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Comparison of SMOS and SMAP retrieval algorithms based on in situ L-band observations at the VAS site.

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The objective of this study was to compare several approaches of Soil Moisture (SM) retrievals from L-band microwave radiometry. The comparison was based on a brightness temperature (TB) data set acquired by the L band radiometer ELBARA-II over a vineyard field. ELBARA-II, developed by ESA within the cal/val SMOS scientific program, was set up on a 17 m tower at the VAS site, close to Valencia, since 2010 (Schwank et al., 2012; Wigneron et al., 2012). The instrument was programmed to register brightness temperature in horizontal and vertical polarization for a range of incidence angles (30°-60°). Based on this 3 year data set (2010-2012), several SM retrieval approaches developed for SMOS, AMSR-E and SMAP were compared. The methods include:

- the 2 parameter (SM and TAU) retrieval method based on multiangular observations and developed for SMOS (Wigneron et al., 2000, referred to as 2P-LMEB)

- the Single Channel Algorithm (SCA) for horizontal (SCA-H) and vertical (SCA-V) polarizations, and the Dual Channel Algorithm (DCA) as described in the NASA SMAP Algorithm Theoretical Basis Document (O'Neill et al., ATBD, 2012). SCA-V and SCA-H require additional information about the vegetation dynamics to estimate the vegetation optical depth TAU from optical remote sensing sensors.

- the Land Parameter Retrieval Model (LPRM) proposed for AMSR-E (de Jeu et al., 2005)

In addition, two simplified methods based on statistical regression were tested : linear regressions proposed by Saleh et al. (2006) and Mattar et al. (2012) (referred respectively to as 'Saleh' and 'Mattar' methods). In this study, measurements of NDVI required for three algorithms (SCA-H , SCA-V and Mattar) were obtained from MODIS time series. A reference for Soil Moisture values was required in this study. It was assumed that this 'reference' SM data set was obtained from the multiangular 2P-LMEB algorithm. Roughness in all methods was parameterized according to Wang and Choudhury et al. (1981). The values of the roughness parameters HR & QR were computed from in-situ measurements of correlation length and standard deviation of heights based on the equations developed by Lawrence et al. (2012). The formulation developed by Mironov et al. (2009) was used to estimate the soil dielectric constant.

The results obtained with the current base line algorithm developed for SMAP (SCA-H) are in very good agreement with the 'reference' SM data set derived from the multi-angular 2P-LMEB method ($R^2=0.92$, bias=-0.04 m³/m³, RMSE=0.08 m³/m³). This result shows that the SCA-H algorithm, based on observations for one angle and one polarization and additional information from MODIS, can provide results very close to SMOS for this typical Mediterranean crop. The other algorithms were found to be slightly less successful in retrieving the 'reference' SM time series, especially when the vegetation was well developed (end of spring and summer period). All results for the different methods are presented and

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discussed, in the context of the improvement & development of the SM algorithms for SMOS, Aquarius and SMAP.