# MARSIS Data Inversion: Frames Selection and Correction

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The data inversion (estimation of the material compatibility composing the surface and subsurface by the identification of the dielectric constant) is based on the analysis of the data available from the sounder observation, that is the surface to subsurface power ratio and the relative time delay.
By the data available at different frequencies it is possible the estimation of the subsurface attenuation and therefore the estimation of the subsurface dielectric constant.
The tolerance on the estimated values of the parameters necessary for the data inversion have been evaluated and the results of the analysis are provided with the error bar. The selection of frames in a stationary region presents some fluctuations; these fluctuations are due to various causes as surface/subsurface shape, speckle, ionosphere compensation errors, pulse compression errors, side lobes and signal sampling frequency. For these reasons great care has been assumed during the frame selection being the objective of the selection the measurement of the backscattering coefficient. Different areas have been considered with different number of frames. The threshold utilized in the selection criteria have been fixed in order to increase the subsurface to volume scattering ratio.
This paper is addressed to a technique utilized for the recovery of poor/bad data in MARSIS data inversion. The experimental planetary sounder data are often degraded by the discrete random media (volume scattering) that can jeopardize the knowledge of the geometric contributions and the surface/subsurface features.
The correction of bad and poor data, based on the modification of the power level of the surface and subsurface echoes, is performed with a best fitting approach with a Gaussian shaped function designed on four points of the raw data.
By the matching of the experimental data with the theoretical model it is possible to estimate the relevant scattering category (physical or geometric optics).
In particular by analyzing a fifth point on the left or on the right of the row data it is possible, by the amplitude of the displacement between the experimental data and the model, to state the condition of Physical or Geometric Optics and apply the suitable correction.
When the surface/subsurface pulse is within the physical optics boundary the increase of its Gaussian shape pulse duration is due to the imperfect pulse compression, side lobes, ionosphere non compensated residual and surface/subsurface small roughness.
When the surface/subsurface pulse is within the geometric optics boundary the relevant pulse does not match the Gaussian shape especially on the falling edge that has an exponential shape.

This permits to distinguish frames from a flat surface, that have a Gaussian trend and match, more or less, perfectly the proposed model, from those belonging to a rough surface. When the geometric optics model applies for the surface and subsurface the correction term is proportional to $1/m^2$ where m is the coefficient present on the model equation.

In the paper are presented example of how the selected frames population can be increased with this techniques with the advantage of better accuracy and reduced standard deviation.