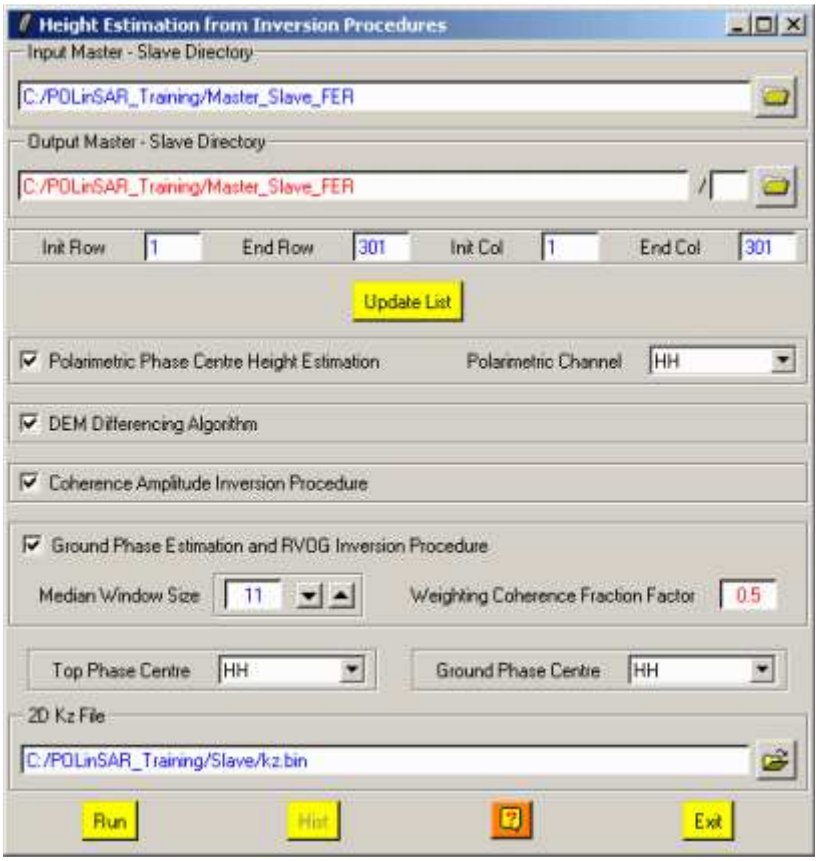
Height Estimation from Inversion Procedures



Description:

Different Height Inversion Procedures are grouped together and proposed in this functionality.

- Phase Center Height Estimation
- DEM Differencing Algorithm
- Coherence Amplitude Inversion
- Ground Phase Estimation and RVOG Algorithm

These different inversion algorithms are all based on the use of the scale factor or vertical wavenumber kz.

The three last Height Inversion Procedures use two selected polarization channels associated to a phase centre close to the ground and to a phase centre close to the top of the canopy.

Comments:

Parameters written in Red can be modified directly by the user from the keyboard.

Input/Output Arguments:

Input Master-Slave Directory	Indicates the complete location of the considered **Main Directory / T6 (MD / T6)** containing the data to be processed.
Output Master-Slave Directory	Indicates the location of the processed data output directory. The default value is set automatically to : **MainDirectory (MD / T6)**.

Output Image Number of Rows/Columns:

The output image numbers of rows and columns are initialised to the input data set dimensions.

Users wishing to process a sub-part of the initial image can modify the **Init** and **End** values of the converted images rows and columns.

Note: init and end values have to remain within the range defined by the input image dimensions.

Update List

Users can select different polarimetric channels in the different combo boxes (*Polarimetric Channel*, *Top Phase Centre*, *Ground Phase Centre*) among a proposed list. The elements of these different lists correspond to the generated complex coherence files. If some polarisation channels are missing, they have to be generated using the **Complex Coherence Estimation** functionality. In this case, it is important to click on the button **Update List** in order to update the different polarisation channel lists.

Polarimetric Phase Centre Height Estimation:

Users have the opportunity to generate the phase center height files at any possible polarization states, including the Lexicographic (Linear), Circular, Pauli basis and optimal polarization states derived from Cloude and Papathanassiou coherence maximization procedure, if the corresponding complex coherence file has already been created.

The output file name is set to: phase_center_height_XX.bin, where **XX** stands for the different polarimetric channel as defined before. The associated output bmp file is set to phase_center_height_XX.bmp

If an averaged complex coherence file is selected, the output file name is set to:phase_center_height_avg_XX.bin and the associated output bmp file to phase_center_height_avg_XX.bmp.

DEM Differencing Algorithm:

Once the two polarisation channels selected, differencing the interferograms and normalising by k_z then provides a direct estimate of relative height.
Running the DEM Differencing Algorithm functionality provides the output file named DEM_diff_heights.bin and the corresponding output BMP file : DEM_diff_ heights.bmp.

Coherence Amplitude Inversion Procedure:

As an alternative to the DEM differencing approach, the coherence amplitude can be used in a channel we believe to have only volume scattering present ($\mu = 0$). The relation between height and coherence can be derived for a *known* extinction in the layer, and if a zero extinction is assumed, the 'sinc' relation is thus obtained (see the POLinSAR Training Course lecture note for in-depth demonstration).
Running the Coherence Amplitude Inversion functionality provides the output file named Coh_heights.bin and the corresponding output BMP file : Coh_heights.bmp.

Ground Phase Estimation:

The first stage in better using phase information is to try and locate the true ground position, and using the two interferograms of the two selected polarimetric channels, it is thus possible to obtain the ground phase estimate.
Running the Ground Phase Estimation functionality provides the output file named Ground_phase.bin and the corresponding output BMP file : Ground_phase.bmp.

However, the phase estimate is usually noisy. To filter the phase jumps, a median filter is used and provides a better way to suppress phase jumps compared to the conventional smoothing or mean filter.
Running the Ground Phase Estimation functionality provides the output file named Ground_phase_median.bin and the corresponding output BMP file : Ground_phase_ median.bmp.

Median Window Size:

Users have to set the size of the sliding window used to compute the median value of the Ground phase estimate.
Default value is set to **11**.

RVOG Inversion Procedure:

Using the filtered estimate of the ground phase, it is now possible to get a better estimation of the ground position.
Running the RVOG Inversion Procedures functionality provides the output file named RVOG_phase_heights.bin and the corresponding output BMP file : RVOG_phase_ heights.bmp.

The underestimation of height is then compensated by adding a fraction of the coherence based height estimate (Weighting Coherence Fraction Factor).
Running the RVOG Inversion Procedures functionality provides the output file

named RVOG_heights.bin and the corresponding output BMP file : RVOG_heights.bmp.

Weighting Coherence Fraction Factor:

Users have to set the value of the **Fraction Factor (ε)** used in the RVOG Inversion Procedure (see the POLinSAR Training Lecture Course).
Default value is set to $\varepsilon = 0.5$

2D Kz File:

Enter the complete full path of the input Vertical Wavenumber Kz file name

Hist:

Clicking on the **Hist** button launches the Data Analysis – Histogram functionality

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