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Evaluation of SMOS and ASCAT soil moisture products over Norway using ground-based in situ observations

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Norway is one the most difficult and challenging areas in the globe for measuring soil moisture remotely. Measurements are difficult or not possible owing to the presence of snow, ice, water bodies, orography, rocks, and a very high coastline-to-area ratio. By focusing on these challenging conditions in Norway, the work described in this study provides a stringent test of the capabilities of satellite sensors to measure soil moisture remotely.

We focus on the evaluation of soil moisture products from the ASCAT (Advanced SCATterometer) and the SMOS (Soil Moisture and Ocean Salinity) satellites. SMOS was launched by ESA on November 2nd, 2009; it records brightness temperatures in the L-Band at 1.4 GHz, which are converted into soil moisture through inverse modelling. ASCAT is a real-aperture radar that measures surface backscattering coefficients in the C-band at 5.255 GHz. This study compares SMOS and ASCAT Level 2 soil moisture data from 2010 until 2012 with in situ data over Norway at various sites spanning a wide range of surface conditions.

We show that the satellite and in situ dataset agree well, with correlation values of 0.53 for SMOS/in situ data and 0.61 for ASCAT/in situ data averaged over all sites considered. These values are comparable with those from studies from other areas of the globe such as France, Australia and the USA. The bias between the satellite and in situ data is smaller than the standard deviation of the individual datasets, indicating that differences between the datasets are within the 1-sigma error bars. We conclude that the SMOS and ASCAT soil moisture products over Norway have high quality, and will be useful for various applications, including land surface monitoring, weather forecasting and hydrological modelling.

Further studies quantifying the quality of soil moisture data over Norway will be discussed, including comparison with soil moisture data from the Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) satellite, and with simulations from the SURFEX land surface model.