Geophysical Research Abstracts
Vol. 12, EGU2010-6396-1, 2010
EGU General Assembly 2010

CryoSat-2: Post launch performance of SIRAL-2 and its calibration/validation

Robert Cullen (1), Richard Francis (1), Malcolm Davidson (1), and Duncan Wingham (2)
(1) ESA-ESTEC, Noordwijk, The Netherlands (Robert.Cullen@esa.int), (2) University College London, London, United Kingdom

1. INTRODUCTION

The main payload of CryoSat-2 [1], SIRAL (Synthetic interferometric radar altimeter), is a Ku band pulse-width limited radar altimeter which transmits pulses at a high pulse repetition frequency thus making received echoes phase coherent and suitable for azimuth processing [2]. The azimuth processing in conjunction with correction for slant range improves along track resolution to about 250 meters which is a significant improvement over traditional pulse-width limited systems such as Envisat RA-2, [3].
CryoSat-2 will be launched on 25th February 2010 and this paper describes the pre and post launch measures of CryoSat/SIRAL performance and the status of mission validation planning.

2. SIRAL PERFORMANCE: INTERNAL AND EXTERNAL CALIBRATION

Phase coherent pulse-width limited radar altimeters such as SIRAL-2 pose a new challenge when considering a strategy for calibration. Along with the need to generate the well understood corrections for transfer function amplitude with respect to frequency, gain and instrument path delay there is also a need to provide corrections for transfer function phase with respect to frequency and AGC setting, phase variation across bursts of pulses. Furthermore, since some components of these radars are temperature sensitive one needs to be careful when the deciding how often calibrations are performed whilst not impacting mission performance.
Several internal calibration ground processors have been developed to model imperfections within the CryoSat-2 radar altimeter (SIRAL-2) hardware and reduce their effect from the science data stream via the use of calibration correction auxiliary products within the ground segment. We present the methods and results used to model and remove imperfections and describe the baseline for usage of SIRAL-2 calibration modes during the commissioning phase and the operational exploitation phases of the mission.
Additionally we present early results derived from external calibration of SIRAL via the use of ocean calibration zones and radar transponders.

3. CRYOSAT-2 OVERALL PERFORMANCE & VALIDATION PLANNING

Validating such retrievals derived from a phase coherent pulse-width limited polar observing radar altimeter, such as SIRAL, is not a simple one [4]. In order to fully understand all the respective error co-variances it is necessary to acquire many different types of in-situ measurements (GPR, neutron probe density profiles, drilled and electromagnetic derived sea-ice thicknesses, for example) in highly inhospitable regions of the cryosphere at key times of the year. In order to correlate retrievals from CryoSat with the in-situ data it was decided early in the CryoSat development that an aircraft borne radar altimeter with similar functionality to SIRAL would provide the necessary link, albeit on the smaller scale, and provide pre-launch incite into expected performances and issues.
In 2001 ESA commenced the development of its own prototype radar altimeter that mimics the functionality of SIRAL. Similar to SIRAL, but with subtle functional differences, the airborne SAR/Interferometric Radar Altimeter System (ASIRAS) has now been the centre piece instrument for a number of large scale land and sea ice field campaigns in the Arctic during spring and autumn 2004, 2006 and 2008. Additional smaller science/test campaigns have taken place in March 2003 (Svalbard), March 2005 (Bay of Bothnia), March 2006 (Western

Greenland) and April 2007 (CryoVEx 2007 in Svalbard).
It is a credit to all parties that constitute the CryoSat Validation and Retrieval Team (CVRT) for the coordination, planning, acquisition of in-situ and airborne measurements and the subsequent processing and distributing of its data for analysis. CVRT has a robust infrastructure in place for validating its level 2 products derived from an operational CryoSat-2.

4. REFERENCES

[1] http://www.esa.int/livingplanet/cryosat

[2] Wingham, D. J., Francis, C. R., Baker, S., Bouzinac, C., Cullen, R., de Chateau-Thierry, P., Laxon, S. W., Mallow, U., Mavrocordatos, C., Phalippou, L., Ratier, G., Rey, L., Rostan, F., Viau. P. and Wallis, D., 'CryoSat: A Mission to Determine the Fluctuations in Earth's Land and Marine Ice Fields'. Advances in Space Research, 37(2006) Pp 841-871. doi:10.1016/j.asr.2005.07.027.

[3] Mission and data description, CS-RP-ESA-SY-0059 issue 3, 2nd January 2007. http://esamultimedia.esa.int/docs/Cryosat/Mission_and_Data_Descrip.pdf

[4] Cryosat calibration and validation concept, http://esamultimedia.esa.int/docs/Cryosat/CVC_14Nov01.pdf