# Initial Assessment of CryoSat-2 Performance

*Andrew Shepherd[1], Duncan Wingham[2], Natalia Galin[2], Andrew Ridout[2], Robert Cullen[3], Katharine Giles[2], Seymour Laxon[2]*
*[1]School of Earth and Environment, University of Leeds, UK*
*[2]Department of Earth Sciences, University College London, UK*
*[3]ESA-ESTEC, Netherlands*

Following the launch of CryoSat-2 in April 2010, we have examined the performance of the CryoSat-2 SAR Interferometer over the continental ice sheets of Antarctica and Greenland, the Arctic Ocean, and, for the purposes of calibration, over the oceans. Our aim has been to provide confirmation of the engineering performance of the radar interferometer, and to provide an initial geophysical validation of the resulting elevation measurements. We have confirmed the engineering performance at system level of the interferometer through performing a sequence of satellite rolls over the oceans, which provide a surface of known behavior and surface gradient. The activity has identified some errors in the SARIN L1b data products presently issued by ESA. Once corrected, the ocean calibration has demonstrated that the interferometer measures across-track surface slopes with a precision of 25 micro-radians and an accuracy of 10 micro-radians, which may be compared with a pre-launch estimation of 100 micro-radians; in short, the engineering performance greatly its the specification.

The elevation measurement over the ice sheets combines the interferometer measurement of across track slope with the range measurement deduced from the SAR echoes. We have examined the performance of the range estimation, and determined the range precision to be 19 cm RMS at 20 Hz. We have examined the retrieval of the phase information over the ice sheets, and found the phase estimates to be robust and little affected by the uncertain ice sheet topography. Based on the calibration of the interferometer, the contribution of the across track slope error is, at 0.4 mm, negligible. While the quantity of data available to us that contains the corrections identified by the interferometer is limited, we have been able to confirm the range precision values from a limited cross-over analysis.

Over marine sea ice, we have verified the discrimination of sea ice and ocean lead returns using contemporaneous SAR imagery from ENVISAT. Using one monthôs of data, we have determined an initial dynamic topography that agrees with a high resolution region ocean model to 4 cm. We have estimated the precision of individual (20 Hz) measurements to be 2 cm. We have combined estimated the Arctic ice thickness for January and February 2011, and made a preliminary comparison with contemporaneous in-situ and air-borne estimates of thickness which agree to 20 cm.

In summary, with the corrected data products, we are able to confirm that the system performance of CryoSat-2 will meet or exceed its specification over the continental and marine ice sheets.