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Using the Baltic Sea to advance algorithms to extract altimetry-derived sea-level data from complex coastal areas, featuring seasonal sea-ice

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The use of satellite altimetry at high latitudes and coastal regions is currently limited by the presence of seasonal sea ice coverage, and the proximity to the coast. The semi-enclosed Baltic Sea features seasonal coverage of sea-ice in the northern and coastal regions, and complex jagged coastlines with a huge number of small islands. However, as a semi-enclosed sea with a considerable extent, the Baltic Sea features a much-reduced tidal signal, both open- and coastal-waters, and an extensive multi-national network of tide-gauges. These factors maximise opportunities to drive improvements in sea-level estimations for coastal, and seasonal-ice regions.

The ESA Baltic SEAL project, launched in April 2019, aims to exploit these opportunities. It is generating and validating a suite of enhanced multi-mission sea level products. Processing is developed specifically for coastal regions, with the objective of achieving a consistent description of the sea-level variability in terms of long-term trends, seasonal variations and a mean sea-surface. These will advance knowledge on adapting processing algorithms, to account for seasonal ice, and complex coastlines. Best practice approaches will be available to update current state-of-the-art datasets.

In order to fulfill these goals, a novel altimeter re-tracking strategy has been developed. This enables the homogeneous determination of sea-surface heights for open-ocean, coastal and sea-ice conditions (ALES+). An unsupervised classification algorithm based on artificial intelligence routines has been developed and tailored to ingest data from all current and past satellite

altimetry missions. This identifies radar echoes, reflected by narrow cracks within the sea-ice domain. Finally, the improved altimetry observations are gridded onto a triangulated surface mesh, featuring a spatial resolution greater than 1/4 degree. This is more suitable for utility for coastal areas, and use by coastal stakeholders.

In addition to utilizing a wide range of altimetry data (Delay-Doppler and Pulse-Limited systems), the Baltic SEAL initiative harnesses the Baltic Seas unique characteristics to test novel geophysical corrections (e.g. wet troposphere correction), use the latest generation of regional altimetry datasets, and evaluate the benefits of the newest satellite altimetry missions. This presentation outlines the methodology and results achieved to date. These include estimations of a new regional mean sea surface, and insights into the trends of the sea level along the altimetry tracks with the longest records. The transfer of advances to other regions and sea-level initiatives are also highlighted.