CryoSat-2 SAR and SARin Inland Water Heights from the CRUCIAL project

Philip Moore (1), Stephen Birkinshaw (1), Peter Bauer-Gottwein (2), Raphael Schneider (2), Marco Restano (3), Américo Ambrózio (4), and Jérôme Benveniste (5)

(1) School of Engineering, Newcasyle University, United Kingdom (philip.moore@ncl.ac.uk), (2) Department of Environmental Engineering, Technical University of Denmark, Denmark, (3) SERCO/ESRIN, Italy, (4) DEIMOS/ESRIN, Italy, (5) ESA-ESRIN, Italy

CRUCIAL was an ESA/STSE funded project investigating innovative land and inland water applications from CryoSat-2 with a forward-look component to the Sentinel-3 and Jason-CS/Sentinel-6 missions. CRUCIAL assessed CryoSat-2 radar altimetry data for river analysis and hydrological modelling.

The high along-track sampling of CryoSat-2 in its SAR and SARin modes offers the opportunity to recover high frequency signals over inland waters. A methodology was developed to process the FBR L1A Doppler beams to form a waveform product using ground cell gridding, beam steering and beam stacking. Inland water heights from CryoSat-2 are derived by using a set of empirical retrackers formulated for inland water applications.

Results of the processing strategy include a comparison of waveforms and heights from the burst echoes (80 m along-track) and from multi-look waveforms (320 m along-track). SAR and SARin FBR data are available for the Amazon, Brahmaputra and Mekong for 2011-2015. FBR SAR results are compared against stage data from the nearest gauge. Heights from Tonlé Sap are also compared against Jason-2 data from the United States Department of Agriculture. A strategy to select the number of multi-looks over rivers was designed based on the rms of heights across Tonlé Sap. Comparisons include results from the empirical retrackers and from waveforms and heights obtained via ESA's Grid Processing on Demand (G-POD/SARvatore) using the SAMOSA2 retracker. Results of FBR SARin processing for the Amazon and Brahmaputra are presented including comparison of heights from the two antennae, extraction of slope of the ground surface and validation against ground data where appropriate.

Regional-scale hydrological modelling has been performed calibrating the river morphology parameters. CryoSat-2 data have been selected using water masks analyzing the impact of the orbit configuration. Assimilation experiments have been conducted on both synthetic and real CryoSat-2 data to infer the theoretical and the real improvement in river discharge estimation.

The Project has recently ended. The output products and the related documentation are available at: http://research.ncl.ac.uk/crucial/.