Geophysical Research Abstracts,
Vol. 11, EGU2009-10680, 2009
EGU General Assembly 2009

Investigating the Application of Synthetic Aperture Altimetry over oceans, coastal and inland waters.

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The application of Synthetic Aperture Radar (SAR) techniques to classical radar altimetry promises significant improvements to measurements made over land, oceans and ice. CryoSat-2, to be launched towards the end of 2009, will be the first to operate an altimeter with a SAR mode. Although it was designed with ice applications as the prime objective, these data will also be of great interest to the hydrosphere and oceanography communities, since they also have the potential to support significant progress in coastal monitoring, ocean floor topography, gravity field and inland water monitoring.
Thus the SAMOSA project, funded by the European Space Agency and led by SatOC (UK), was initiated to provide a thorough scientific assessment of this technology and to quantify the improvement that may be expected in measurements over water surfaces offered by SAR altimetry, as compared to conventional altimetry.
The SAMOSA study combined theoretical developments with the analysis of computer simulations of SAR altimeter data over oceanic, coastal and inland water features.
The theoretical work included the development of a new theoretical model for the SAR altimeter mode processed echoes over water. This model was then used to develop and test a re-tracker specifically designed for SAR mode data
For the computer simulations, the CryoSat mission performance simulator (CRYMPS) was used. This simulator, developed by Mullard Space Science Laboratories (UK) specifically for Cryosat, simulates the products for the three available Cryosat-2 altimeter modes: Synthetic Aperture Radar, Interferometric Synthetic Aperture Radar and Low Rate Mode (equivalent to a conventional altimeter). The project team generated a number of digital elevation and backscatter models, representing short sections of representative oceanic, coastal and inland water “scenarios”, and used these to investigate the modelled response of the SAR mode altimeter.

For this presentation we present an overview of the results of the project, including
- The results of computer simulations to investigate the SAR altimeter response to oceanic features such as fronts, slicks and variable wave fields.
- An investigation into how SAR altimeter data can help improve recovery of short spatial scale geophysical signals over the ocean (bathymetry, marine gravity field)
- The development and testing of a new echo model and associated re-tracker adapted to the specific nature of SAR altimetry echoes.
- An investigation of the modelled performance of the SAR altimeter over coastal and complex inland water features.
We offer some recommendations for further theoretical and experimental investigations, and some suggestions on processing approaches for CRYOSAT-2 data to support the improved retrieval of data over ocean, coastal and inland water surfaces.