

Baltic SEAL: assessment and perspectives of Ku and Ka band sea level retrieval with and without sea ice coverage

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The seasonally sea-ice covered Baltic Sea is the perfect laboratory to test altimetry measurements in Ku and Ka band, given the availability of in-situ data, otherwise very scarce or hard to obtain at polar latitudes. In the framework of the ESA Baltic SEAL project (<http://balticseal.eu/>) a dedicated regional sea level dataset have been generated using advanced processing techniques to improve estimations in the coastal zone and among sea ice.

We present the results of sea level estimates with Ku and Ka-band satellites during the sea ice season and in the ice-free months. The methodology employs a classification algorithm to distinguish water and sea-ice returns, a retracking algorithm and a quality control. The processing steps are applied to almost all past and present altimetry missions. The classification is based on an unsupervised machine-learning algorithm. The retracking is based on ALES+ and ALES+ SAR, which guarantee a homogenous processing regardless of the waveform shape. Results are validated against tide gauges in the Bothnian Bay. Considering for example AltiKa, the correlation is in both seasons ~ 0.85 . Considering Cryosat-2 (SAR mode), the correlation is ~ 0.92 in both seasons. This demonstrates that the processing scheme provides a decisive step towards the solution of the longstanding problem concerning the varying performances and biases between open ocean and lead returns.

The estimation of sea level is essential to compute freeboard. Moreover, in future studies, classification and fitting on the radar signal could be used to detect and fit signals from sea ice. The Baltic SEAL development and validation settings are fully capable to test Ku and Ka measurements with a solid validation to then extend the application to the polar ocean.