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Full and sub-waveform retracking to assess the ability of pulse limited altimeter in monitoring water level variations of inland water body

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Pulse-limited-satellite altimetry was originally designed for oceanographic observations but has been extended to monitor inland water bodies. So far, studying water level variations of inland water bodies, e.g. lakes, has been a challenge for this type of altimetry in terms of data quality. The returned altimetry waveforms could be seriously contaminated by topography and environmental error sources. Retracking is an efficacious method against this contamination to improve the accuracy of range measurement and consequently robust water level determination. In addition, the choice of an optimal retracking algorithm appropriate for the specific regional water bodies is very important in this respect.

In this study we processed 18 Hz Envisat RA2 altimetry data, i.e. Sensor Geophysical Data records (SGDR), with respective different retrackers and 1 Hz Geophysical Data Records (GDRs) of this mission by on-board retrackers. First, for a given waveform the whole waveform, called full-waveform, was processed to estimate retracked water level variation using OCOG, Threshold and β-parameter retrackers. In the next step we assumed that the reflecting surface inside the radar foot print is a complex surface with different responses. Therefore a given waveform considered as a combination of a number of small waveforms, called sub-waveform. Each sub-waveform was processed by all of the mentioned retrackers to determine water level variations. Finally the result of different retracked heights were compared with on-board retrackers, and with available in-situ gauge data. The largest salt lake in the middle east, Urmia lake, has been selected as a testing area in this study. This lake is drying up due to climate change and human activities, e.g. irrigation and dam construction. Our retracking analysis shows that the sub-waveform retracking outperforms the full-waveform retracking. The minimum RMS, i.e. 18 cm, was obtained by sub-waveform, retracked with Threshold 50% algorithm, that is the best retracker to retrieve water level variation of Urmia lake