Towards a Soil Moisture Climate Record from Active and Passive Microwave Remote Sensing

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The latest IPCC assessment report identified soil moisture as an emerging essential climate variable and stressed the need to fosters activities to "assemble, quality check reprocess, and re-analyse" respective datasets "relevant to decadal prediction"

Satellite remote sensing can be a powerful data source to fulfil those needs. Unfortunately, methodological problems, lack of validation and limitations in computing have frequently delayed the research process to retrieve soil moisture from space observations. But research in these fields evolved, resulting in several global soil moisture datasets. Today validated global soil moisture data sets are publicly available from active (ERS-1/2, METOP) and passive (SMMR, SSM/I, TMI, AMSR-E) microwave remote sensing instruments. These data sets reach back for more than 30 years. In addition, in the near future dedicated soil moisture sensors such as the SMOS mission will provide experimental soil moisture products in an unprecedented quality. The available data sets are based on different sensors and retrieval concepts. It is now the time to harmonize these different sets to create one long term consistent global soil moisture dataset.

Within the ESA project WACMOS (Water Cycle Multi-mission Observation Strategy) respective activities are reinforced. More specifically the objective of the WACMOS soil moisture observatory is to establish a solid scientific basis for the development of long-term coherent soil moisture products. To this end we exploit the triple collocation error estimation technique to assess the error and systematic biases between the different data sets and use a cumulative distribution function matching approach to harmonise the observations. The proposed methodology has the advantage that it can easily be adapted to a new observation record such as observations of the SMOS mission.

In this paper we will present first results based on data records from the ERS-1/2 and the AMSR-E missions. We will discuss systematic differences between the active and passive microwave derived soil moisture products and analyse the error structure of each. Finally, we will discuss the potential of the proposed technique to harmonise these data sets. The analyses of the two datasets will provide new insights into the advantages and disadvantages of different microwave techniques and retrieval approaches and will likely lead to a new superior soil moisture product.