Revised Alternate Waveform Fitting Release Notes for Release-19

Published: 12/08/2004

NOTE: References to GLAS binary product names GLA01 to GLA15 refer to original GLAS binary data, and are retained here for informational and provenance purposes. Access to GLAS binary data was removed 01 August, 2017. All GLAS data are available in HDF5 format, products GLAH01 to GLAH15.

Alternate waveform fitting results through Release 18 typically yield only one or several Gaussian peaks that do not fully characterize the shape of complex waveforms from areas of significant relief and/or vegetation cover. The alternate solution for waveform fitting in Release 19 has been revised in order to more accurately fit complex waveforms. The determination of initial Gaussian fits is done as in prior releases, based on zero-crossings in the second derivative of a smoothed version of the waveform. The six largest Gaussian fits by area are then input to a least squares fitting routine that iteratively adjusts Gaussian amplitudes, positions and widths to minimize the difference between the sum of the six Gaussian fits and the received waveform. Three changes have been made in Release 19 in this least squares fitting procedure: (1) six Gaussian fits are always retained (in prior releases the number was allowed to decrease), (2) the base-level for the Gaussian fits is forced to be the mean level of the background noise (in prior releases the base-level could increase above the mean noise level), and (3) the Gaussian center positions are constrained to be between signal start and end defined by the alternate threshold.

The amplitude, location, and width of the six Gaussian fits are reported together in i_parm1 in GLA05 and in i_Gamp, i_gpCntRngOff, and i_Gsigma, respectively, in GLA14. The GLA products minimum for Gaussian fit amplitude is 0.0001 volts. Any Gaussian fit amplitude less than the minimum will be reported as 0 in the data products. A goodness-of-fit measure, the standard deviation of the difference between the sum of the Gaussian fits and the received waveform, is reported in i_wfFitSDev_1in GLA05 and i_LandVar in GLA14. Standard deviation values of less than 0.05 correspond to reasonably well fit waveforms. The alternate fitting procedure yields anomalous, very poor results with standard deviation values above 0.1 in a small percentage of cases (estimated to be about 5%).

The Gaussian fit results are a useful means of representing the received waveform in a compact, compressed form. Summing the six Gaussian distributions provides an approximation of the received waveform shape for those waveforms with low goodness-of-fit standard deviation results.

In addition, the peaks of the receive waveform provide information about the vertical distribution of scattering from the surface within the laser footprint. This Gaussian fitting approach provides a

useful, although non-unique, representation of the scattering height distribution. Inversion of the waveform distribution to obtain geophysical surface properties is an area of ongoing research.