DOMEX-2: L-BAND MICROWAVE EMISSION MEASUREMENTS OF THE ANTARCTIC PLATEAU

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In recent years, the need to investigate microwave emission of the East-Antarctic ice sheet is motivated by the growing interest of the remote sensing community in using this area e Antarctic and, in particular, the East-Antarctic plateau where the Italian-French station of Concordia is located, for calibrating and validating data from satellite-borne microwave and optical radiometers. The reason of this interest lies in the size, structure, spatial homogeneity and thermal stability of this area. The roughness is limited with respect to other Antarctic area and the temperature of the firn below 10 m remains constant during the years. This is particularly interesting for low-frequency microwave radiometers since, due to the low extinction of dry snow, the upper ice sheet layer is almost transparent and the brightness temperature variability is therefore extremely small. Moreover the Concordia-base, which operates all year round, guarantees the availability of ancillary data, such as atmospheric parameters and snow temperature at different depths, which are necessaries for the analysis and the interpretation of microwave data.

With a view to the launching of new low-frequency space-borne sensors based on L-band radiometers such as ESA's Soil Moisture and Ocean Salinity mission (SMOS) and NASA's Aquarius and Hydros a pilot ground experiment for measuring emission at L- and C- bands called DOMEX took place in the Austral summer of 2004-2005. This experiment was supported by ESA within the framework of the SMOS programme and by the Italian Programme of National Research (PNRA) and included radiometric measurements from a tower at different incidence and azimuth angles and snow measurements, using conventional methods. On the basis of this first experiment the spatial uniformity (on a kilometer scale) and temporal stability (on a monthly scale) of the snow layers emitting low frequency microwave radiation was confirmed.

In spite of this brief, successful demonstration experiment, a new experiment (called Domex-2) is proposed within the framework of SMOS calibration and validation activities in order to extend these measurements over a a longer duration period. This will provide an independent absolute reference target site allowing estimating the long-term performance degradation or drifts of the MIRAS radiometer instrument during the SMOS mission. The experiment is supported by ESA within the framework of SMOS calibration activities and by the Italian National Project in Antarctica.

Domex-2 experiment consists in an L-band and an infrared (8-14 μm) radiometers installed at Concordia base in a protected box on an observation tower at a height of 13 m respect to the ice sheet. Data are collected continuously (24/24 h) over an entire Austral annual cycle, starting from December 2008 at different incidence angles e within 30°- 130° range with respect to nadir. Snow measurements (including snow stratigraphy, density, grains size and shape), as well as meteorological data, are also collected during the experiment. The instrument is remotely controlled to the station form the tower using LAN cable, data will be daily transferred in Europe using satellite connection.

Before the campaign, particular attention have been paid in the calibration of the instruments and in its thermal design of the system in order to be able to work at the extreme environmental conditions over an entire year from the very cold conditions in the winter period (no sun illumination and external temperatures down to -75 °C) to the summer period with 24h sun illumination and external temperatures up to -20°C taking into account that DOMEX equipment has been designed to work with stability requirements of 1°C/h.

Data collected in the first period of the experiment, confirms that the brightness temperature remains stable in time, as well as snow data confirms the spatial homogeneity of the site. New data will be analyzed in the forthcoming months.