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A first assessment of the SMOS data in southwestern France using in situ and airborne soil moisture estimates: the CAROLS airborne campaign

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Passive microwave remote sensing of soil moisture has been at the centre of attention of many research programs, for several decades. Various airborne and in situ radiometers have been developed, showing the high potential of L-band (1.41 GHz) measurements for the estimation of surface parameters. The Soil Moisture and Ocean Salinity (SMOS) satellite mission, based on an aperture synthesis L-band radiometer was successfully launched on November 2009. In the context of a validation campaign for the SMOS mission, intensive airborne and in situ observations were performed in southwestern France for the SMOS CAL/VAL, from April to May 2009 and April to July 2010. The CAROLS (Cooperative Airborne Radiometer for Ocean and Land Studies) multiangular (34°-0°) bipolarized (V and H) L-band radiometer was designed, built and installed on board a dedicated French ATR42 research aircraft. In spring 2009 and 2010, soil moisture observations from 12 stations of the SMOSMANIA (Soil Moisture Observing System – Meteorological Automatic Network Integrated Application) network of Météo-France were complemented by airborne observations of the CAROLS L-band radiometer, following an Atlantic-Mediterranean transect in southwestern France. Additionally to the SMOSMANIA soil moisture network, in situ measurements were collected in three specific sites within an area representative of a SMOS pixel. Microwave radiometer observations, acquired over southwestern France by the CAROLS instrument are analyzed in order to assess their sensitivity to surface soil moisture (mv). A combination of microwave brightness temperature (Tb) at either two polarizations or two contrasting incidence angles is used to retrieve mv through regressed empirical logarithmic equations with good results, depending on the chosen configuration. The retrieval performance of the regression from the CAROLS measurements is applied to the SMOS Tb, also.