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Improved altimetric performance of Cryosat-2 SAR mode over the open ocean and the coastal zone

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The Cryosat-2 SIRAL altimeter has been operating in SAR mode over a number of ocean sites and has been providing L1B SAR waveforms continuously to the science community since July 2010. The Cryosat-2 SAR mode is a precursor for the SRAL altimeter on the GMES Sentinel-3 Surface Topography Mission (STM) and provides the first opportunity to gather observational evidence about the altimetric performance of SAR altimeters over water surfaces compared to conventional pulse-limited instruments. Among a number of attractive features, SAR altimeters are expected to achieve improvement in range retrieval accuracy by a factor of 2 and finer along-track spatial resolution ($\sim$ 300m), making them particularly appealing for coastal and ocean bottom topography applications.

This paper presents a comparative analysis of the retrieval accuracy for sea surface height (SSH) and significant wave height (SWH) from Cryosat-2 SAR mode and Jason-2 in various regions of the open ocean and in the coastal zone. Cryosat-2 SAR mode SSH and SWH estimates are obtained by retracking L1B Cryosat-2 SAR mode waveforms over the ocean using the physically based SAR ocean waveform models developed in the ESA project "Development of SAR Altimetry Studies and Applications over Ocean, Coastal zones and Inland waters (SAMOSA)". Our observational results indicate an almost two-fold improvement in range retrieval accuracy for Cryosat-2 SAR mode compared to Jason-2, in support of previous theoretical and numerical findings. The paper also considers the sensitivity of the theoretical waveform models and of the SAR altimetric retrieval performance to along- and across-track antenna mispointing and ocean wave conditions.