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Cryosphere campaigns in support of ESA's Earth Explorers Missions

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In the framework of its Earth Observation Programmes the European Space Agency (ESA) carries out ground based and airborne campaigns to support geophysical algorithm development, calibration/validation, simulation of future spaceborne Earth observation missions, and applications development related to land, oceans, atmosphere and solid Earth.

ESA has conducted over 110 airborne and ground measurements campaigns since 1981 and this presentation will describe three campaigns in Antarctica and the Arctic. They were undertaken during the calibration/validation phase of Earth Explorer (EE) missions, such as SMOS (Soil Moisture and Ocean Salinity), GOCE (Gravity field and steady-state Ocean Circulation Explorer) and CryoSat-2.

In support of SMOS and GOCE, the DOMECair airborne campaign took place in Antarctica, in the Dome C region in the middle of January 2013. The two main objectives were a) to quantify and document the spatial variability in the DOME C area (SMOS) and b) to fill a gap in the high-quality gravity anomaly maps in Antarctica where airborne gravity measurements are sparse (GOCE). Results from the campaign for the SMOS component, showed that the DOME C area is not as spatially homogenous as previously assumed, therefore comparisons of different missions (e.g. SMOS and NASA's Aquarius) with different footprints must be done with care, highlighting once again the importance of field work to test given assumptions. One extremely surprising outcome of this campaign was the pattern similarity between the gravity measurements and brightness temperature fields. To date, there has never been an indication that L-Band brightness temperatures could be correlated to gravity, but preliminary analysis showed coincident high brightness temperature with high gravity values, suggesting that topography may influence microwave emissions.

Also in support of SMOS, the SMOSice airborne campaign has been planned in the Arctic. It was motived by a previous ESA SMOSice study that demonstrated for the first time the potential to retrieve sea ice thickness from SMOS data. However, the product retrieval algorithm had never been validated using independent airborne measurements in the Arctic region. Therefore, the SMOSice airborne campaign will take place over sea-ice south east of Svalbard during the last week of March 2014.

CryoVEx 2014 is a large collaborative effort to help ensure the accuracy of ESA's ice mission CryoSat-2. ESA has supported extensive CryoSat-2 pre-launch validation campaigns by providing simultaneous overflights of surface experiments performed by CryoSat Validation Retrieval Team (CVRT) members in Greenland, Canada, Svalbard and the Arctic Ocean in 2003, 2005, 2006, 2007 and 2008. Since CryoSat-2's launch, the field campaigns have been significantly augmented including a close collaboration with NASA's Operation Icebridge since 2011 and continued in 2014. Collectively, these activities are known as CryoVEx (CryoSat-2 Validation Experiment).

The aim of this large-scale CryoVEx2014 ground and airborne campaign is to record sea-ice thickness and conditions of the ice along the CryoSat-2 ground track. A range of sensors installed in different aircraft included simple cameras to get a visual record of the sea ice, laser scanners to clearly map the height of the ice, an ice-thickness sensor (EM-Bird), ESA's radar altimeter (ASIRAS) and NASA's snow and Ku-band radars, which mimic CryoSat's measurements but at a higher resolution. Results from previous campaigns have shown the ability to detect centimetre differences between sea-ice and thin ice/water which in turn allowed for an accurate estimation of actual sea ice thickness.

For the different activities a rich variety of datasets has been recorded, are archived and users can access campaign data through the EOPI web portal [http://eopi.esa.int].