STATUS OF THE METOP ASCAT SOIL MOISTURE PRODUCT

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Microwave sensors onboard remote sensing satellites offer an attractive and relatively direct way of measuring soil moisture. In contrast to in-situ measurements, satellite-borne instruments deliver measurements readily integrated over larger areas (in the order of metres to kilometres), better suited for hydrological studies of entire catchments or geographical regions. Additionally, observations can be made consistently, globally and frequently, without intensive labour and field work. Nevertheless, many aspects of determining soil moisture using microwave instruments are still much of an open issue and the subject of extensive research. Attempts to retrieve this elusive parameter from microwave sensors so far have focused mostly on passive techniques at longer wavelengths [1-11]. Advances in active techniques have also shown the potential of real- and synthetic aperture radars to retrieve surface soil moisture. Several authors have suggested retrieval methods, many of them using SAR data [e.g. 12, 13-16] and several applied to scatterometers [e.g. 17, 18-23].

The present article gives an overview of the existing soil moisture product derived using backscatter measurements from the Metop ASCAT scatterometer, as well as its chronology. The retrieval method, named the *TU Wien method*, was first proposed by Wagner [18] and developed at Vienna University of Technology. The TU Wien method is, from its conception, a semi-empirical change detection method. Backscatter measurements are extrapolated to a reference incidence angle (chosen to be 40°). The seasonal effect of the vegetation is determined and eliminated by exploiting the multi-incidence angle viewing capabilities of fan-beam scatterometers. The normalised and vegetation-corrected backscatter values are then compared to dry and wet references values, in turn derived at 40° from the long-term history of extreme dry and wet conditions of the location in question. As a result, time series of the topsoil (<5 cm) moisture content are obtained in relative units ranging between 0 (dry) and 100 (saturated).

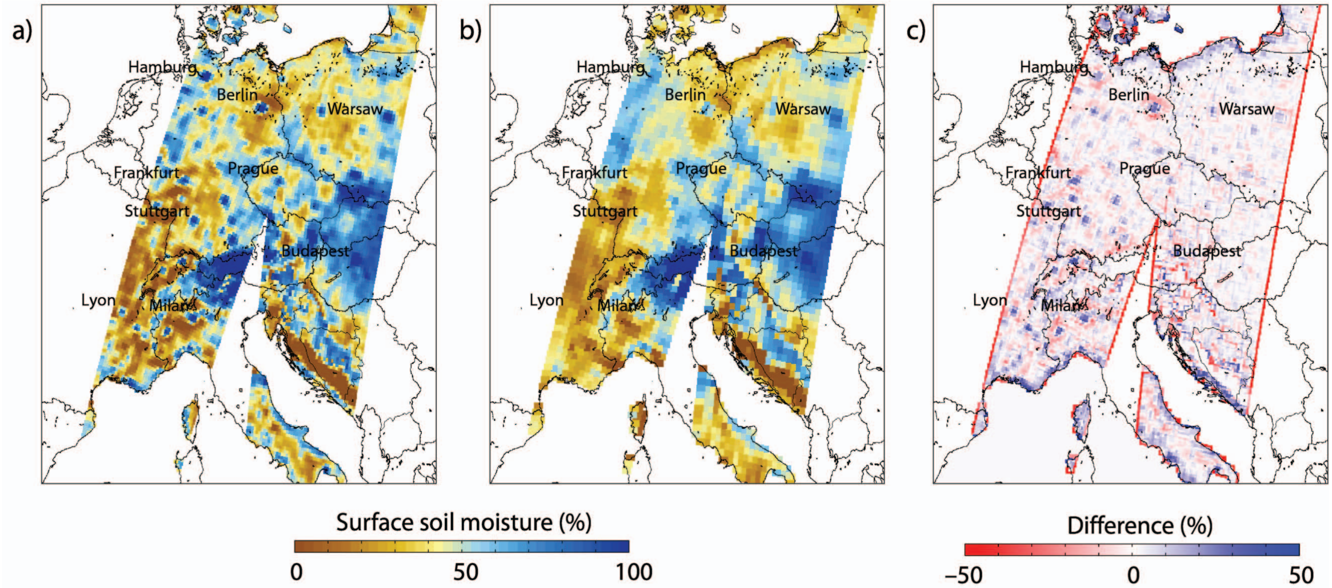

Fig. 1. ASCAT surface soil moisture with a) 25 km resolution and b) 50 km resolution over Central Europe, for descending orbits on 2008 July 23 (orbit numbers 9130–9131). Both datasets are based on long-term scattering parameters from the ERS-1/2 scatterometers (50 km resolution). The difference between the two resolution cases, shown in c), reveals not only artifacts due to resolution mismatch, but also prominence of urban areas, imaged as overly wet. The latter effect is possibly a consequence of land cover changes since the 1990's, the time when most of the ERS Scatterometer data was acquired.

The statistical scattering parameters needed to drive the soil moisture retrieval (such as the yearly average behaviour of the backscatter–incidence angle relationship or the dry and wet references) have been derived globally and empirically from a multi-year ERS-1/2 Scatterometer dataset (1991–2007). These have been used to generate time series not only of ERS Scatterometer-based soil moisture (50 km resolution), but, thanks to the similar instrument design [24, 25] and good method transferability, also time series of Metop-A ASCAT-based soil moisture with 25 km spatial resolution [26]. Investigations of the soil moisture data ascertained however a sometimes significant, incidence angle-dependent bias between soil moisture levels from the two instrument generations. This can be traced back to the slightly different incidence angle ranges of the ERS Scatterometers and ASCAT or even possible biases in the backscatter calibration. Due to the not yet finalised efforts within the scatterometery community towards intercalibration of the ERS–ASCAT backscatter data, as well as the spatial resolution mismatch, recent work has been focusing on eliminating the dependency of ASCAT soil moisture data on historical ERS Scattrometer measurements, by deriving the equivalent scattering parameters from the first two years of ASCAT Level 1 (backscatter) data. These were reprocessed by EUMETSAT after calibration using transponders, for the period 2007–2008. This article also compares some of these ASCAT-based parameters with their older ERS equivalents, to reveal improvements in terms of spatial detail, reductions of the effects due to calibration differences, etc.

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