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Comparison of soil moisture products obtained from active and passive microwave data

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Forty years of research on passive and active microwave observations have led so far to a better understanding of the sensitivity of satellite microwave observations to soil moisture and to a higher confidence in the possibility to retrieve reliable soil moisture from these sensors at small as well as large scale. This research forms the basis of two important new satellite missions: ESA's Soil Moisture and Ocean Salinity mission (SMOS) and NASA's Soil Moisture Active and Passive mission (SMAP) whose main goal is the retrieval of soil moisture at global scale. In view of these missions, the research has been recently focussed more on the development of soil moisture retrieval methods which can be applied at global scale and on their application over the existing scatterometer (ERS scatterometer and Metop ASCAT) and radiometer (SMMR and AMSR-E) data to obtain long time series of global products.

In this work, two global soil moisture products, one obtained from radiometer data and the other from scatterometer data, have been compared. The main objective of this comparison is to better understand the potential and limitations for soil moisture retrieval of both the data and the applied method and to investigate the possible complementarity of the different datasets.

The two surface soil moisture datasets employed in this study are: the product obtained from AQUA AMSR-E data by the Department of Hydrology and Geo-Environmental Sciences of the Vrije Universiteit of Amsterdam and the product retrieved from ERS-2 scatterometer data by the Institute of Photogrammetry and Remote Sensing of the Vienna University of Technology. The temporal variability from 2003 to 2007, the seasonal trends, the anomalies, the autocorrelations and the correlation between the two global datasets have been analysed. Two in-situ datasets collected by large soil moisture monitoring networks in Oklahoma (Oklahoma Mesonet) and in Australia (OzNet) have been also included in this comparison. However the analysis has been also extended to other areas characterised by different vegetation cover. In these cases, temporal variability and trends have been compared with GPCC precipitation data.

The analysis shows a general good agreement between the two global soil moisture datasets and with in-situ and precipitation data. Comparable temporal variability, trends and autocorrelations have been observed between AMSR-E and ERS soil moisture products over OzNet test site, confirmed also by the analysis of the soil moisture measured in-situ at a depth of 5 cm. As expected, the soil moisture measured at deeper layer shows trends shifted in time and longer autocorrelation than the satellite products.

The obtained results can support the possibility to integrate the two soil moisture products and to synergistically use active and passive microwave data for soil moisture monitoring at global scale.