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Description of CAROLS airborne campaigns for SMOS CAL/VAL

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SMOS satellite mission is based on an aperture synthesis L-band radiometer, designed and developed by the European Space Agency (ESA). In the context of the validation activity for the SMOS mission, the authors proposed to design, build and operate the CAROLS L-Band radiometer from an aircraft. Because the sensitivity of L-band brightness temperature to salinity is very small (-0.45°K/psu at a physical temperature equal to 15°K), it was necessary to build a very accurate, sensitive, and stable system. The CAROLS, an L-band radiometer (1400 – 1427 MHz), was built and designed as a copy of EMIRAD II radiometer of DTU team by the LATMOS. It is a Correlation radiometer with direct sampling and fully polarimetric (i.e 4 Stockes) which shows sensitivity equal to 0.1 K for 1 s integration time (300K target) and with stability better than 0.1 K over 15 min. This radiometer could be used in conjunction with other airborne instruments (in particular the C-Band scatterometer (STORM), one visible camera), in coordination with in situ field campaigns for SMOS CAL/VAL.
An airborne campaign was realized during spring and autumn 2010 over south west of France, Valencia (Spain), and Bay of Biscay (Atlantic Ocean). Twenty six flights are proposed with CAROLS radiometer, using two antennas, one looking at nadir and the other at 33.5° incidence angle. Simultaneously to flights, different ground measurements were made over continental surfaces and ocean. First results show a good quality of data over ocean and continental surfaces. For continental surfaces, Radio-Frequency Interferences (RFI) were observed particularly over south west of France. Different approaches are proposed to correct RFI with statistical analysis or using a spectral analyzer. The ability of the CAROLS radiometer to measure the brightness temperature of the surface was evaluated and then we compared measurements with ocean emission models outputs for different configurations. These estimations were performed for different view angles - using wing and nose wags movements and circles done by the aircraft over ocean - and for different dates. First comparisons between CAROLS data and SMOS products are realized.