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0.1 degree soil moisture retrievals from passive microwave observations

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For several years passive microwave observations have been used to retrieve surface soil moisture from the Earth's surface. Satellite sensors such as the Advanced Microwave Scanning Radiometer-EOS (AMSR-E) have been used for this purpose using their multi-channel observations. These soil moisture retrievals are routinely available in a relatively coarse spatial resolution (∼0.25 degree), which allows for studies and applications on a global and continental scale. The use of such surface soil moisture retrievals for smaller areas, e.g. regional scale or watershed studies, is generally limited due to the coarse scale of the native soil moisture product. In response to this challenge a method to enhance the spatial resolution of surface soil moisture retrievals from these passive microwave observations was developed.

The Smoothing Filter-based Intensity Modulation (SFIM) technique was applied to AMSR-E observations in combination with the Land Parameter Retrieval Model (LPRM) to derive a 0.1 degree soil moisture product over Southern France and the Iberian Peninsula. The results were compared with soil moisture fields from a Thermal Infrared observation based model (ALEXI). The spatial resolution of ALEXI-based soil moisture retrievals is typically on the order of 3-10 km2, which allows a spatial comparison between ALEXI and AMSR-E at both native- (∼0.25 degree) and downscaled (0.1 degree) spatial resolution. Additionally the remotely sensed soil moisture products, at respectively coarse and high spatial resolution, were compared to in situ observations over the Remedhus and SmosMania soil moisture network.

The results revealed no significant loss in soil moisture retrieval skill in the 0.1 degree soil moisture product as compared to the original 0.25 degree product and demonstrated a better spatial correspondence between ALEXI. Based on this study the applied SFIM technique seems to be a promising approach to downscale passive microwave observations, not only for AMSR-E but also for other (future) satellite missions like GCOM/W-AMSR 2, GPM and SMAP. However, more research is still needed to determine the full potential of this new method.