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A follow-up for the Soil Moisture and Ocean Salinity mission

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The Soil Moisture and Ocean Salinity (SMOS) satellite, launched in 2009 by ESA, has provided, for the first time, systematic passive L-band (1.4 GHz) measurements from space with a spatial resolution of ~ 40 km. SMOS data are an essential component of the ESA Climate Change Initiative (CCI) for ocean salinity and soil moisture and they are used by the CCI biomass. A specific SMOS neural network soil moisture product is assimilated operationally at the European Centre for Medium Range Weather Forecasts (ECMWF). L-band surface SM measurements have also been used to estimate root zone soil moisture, to derive drought indices, to enable food security monitoring and to improve satellite precipitation estimates. SMOS data have also been used to detect frozen soils, thin ice-sheets over the ocean and ice melting in Antarctica and Greenland.

Different studies on scientific and operational applications of L-band radiometry have shown the need of the continuity of L-band observations with an increased resolution with respect to the current generation of sensors. Resolutions from 1 km to 10 km would be a breakthrough for many applications over ocean, land and ice. One approach to obtain those resolutions could be downscaling coarse resolution data using an auxiliary dataset with higher resolution. However, using airborne data, we will show that the accuracy of the data downscaled to 1 km decreases significantly when the initial native resolution is 40 km with respect to downscaling from initial resolutions of 5-10 km. We will present two instrumental concepts to reach native resolutions of 5-10 km.

The SMOS-HR mission project, completed the Phase 0 study at the French Centre National d'Etudes Spatiales (CNES) with contributions from Airbus Defence & Space and CESBIO. The goal was to ensure the continuity of L-band measurements while increasing the spatial resolution to ~10 km, which requires a typical antenna size of ~18 meters. Taking into account the difficulty of

deploying a real aperture of this size in space and the successful alternative approach used by SMOS, SMOS-HR will perform aperture synthesis using an array of 230 small antennas distributed in a cross with four 12 m arms. During the Phase A study (ongoing at CNES) a mission concept with a central carrier surrounded by a swarm of nanosatellites will also be studied.

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