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On the use of L-band microwave and multi-mission EO data for high resolution soil moisture

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Sub-kilometric soil moisture maps have been increasingly mentioned as a need in the scientific community for many applications ranging from agronomical and hydrological (Wood et al. 2011). For example, this type of dataset will become essential to support the current evolution of the land surface and hydrologic modelling communities towards high resolution global modelling. But the ability of the different sensors to monitor soil moisture is different. The L-Band microwave EO provides, at a coarse resolution, the most sensitive information to surface soil moisture when compared to C-Band microwave, optical or C-band SAR. On the other hand the optical and radar sensors provide the spatial distribution of associated variables like surface soil moisture,surface temperature or vegetation leaf area index. This paper describes two complementary fusion approaches to obtain such data from optical or SAR in combination to microwave EO, and more precisely L-Band microwave from the SMOS mission. The first approach, called MAPSM, is based on the use of high resolution soil moisture from SAR and microwave. The two types of sensors have all weather capabilities. The approach uses the new concept of water change capacity (Tomer et al. 2015, 2016). It has been applied to the Berambadi watershed in South-India which is characterised by high cloud coverage. The second approach, called Dispatch, is based on the use of optical sensors in a physical disaggregation approach. It is a well-established approach (Merlin et al. 2012, Malbeteau et al. 2015) that has been implemented operationally in the CATDS (Centre Aval de Traitement des Données SMOS) processing centre (Molero et al. 2016). An analysis on the complementarity of the approaches is discussed. The results show the performances of the methods when compared to existing soil moisture monitoring networks in arid, sub-tropical and humid environments. They emphasis on the need for large inter-comparison studied for the qualification of such products on different climatic zones and on the need of an adaptative multisensor approach. The availability of the recent Sentinel-1 2 and 3 missions from ESA provides an exceptional environment to apply such algorithms at larger scales.