CryoSat-2: A new perspective on Antarctica

Andrew Shepherd[1], Thomas Armitage[2], Kate Briggs[3], Thomas Flament[4], Anna Elizabeth Hogg[3], Malcolm McMillan[1], Alan Muir[2], Andrew Ridout[2], Aud Sundal[4], Rachel Tilling[2] and Duncan Wingham[2]

(1)University of Leeds, Leeds, LS2, United Kingdom, (2)University College London, London, United Kingdom, (3)University of Leeds, Leeds, United Kingdom, (4)University of Leeds, School of Earth and Environment, Leeds, United Kingdom

CryoSat-2 is ESA's first satellite mission dedicated to measuring changes in the polar land ice and sea ice cover.

Following its launch in April 2010, we have examined the performance of the instrument over the continental ice sheets of Antarctica and Greenland, the Artic Ocean, and, for the purposes of calibration, over the oceans. We have confirmed the engineering performance at system level of the interferometer demonstrating that it measures across-track surface slopes with a precision of 25 micro-radians and an accuracy of 10 micro-radians, greatly exceeding the pre-launch specifications (100 micro-radians). Over the polar ice sheets, 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. Over marine sea ice, we have verified the discrimination of sea ice and ocean lead returns using contemporaneous SAR imagery from ENVISAT, and we have estimated the precision of individual (20 Hz) measurements to be 2 cm. In summary, the CryoSat system performance meets or exceeds its specification over the continental and marine ice sheets.

This presentation summarises the mission performance and presents a series of example case studies where CryoSat-2 data have been applied to study changes in Antarctica. We show that in just 4 years the mission has been able to detect changes in the ice sheet mass with an accuracy comparable to that of the past 20 years of conventional satellite altimetry, that important changes have occurred in West Antarctica and at the Antarctic Peninsula, and we show that the mission has been able to detect changes in rugged, glaciated terrain, that were beyond the capability of past altimeter missions. Finally, we demonstrate the mission performance in full, swath-interferometric mode, which is capable of detecting elevation and elevation change with extremely fine and dense spatial resolution.

Theme: Changes in WAIS from observations (*The Times They are a-Changin')*