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Accuracy of Global Soil Moisture Data from Microwave Scatterometers

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Global soil moisture retrieval is a key research area in applied and theoretical remote sensing. Considerable technological progress during the last three decades leave no doubt that remote sensing from space afford the possibility of obtaining frequent global sampling of soil moisture over large fractions of the earth surface. Only recently, the first global coarse resolution remotely sensed soil moisture data set has been derived. The soil moisture products are derived from data provided by an active coarse resolution microwave sensor, the scatterometer operated onboard ESAs ERS satellites. The data set has been made available to the scientific community and is currently tested in first pilot studies. The operational continuation of the ERS scatterometer on the METOP satellite series with a foreseen lifetime of 17 years opens an exciting perspective for operational applications. In order to facilitate the use of the derived soil moisture data it is however imperative that the reliability of the products is demonstrated and their validity range is established.

However validation and accuracy assessment of coarse resolution soil moisture is not a straight forward task. A main obstacle in data validation is the identification of useful reference data sets. The data sets to which the soil moisture product is compared has to share the specific scaling characteristics, must be of known quality and must provide significant temporal and spatial coverage. A data set which fulfils all of these requirements does currently not exist. It is therefore imperative to use data from different sources such as in-situ field measurements from experimental and large operational networks, model data and other earth observation products in a synergistic way. Exploiting the specific characteristics and advantages of each of the data sets, a more complete insight into the quality and the error structure of the derived products can be obtained.

To asses the quality of soil moisture products derived from ERS scatterometer data, soil moisture information from different sources has been used. These comprise soil moisture information form an experimental catchment in Spain and from large agrometeorologic in-situ networks in China, Russia, Ukraine, Illinois and India as well as data from climate models. Comparison of soil moisture products with climate model outputs gave evidence to the general consistency of the data set under various climatic and geophysical conditions. Only under extreme climatic conditions such as deserts and the arctic spurious effects have been identified. Comparison with data from the agrometeorologic networks resulted in a more quantitative measure of the accuracy. The estimated retrieval error was estimated to be about 5 % volumetric soil moisture.