ALES+: Adapting a homogenous ocean retracker for satellite altimetry to sea ice leads, coastal and inland waters

Water level from sea ice-covered oceans is particularly challenging to retrieve with satellite radar altimeters due to the different shapes assumed by the returned signal compared with the standard open ocean waveforms. Valid measurements are scarce in large areas of the Arctic and Antarctic Oceans, because sea level can only be estimated in the openings in the sea ice (leads and polynyas). Similar signal-related problems affect also measurements in coastal and inland waters.

This study presents a fitting (also called retracking) strategy (ALES+) based on a subwaveform retracker that is able to adapt the fitting of the signal depending on the sea state and on the slope of its trailing edge. The algorithm modifies the existing Adaptive Leading Edge Subwaveform retracker originally designed for coastal waters, and is applied to Envisat and ERS-2 missions.

The validation in a test area of the Arctic Ocean demonstrates that the presented strategy is more precise than the dedicated ocean and sea ice retrackers available in the mission products. It decreases the retracking open ocean noise by over 1cm with respect to the standard ocean retracker and is more precise by over 1cm with respect to the standard sea ice retracker used for fitting specular echoes. Compared to an existing open ocean altimetry dataset, the presented strategy increases the number of sea level retrievals in the sea ice-covered area and the correlation with a local tide gauge. Further tests against in-situ data show that also the quality of coastal retrievals increases compared to the standard ocean product in the last 6km within the coast.

ALES+ improves the sea level determination at high latitudes and is adapted to fit reflections from any water surface. If used in the open ocean and in the coastal zone, it improves the current official products based on ocean retrackers. First results in the inland waters show that the correlation between water heights from ALES+ and from in-situ measurement is always over 0.95.