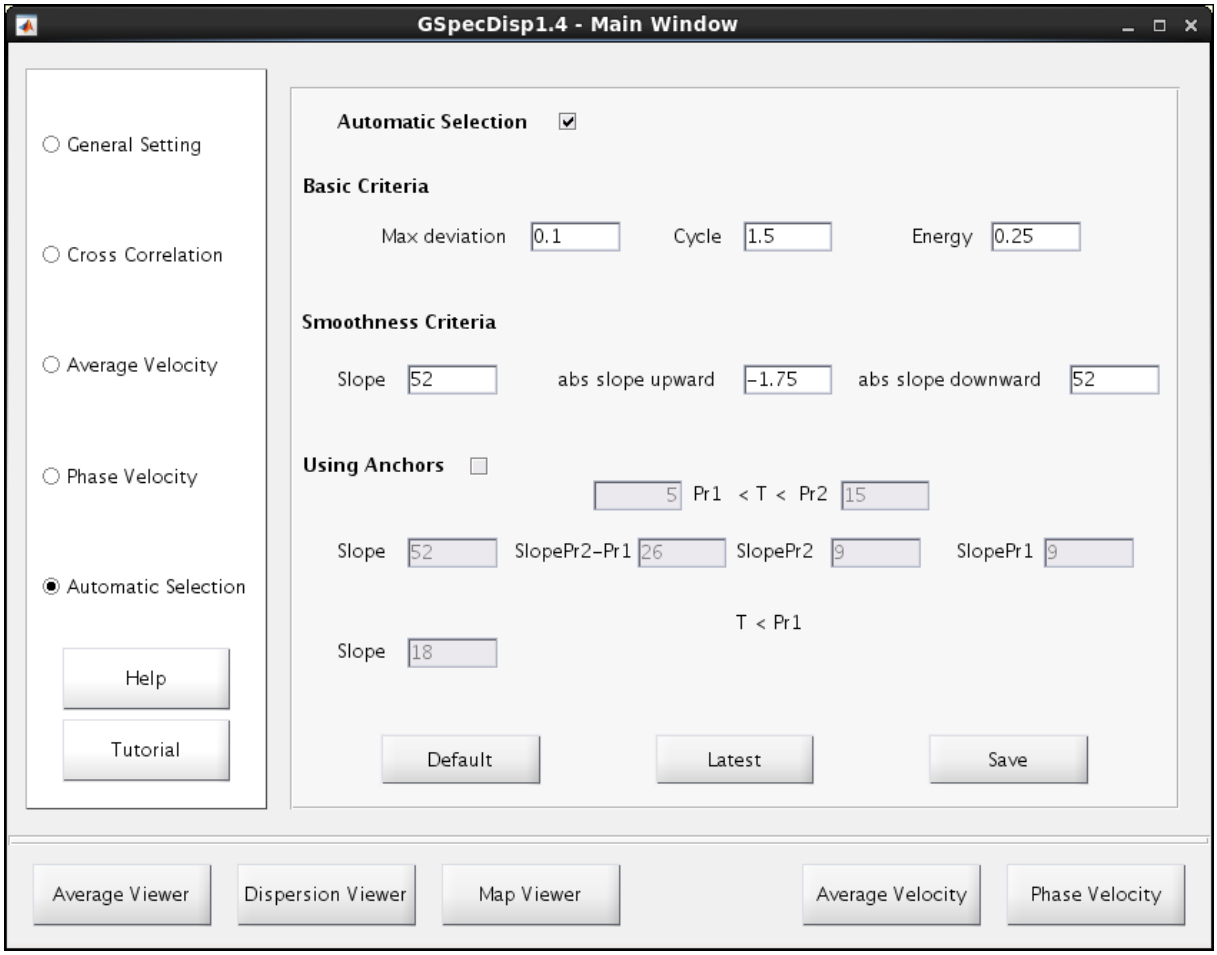

Figure 6: *Main Window - Automatic Selection menu*

- There are 3 types of criteria for the automatic selection. The first type we call Basic criteria: 1- maximum relative deviation from the reference-dispersion curve (e.g., 0.1 means 10 percent). The automatic selection will not choose any dispersion points that lie outside of this limit. 2- Maximum cycle does not allow point selection outside of the defined cycle range (e.g., 1.5 means one-and-a half cycle from the reference dispersion curve). 3- Energy, means that the amplitude of the dispersion points should not be less than the specified number compared to the maximum amplitude of the real part of spectrum (e.g., 0.25 means the amplitude of nearby zero crossing should not be less than 25% of the largest amplitude). Using the spectral whitening option in the Cross Correlation menu can be useful, because large amplitude variations may exist in the spectrum. Whitening equalizes the amplitude spectrum. However, where the amplitude of the unwhitened spectrum is

low, the signal-to-noise ratio is low. The noise will not be symmetric. Therefore, a proportionally large part of the energy will remain in the imaginary part of the spectrum and whitening will not alleviate low amplitude in the real part of the spectrum. The third criterion ensures that points with low energy are not selected, because less energy means a higher noise level.

- The second type of criteria relates to the smoothness of the dispersion curve. We can define 3 parameters for this purpose: 1- the slope difference between the line connecting the current point and the previously selected point and the line connecting the 2 previously selected points should be within, e.g. $\pm 52\ m/s^2$ (Fig. 7). 2- The absolute upward slope between the current point and the previously selected point should be less than some threshold, e.g. $-1.75\ m/s^2$. 3- The absolute downward slope between the current point and the previously selected point should be less than, e.g. $+52\ m/s^2$. The first is to check smoothness by comparing the two previously selected points. The last two criteria check the absolute slope.
- All parameters starting with "Slope" are calculated from $(C_2 - C_1)/(T_2 - T_1) \times 1000\ (m/s^2)$. The convention is $T_2 > T_1$, and therefore, the absolute upward slope is negative. These parameters should be adjusted based on your dataset.

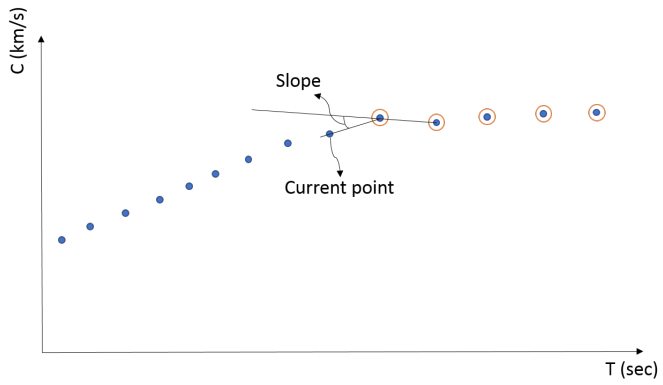

Figure 7: *The Slope parameter is the slope difference between two lines, 1- the line between the current point and the previously selected point, and 2- the line connecting the two previously selected points.*

- The algorithm starts to select dispersion points at the longest possible period (the Maximum Measurable Period), and checks the Basic Criteria to select the closest point to the reference dispersion curve as the first point. The second point is selected by comparing the smoothness criteria to the reference curve. Other points are selected only from the smoothness criteria. Notice that the Basic criteria are the first of a series of criteria that are applied before final selection.
- Because of the energy minimum between the primary and secondary microseisms (around 10 s) phase-velocity measurements can be unstable, and therefore, the automatic selection can get into trouble. One way to deal with this is to use two stable dispersion points on either side of this period range to select the dispersion points in between. We call this procedure "using Anchors". First, the user defines these two stable periods, e.g., Pr1= 5 and Pr2= 15 s. The algorithm selects the dispersion points from the longest period until Pr2. Then, it selects the closet point to the reference curve at Pr1. All dispersion points between Pr1 and Pr2 are selected based on 4 slopes (Slope, SlopePr2-Pr1, SlopePr2, and SlopePr1 in Fig. 6).
- The first slope is similar to the first criterion of the smoothness constraints, i.e., the slope difference of the current point and the 2 previously selected points should be within a specified range (Fig. 7).

- The second slope parameter (SlopePr2-Pr1) is the slope difference between the line connecting the current point and the previously selected point and the line connecting the selected points at Pr1 and Pr2 (Fig. 8). This value should be less than the user-defined value, e.g. $\pm 26\ m/s^2$.
- Fig. 9 shows the next two slopes that are used to select dispersion points between Pr1 and Pr2. The angles must be less than the user-defined values.
- For periods less than Pr1, the algorithm again uses the smoothness criteria (Fig. 7).
- Do not forget to save your parameters.

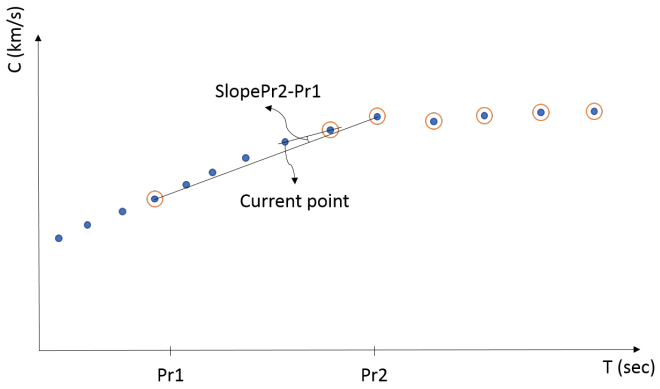

Figure 8: *Automatic selection using Anchors. Any point between the periods of Pr1 and Pr2 is selected compared to the selected points at Pr1 and Pr2. SlopePr2-Pr1 is the slope difference between the specified lines. It should be less than the user-defined threshold in order for the current point to be selected.*

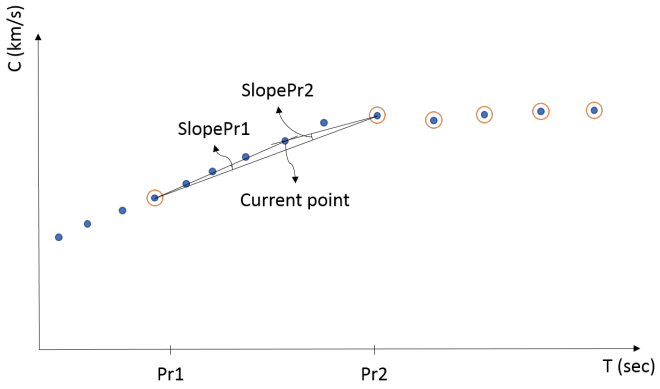

Figure 9: *Automatic selection using Anchors. SlopePr2 is the slope difference between the connecting line of the current point and the selected point at Pr2 and the line connecting Pr2 to Pr1. Same explanation for SlopePr1.*

4 GSpecDisp Modules

GSpecDisp has 5 modules, 2 for the phase-velocity dispersion measurements and 3 for presentation of the results (Viewers).

4.1 Average Velocity module

- The Average Velocity module is used to estimate the average dispersion curve for a region. To estimate, you should read the correlation SAC files of the study region and define the component and norm to be applied. After measurement you can smooth the estimated dispersion curve and save it. Notice, that if you have a region with very variable geological structures (velocity), you may need to estimate reference curves for the different subregions. To do this, you only need to read the station-pairs within the same subregion for each average-velocity calculation. For example, if you work in an area with sediment and hard rock, you may need to have a reference curve for those pairs that pass through sediment and another reference curve for the pairs that pass through hard rock.

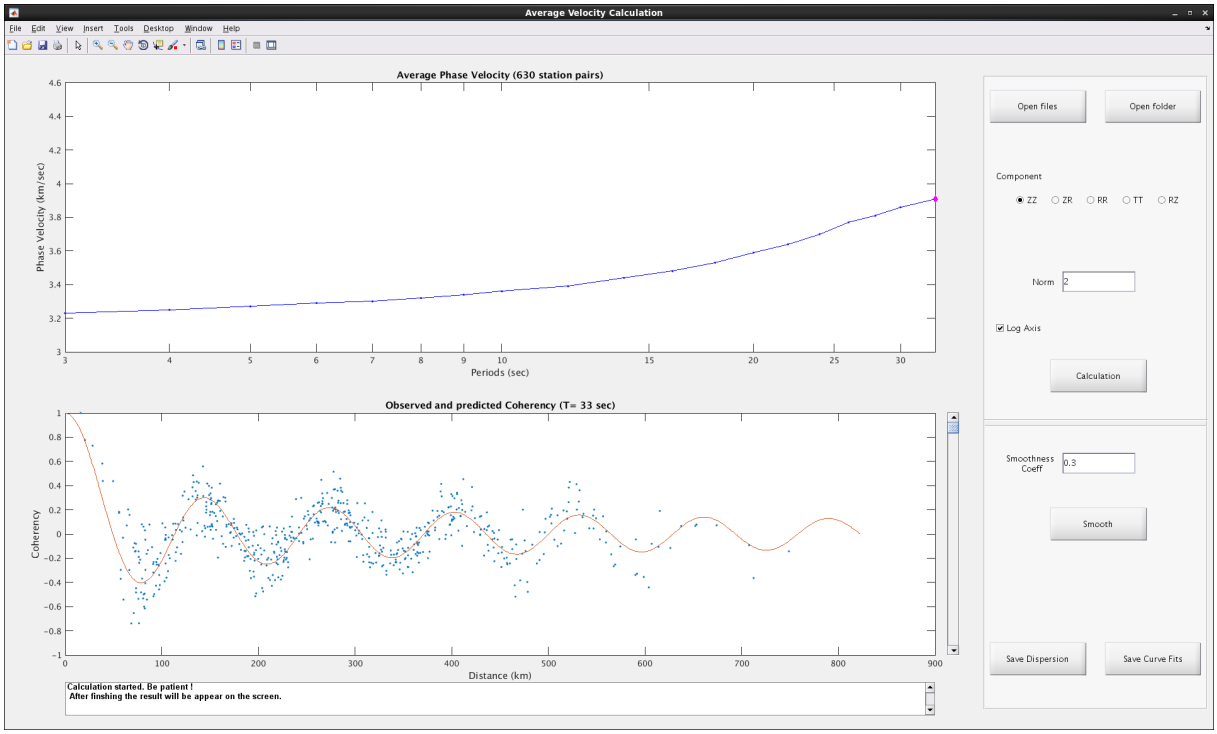

Figure 10: *Average Velocity module*

- Read SAC files using Open files or Open Folder (Open Folder opens all files which are in the defined folder and sub-folders). Define component and norm. Press Calculation button. Wait for some seconds (depending on how many periods you want to estimate the average velocity at and the number of data files). In the top window you can see the estimated dispersion curve and in the lower window you can see a curve fit with a Bessel function (Fig. 10) for a specific period. You can use the scrollbar or the mouse wheel to see the curve fits at other periods. A magenta diamond in the dispersion window indicates the current period and velocity that have used for the curve fitting.
- You can repeat the calculation for example with another norm without reading the data again, and see the dispersion behavior and the curve fit. Finally, set a smoothness coefficient to smooth the dispersion curve (using a Matlab function called smooth with rloess option). Notice that after smoothing, the curve fitting is drawn based on the smoothed curve. You can try different smoothing coefficients without need to redo the calculation. Finally, you can save the dispersion curve and the curve fits for later use. The Dispersion curve is saved with two names, with a "_sm" extension for the smoothed curve, and a "_nonsm" extension for the calculated curve.

4.2 Phase Velocity module

- The Phase Velocity module is used to measure the phase-velocity dispersion curve for each cross-correlation. The measurement can be carried out on 5 correlation components using the suitable Bessel function. Therefore, selecting the correct component is vital. If you have chosen the automatic-selection option in the Main window, the selected dispersion points appear as red circles. You can use Selection Mode options to refine the automatically selected points.

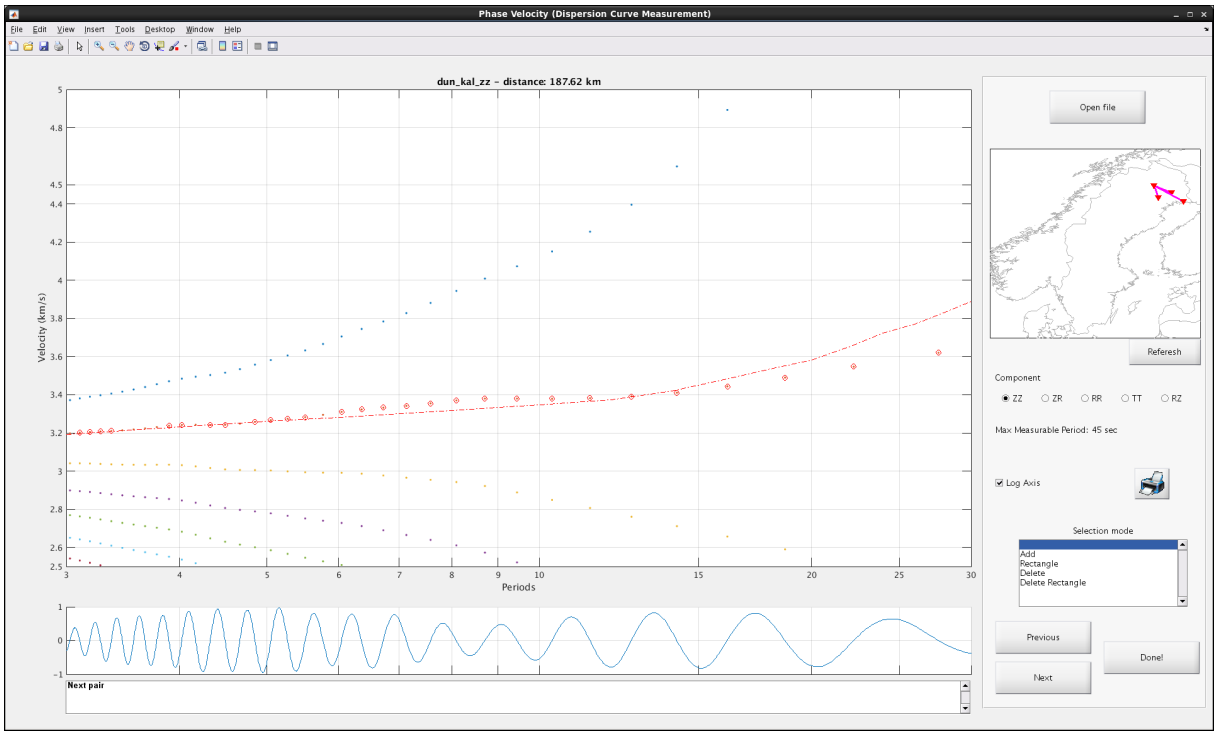

Figure 11: *Phase Velocity module*

- When you read the correlation SAC files using the Open File button (multiple files can be read), some procedures start automatically: 1- the location of the first station pair is shown on a regional map (right panel - Fig. 11); 2- the first cross correlation is transformed to the frequency domain; 3- the real part of the cross-correlation spectrum is matched with the zero crossings of the appropriate Bessel function in order to measure phase velocity; 4- the automatic selection starts to select the dispersion curve by comparison to a reference dispersion curve; 5- results are shown on two plots (left panel - Fig. 11).

- The upper plot shows the measured dispersion curves, the reference dispersion (red dashed line), and the selected dispersion (red circles). The lower plot shows the real part of the cross-correlation spectrum. Notice, the measurements are done at the zero-crossings of the displayed spectrum. The amplitude of the real part of the cross-correlation spectrum shows the energy level around each period and, therefore, can indicate the goodness of the phase-velocity measurements around that period.

- The cross-correlation name and distance are shown in the title of the upper plot. The Maximum Measurable Period is shown on the right panel (based on the r/λ ratio that has been set in Main window and distance), and the automatic selection selects only dispersion points that are at periods shorter than this period.

- You can use Selection modes to add or delete the selected dispersion points. The deleted points are shown as black crosses. When you press the Done button, any points that are indicated as a red circle without a black cross will be saved, and the measurement will be applied to the next pair. The Next and Previous buttons do not save the measured and selected points and, therefore, you can move to other pairs without saving.
- When you press the Done button, the selected dispersion points and linearly interpolated phase velocities at the predefined periods (which have been set in the Main Window) are saved.
- The printer button allows you to save plots of the current station pair, with different formats and resolutions. A new window opens where you can change the title of the plot. After defining the path and file name, press the printer button again in the newly opened window to save your plot. You can choose to include the real part of the spectrum or not.

4.3 Average Viewer module

- The Average Viewer is to view, modify and create new average-dispersion curves. When you open the average-dispersion files, they are shown on the plot and the values are displayed in the middle table (Fig. 12).
- You can create a new dispersion curve by checking the New Dispersion check-box. The Interpolate/Average button will interpolate the existing dispersion values and will display the new dispersion curve in the right-hand table. Period (T) defines the periods where interpolation is applied and the values appear in the new dispersion table. You can also change the T values and press the Interpolate/Average button again in order to have dispersion at these new T. By pressing the Draw button, this dispersion curve will be plotted. You can change the new dispersion values by typing in the table, and also you can add new dispersion points by pressing "n" on your keyboard. Finally, you can save the new dispersion.

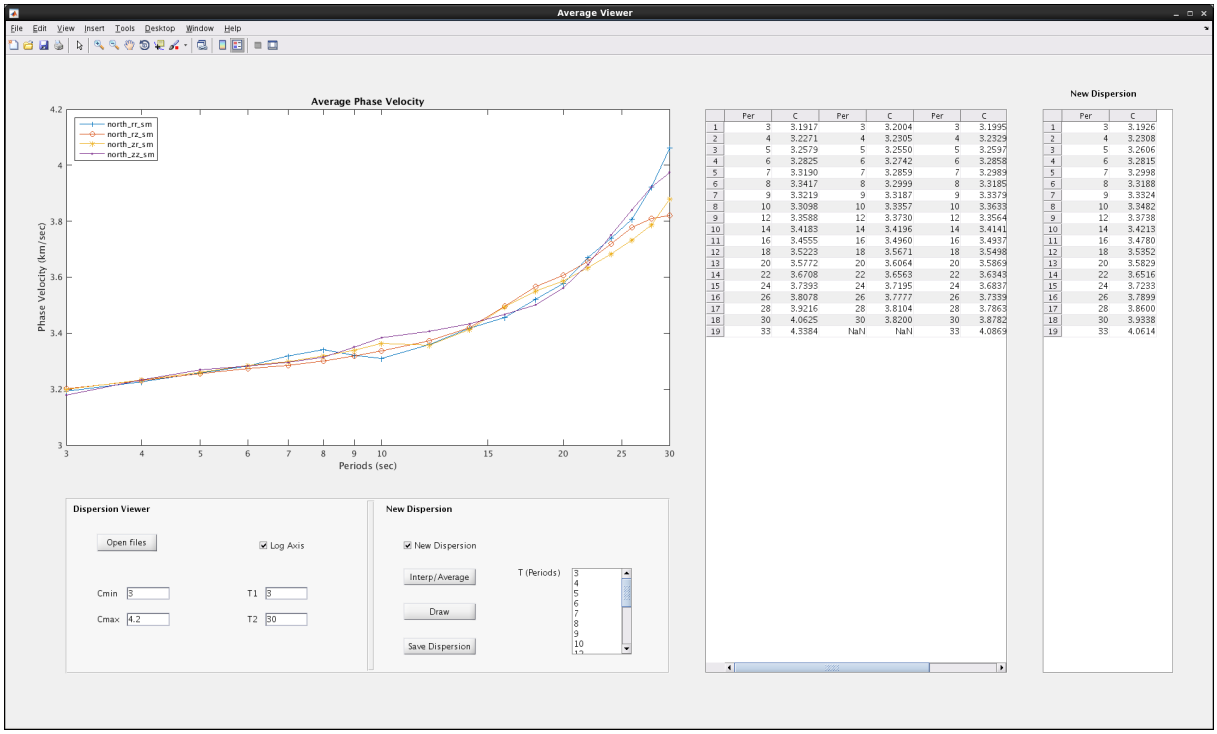

Figure 12: *Average Viewer module*

4.4 Dispersion Viewer module

- The Dispersion Viewer is to plot and print/save the measured dispersion curves (Fig. 13). You can open the measured dispersion curves for different pairs and compare them. Also, you can compare them with the average dispersion of the region. Finally, you can save the plot to a file by defining title and name.
- There are two options (check boxes) for displaying the selected dispersion values at zero crossings (the points that were selected from Phase Velocity module) or interpolated dispersion values at predefined periods, or both. You can check and un-check to view dispersion values.

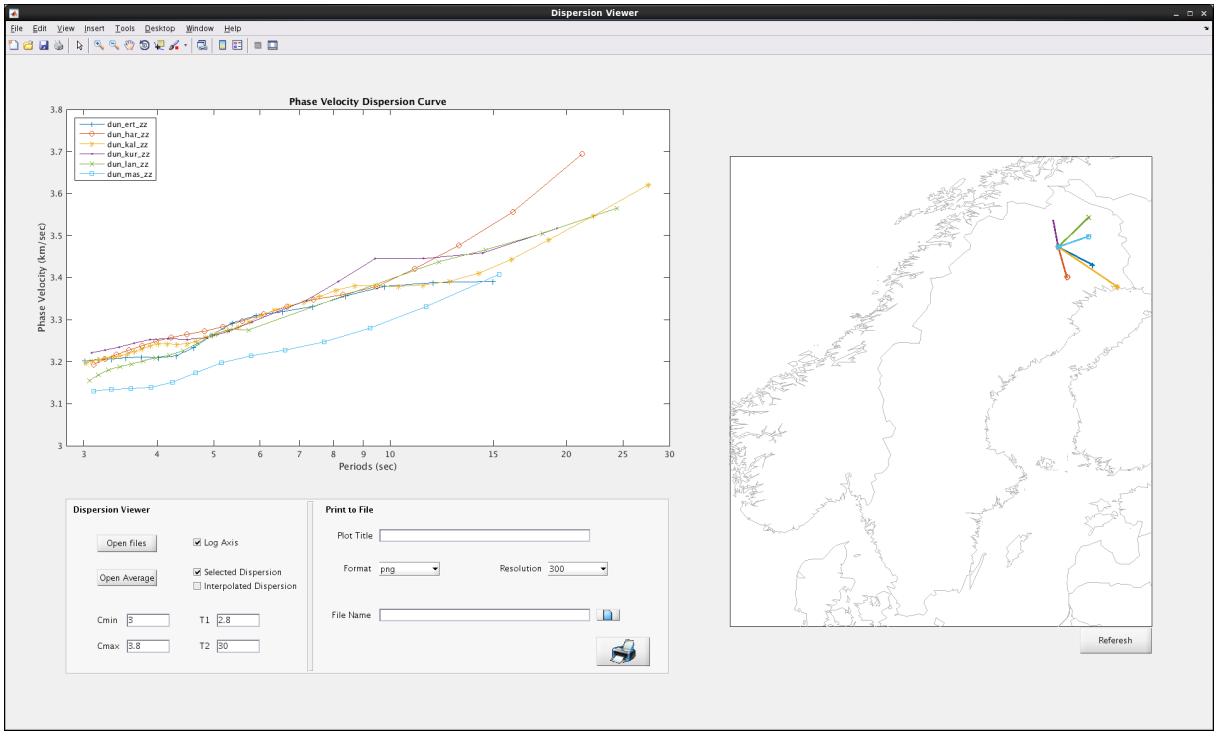

Figure 13: *Dispersion Viewer module*

4.5 Map Viewer module

- The Map Viewer is used to map and print/save the interpolated phase-velocity dispersion curves (Fig. 14). You can read the measured dispersions (.mat files) of various pairs and the module maps the interpolated phase velocities at the predefined periods. You can set the map option to fetch the desired map and save it to a file. The mouse wheel and the scroll bar are used to map the phase velocities at other periods.
- The map options are, from top to bottom: 1- Map file: you can choose a map file. However, if a name is not given, a predefined map containing a world-border map is the default; 2- map coordinates; 3- map projection: you can choose from 5 predefined map projections on the pop up list; 4- color template of the color bar; 5- color order: starting at the higher velocities or the lower velocities; 6- fixed range of velocity of the colorbar, you can define it with Cmin and Cmax. If you do not set Cmin and Cmax, the minimum and maximum velocities of all periods will be used; 7- you can change station symbol size and color, and also the thickness of the lines; 8- turn on and off the map grid.

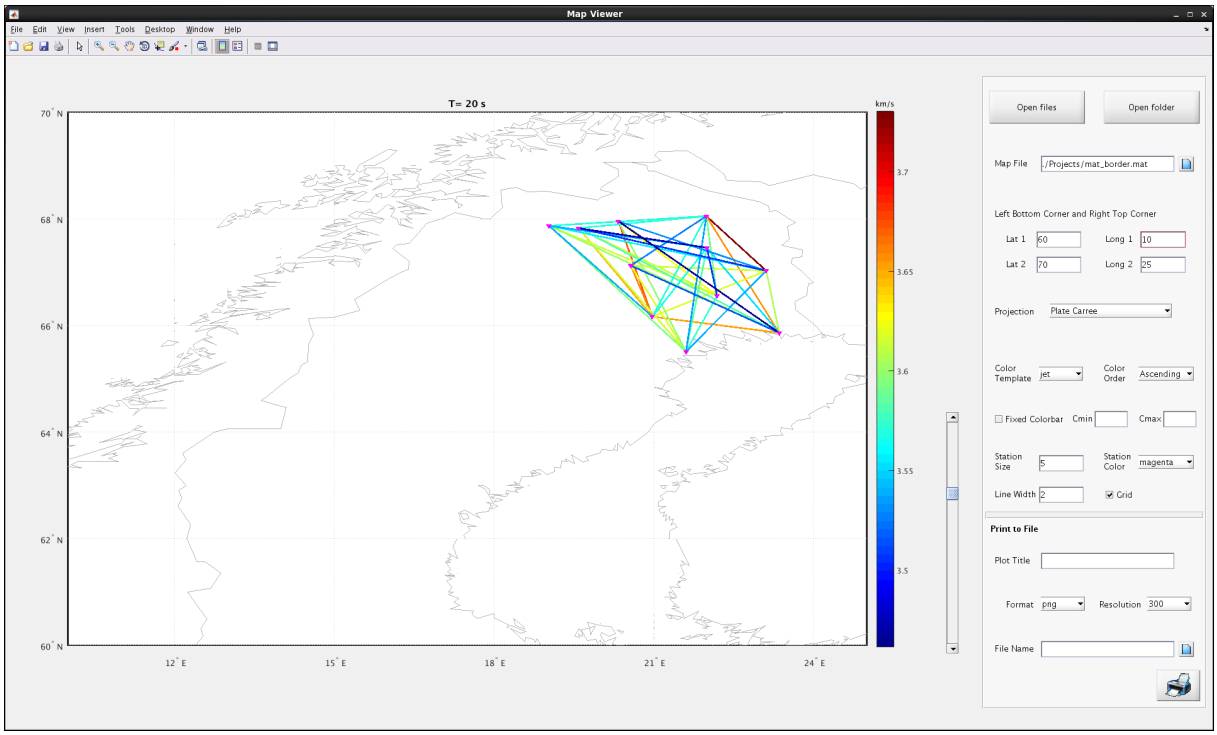

Figure 14: *Map Viewer module*

5 Inputs/Outputs

As mentioned before, the time-domain input files should be in SAC format with correct headers. The most important value in the header for the measurement is distance. The Viewer modules read output files which are in ".mat" format. These ".mat" files are the product of the two measurement modules (i.e., Average Velocity and Phase Velocity modules). When you click on Open File or Folder in the Viewers, the default path is the path where you saved the measurements (i.e., Saving Folder in the Main Window under General Setting menu).

If you choose the "txt" option of the Output File Format in the General Setting of the Main window, the measured phase velocities from the Phase Velocity module are saved with both ".mat" and ".txt" format. Each ".txt" file has 10 columns as:

Column 1: periods of selected dispersion points
Column 2: phase velocities of selected dispersion points
Column 3: periods of interpolated dispersion points (at predefined periods)
Column 4: phase velocities of interpolated dispersion points (at predefined periods)
Column 5: periods of all zero crossings that are less than the maximum measurable period
Column 6: first station latitude
Column 7: first station longitude
Column 8: second station latitude
Column 9: second station longitude
Column 10: inter-station distance (km) from the SAC file header

6 Change Default Values

You can change the default values of parameters using a Matlab mfile, which is inside the "defaults" folder ("./GSpecDisp1.4/defaults/default_values.m"). The parameters are described in the "Brief explanation of parameters" section of this manual (section 3.1).

7 References

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