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Supplement of

Impacts of differing melt regimes on satellite radar waveforms and elevation retrievals

Alexander C. Ronan et al.

Correspondence to: Alexander C. Ronan (alexander.clark.ronan@dartmouth.edu)

S1. Outliers

Level 1B waveforms that deviated from ideal were removed before the clustering and aggregation steps. Outliers were removed if the waveform array was incorrectly clipped and contained a second Leading-Edge Slope (LeS) after the first waveform, if they contained any Level 0, 1B, or Leap Error Flags, or contained irregularities that caused scripting error (Ronan et al., 2024). In addition, a waveform is deemed an outlier if the following conditions are met:

1. $LE \geq 64\ (Range\ Bins)$
    a. Explanation: When the Leading-Edge Width of the clipped Level 1B waveform is greater than or equal to 64 range bins, corresponding to half the range bins of an un-clipped waveform.
    b. Purpose: Removes waveforms with abnormally large LeW (Fig. S1)

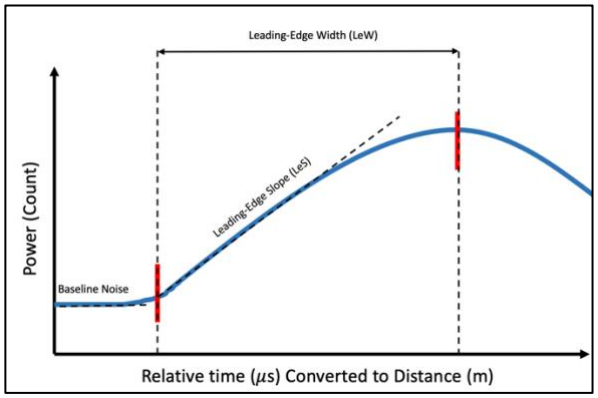

Figure S1: Illustration of Waveform with an abnormally large LeW.

2. $\frac{dy}{dx}(LE)\ \leq 500\ (\frac{Counts}{m})$
    a. Explanation: When any of the derivative values of the Leading-Edge (LE) is below 500 Counts/m
    b. Purpose: Ensures only waveforms with straight LE (and waveforms with abnormally low LeS) (Fig. S1) are included, and those with a plateau (Fig. S2) along the LE are not included.

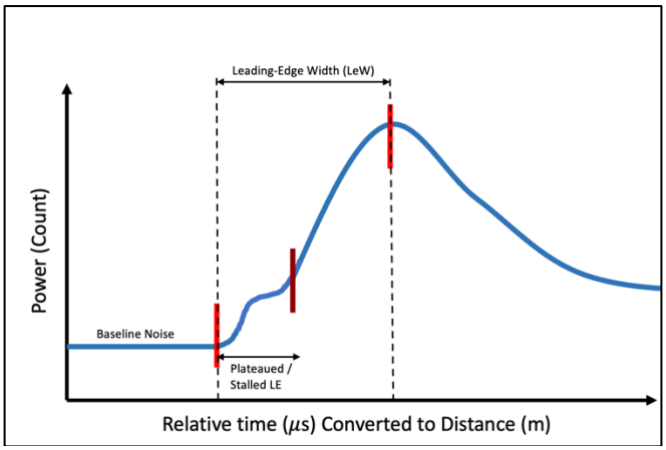

Figure S2: Illustration of Waveform with a plateaued LE

3. $\bar{X}_{S:Pre-LE} \geq \bar{X}_{R:Pre-LE} + 2\sigma_{\bar{x}_{R:Pre-LE}}$, where $\bar{X}_{S:Pre-LE}$ is the mean power of the selected waveform between eight and two positions before the beginning of the LE and $\bar{X}_{R:Pre-LE}$ is the mean power of the ideal waveform between eight and two positions before the beginning of the LE. $\bar{X}_{R:Pre-LE}$ is equivalent to [0, 137.8, 137.6, 363.8, 359.2, 1194]. This array was determined by empirically examining different "ideal" waveforms.
    a. Explanation: When the selected waveform's baseline noise floor is above two standard deviations of an "ideal" waveforms.
    b. Purpose: Ensures only waveforms with properly clipped LEs and baseline noise floors are included.

References

Ronan, A., Hawley, R., and Chipman, J.: Impacts of Differing Melt Regimes on Satellite Radar Waveforms and Elevation Retrievals: Data, Scripts, and Graphs (October 2024)., Zenodo [dataset], https://doi.org/10.5281/zenodo.13883490, 2 Oct 2024.