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CryoSat Plus for Oceans – analysis of the state-of-the-art

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The CryoSat Plus for Oceans (CP4O) project is an ESA initiative carried out by a European wide consortium of altimetry experts. It aims to build a sound scientific basis for new scientific and operational applications of data coming from CryoSat-2 over the open ocean, polar ocean, coastal seas and for seafloor mapping. It also generates and evaluates new methods and products that will enable the full exploitation of the capabilities of the CryoSat-2 SIRAL altimeter, and extend their application beyond the initial mission objectives. It therefore also acts as a preparation for the upcoming Sentinel and Jason SAR enabled altimetry missions.

In this paper we address the review of the CryoSat state-of-the-art, relevant current initiatives, algorithms, models and Earth Observation based products and datasets that are relevant in the Cryosat+ ocean theme. Compared to conventional (pulse-limited) altimeter missions, Cryosat-2 is not a dedicated platform for ocean research: typically the microwave radiometer (MWR) for wet tropospheric corrections is lacking, as is the direct measurement of the first order ionospheric effect by means of a dual-frequency altimeter. Also the orbit of Cryosat-2 has a rather long repetition period, unsuited for collinear tracks analyses. These three particular features have been studied already in the HERACLES project on the eve of the first CryoSat launch. We revisit the outcome of this study, update to current understanding and perception, and ultimately develop what was, is and will be proposed in these problem areas. Clearly, we question the standard ionosphere corrections, the wet troposphere corrections and the accuracy of the mean sea surface (MSS) underlying the accuracy of derived sea level anomalies. In addition, Cryosat-2 provides the first innovative altimeter with SAR and SARIn modes. This raises the direct problem of “how to process these data”, simply because this has not been done before. Compared to pulse-limited altimetry it is a totally different branch of sport. In our CP4O project we try to answer this. We build on the results that have come out of the SAMOSA study, which was initiated to investigate the improvements that SAR mode altimetry can offer in measurements over ocean, coastal and inland water surfaces, developing practical implementation of new theoretical models for the SAR echo waveform. It is clear that having specific processing for SAR and SARIn raises a number of new issues to be studied, such as RDSAR (reducing SAR to pseudo LRM data), sea state bias (SSB) in SAR mode, and land contamination, to name a few. The outcome of the analysis of the state-of-the-art culminates in the delivery of the Preliminary Analysis Report and the Development and Validation Plan (DVP). We present the summary of these documents.