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Abstract Title: Improved Oceanographic Measurements with CryoSat SAR Altimetry

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The ESA CryoSat mission is the first space mission to carry a radar altimeter that can operate in Synthetic Aperture Radar "SAR" (or delay-Doppler) and interferometric SAR (SARin) modes. Studies on CryoSat data have analysed and confirmed the improved ocean measuring capability offered by SAR mode altimetry, through increased resolution and precision in sea surface height and wave height measurements, and have also added significantly to our understanding of the issues around the processing and interpretation of SAR altimeter echoes.

We present work in four themes, building on work initiated in the CryoSat Plus for Oceans project (CP4O), each investigating different aspects of the opportunities offered by this new technology.

The first two studies address the coastal zone, a critical region for providing a link between open-ocean and shelf sea measurements with those from coastal in-situ measurements, in particular tide gauges. Although much has been achieved in recent years through the Coastal Altimetry community, (http://www.coastalt.eu/community) there is a limit to the capabilities of pulse-limited altimetry, which often leaves an un-measured "white strip" right at the coastline. Firstly, a thorough analysis was made of the performance of "SAR" altimeter data (delay-Doppler processed) in the coastal zone. This quantified the performance, confirming the significant improvement over "conventional" pulse-limited altimetry. In the second study a processing scheme was developed with CryoSat SARin mode data to enable the retrieval of valid oceanographic measurements in coastal areas with complex topography. Thanks to further development of the algorithms, a new approach was achieved that can also be applied to SAR and conventional altimetry data (e.g., Sentinel-3, Jason series, Envisat).

The third part of the project developed and evaluated improvements to the SAMOSA altimeter re-tracker that is implemented in the Sentinel-3 processing chain. The modifications to the processing scheme should support improved performance in terms of accuracy and efficiency in retrieving oceanographic geophysical parameters from altimeter data.

Finally, we describe the development of a state of the art tidal atlas for the Arctic Ocean with CryoSat altimeter data. Through its high inclination orbit, the CryoSat mission provides the most complete altimeter data set ever used in this region, and so should enable the production of a highly accurate Arctic tidal model. This in turn will improve the quality of CryoSat Sea Surface Height measurements and all derived products (e.g. mean sea surface, mean dynamic topography).

Together these studies provide an important foundation for exploiting data from the Sentinel-3 and Sentinel-6/Jason-CS missions.

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