Coastal altimetry at high-latitudes: The Baltic SEAL project observing sea level among jagged coastline and sea ice

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The use of satellite altimetry at high latitudes and coastal regions is currently limited by: (i) the presence of seasonal sea ice coverage, and (ii) the proximity to the coast. Improvements in technology (such as the advent of Delay-Doppler, or SAR, altimetry), signal processing (retracking), sea-ice classification methods, and advances in geophysical corrections (wet tropospheric correction, sea state bias) have made regional-scale exploitation of satellite altimetry increasingly possible. However, it is now necessary to explore these advances in a region such as the Baltic Sea, which strongly features these limiting conditions. These efforts could improve product quality, and in particular, product applicability to high latitude and coastal regions.

The European Space Agency-funded Baltic SEAL (http://balticseal.eu/) activity is framed as a laboratory to explore these factors. Using the Baltic Sea region as a testbed, advanced solutions in the preprocessing and postprocessing of satellite altimetry can be tested, and assessed for integration into global initiatives such as the ESA Sea Level Climate Change Initiative. The project is generating gridded and along-track multi-mission sea level anomalies to estimate sea level trends and map seasonal sea level variability. It is exploiting the full data resources available from the altimetry era, improving our understanding and the utility of altimetry for high latitude and coastal regions.

The dataset will be released within 2020 and includes innovative processing steps such as:

- The homogenous retracking strategy applied for open-ocean, coastal and sea-ice conditions (ALES+),
- The unsupervised classification method based on artificial intelligence developed to detect radar echoes reflected by open-water gaps within the sea-ice layer, and
- The development of the gridded product based on a triangulated surface mesh, characterised by a spatial resolution higher than 0.25° degree and enhanced utility for coastal areas.

The activity aims at establishing a state-of-the-art altimetry processing chain developed in a region featuring two typical challenges of satellite altimetry. Here we present the methodology and first validation results, as well as preliminary results such as a new regional mean sea surface that benefits from the reprocessed dataset, and insights into the trends of the sea level along the altimetry tracks with the longest records. The developments within this project can be easily exported to other key areas.