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Determination of sea surface heights in the Arctic using SAMOSA3 Adapted retracker on Cryosat-2 SAR data

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Reliable knowledge of sea surface heights is used in climate prediction, weather forecasting, study of ocean currents and circulation, ship navigation and fisheries. Sea surface heights can be estimated using Cryosat-2 SAR data through appropriate retracking. Retracking involves extraction of the reflected epoch from the reflected waveform. The reflected epoch is used in the altimetric equation to compute the sea surface height.

The Arctic has a significant presence of sea ice. Thus the Cryosat-2 reflected waveforms are noisy due to the superposition of the echoes from sea ice and water. Hence, there is a need of using customized retracking procedures for determining sea surface heights. This work evaluates the performance of the SAMOSA3 Adapted retracker when applied on Cryosat-2 SAR data in the Arctic for sea surface height determination.

SAMOSA3 Adapted retracker is a simplified version of the SAMOSA2 retracker. In this work, the SAMOSA3 adapted retracker is used in Lead Mode and Ocean Mode. Lead Mode is customized for Lead-type specular waveforms which occur when ice cracks. Ocean Mode is customized for waveforms which occur over open ocean. Both Lead and Ocean modes involve the waveform fitting of the Cryosat-2 SAR waveform using the Levenberg Marquadt algorithm. The two modes differ in the waveform parameters which are fit.

The SAMOSA3 Adapted retracker comprises of a Multi Look function which makes a stack of Single Look Waveforms for different looks of the SAR (Synthetic Aperture Radar). Look up tables have been used in the Single Look Function in order to increase the computational speed of the SAMOSA3 Adapted retracker.

The retracker performance evaluation is done by observing the standard deviation in the sea surface height anomaly. The sea surface height anomaly is obtained by removal of the mean sea surface and various geophysical corrections from the retracked sea surface heights. The standard deviation in the sea surface height anomaly is compared for various retrackers, namely SAMOSA3 Adapted retracker, primary peak empirical retrackers and the ESA retracker.

It was concluded that for Cryosat-2 SAR waveforms which fit to the Lead/Ocean Mode of SAMOSA3 Adapted retracker with a high correlation, the standard deviations on the sea surface height anomaly was the least for SAMOSA3 Adapted retracker amongst all the retrackers compared. This indicates that the SAMOSA3 Adapted retracker provides precise sea surface heights in the cryospheric Arctic and qualifies well as a waveform retracker for the region.