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ON THE RANGE RETRIEVAL PERFORMANCE OF DELAY DOPPLER ALTIMETERS OVER THE OCEAN AND IN THE COASTAL ZONE: A NUMERICAL STUDY

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The Delay Doppler Altimeter (DDA) concept – also known as SAR altimetry – was first proposed by R.K. Raney (1998), and promises improved altimetric precision and better along–track resolution than conventional pulse limited altimeters. The Sentinel–3 Surface Topography Mission altimeter will be able to operate in SAR mode over the ocean, and will aim to achieve high–resolution high–accuracy altimetric mapping of the ocean in regions of high mesoscale variability and in coastal areas.

Delay–Doppler altimeters have high pulse repetition frequency to ensure pulse–to–pulse coherence, leading to a potential along–track resolution around 300 meters, improved signal–to–noise ratio and enhanced altimeter ranging performance. With noise statistics and the shape of SAR altimeter waveforms over the ocean so markedly different from those of pulse limited altimeters, a new waveform model and retracking methodology is required to retrieve geophysical information from SAR altimeters over the ocean. In this paper, we present results of the expected performance of a Sentinel–3 type Delay–Doppler altimeter over the ocean as obtained during the ESA SAMOSA project "Development of SAR Altimetry Studies and Applications over Ocean, Coastal zones and Inland waters".

In this paper, we present a comparative assessment of the range retrieval capabilities of conventional low–rate mode altimeters (LRM) and SAR altimeters over ocean. The study is based on numerical simulations of Level 1B LRM and SAR waveforms from the Cryosat Mission Perfor-

mance Simulator (CRYMPS) obtained over explicit 3D realisations of ocean surfaces in different sea state conditions. LRM and SAR waveforms are obtained over a range of significant wave height conditions, then retracked with an appropriate theoretical waveform retracker. In the case of LRM, the ocean retracker is the National Oceanography Centre, Southampton (NOCS) implementation of a conventional Brown ocean altimeter waveform model. The SAR–altimeter L1B waveforms are fitted using a prototype SAR altimeter retracker developed at NOCS, and based on the recent theoretical Delay–Doppler Altimeter waveform model by Martin–Puig et al. (2009). The altimetric precision of the retrieved range is estimated for both LRM and SAR data over same ocean surfaces for a range of significant wave height, and compared with earlier results by Jensen & Raney (1998), who reported a twofold improvement in altimetry precision with SAR altimetry.