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Improving soil moisture retrieval from SMOS using the synergy with other sensors or meteorological data.

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The SMOS mission is scheduled for 2008. One of the major mission output is the estimation of the surface soil moisture. It is derived among the other factors of influence (vegetation, soil surface roughness, temperature) thanks to the numerous configurations including the dual polarization and a wide range of incidence angles. So, the SMOS sensor is designed to be self consistent to fulfill the mission objectives. However, it appears that the numerous factors influencing the SMOS signal and the surface heterogeneity in a SMOS pixel, prevent to reach a satisfactory accuracy (the expected SMOS accuracy is 0.04 m3/m3). Moreover, the SMOS spatial resolution will be about 40 km. This is too low for some applications as in Hydrology. So, dis-aggregation of the retrieved soil moisture will extent the use of SMOS data.

The aim of the work is to analyse how information from other sensors or meteorological data leads to improve the soil moisture accuracy and how higher resolution source of data allows SMOS output dis-aggregation. The considered sources of information are:

- fcover products obtained with optical sensors to estimate the bare soil fraction,
- NDVI or NDWI to estimate the vegetation optical thickness,
- the air temperature (Tair) or the thermal infrared brightness temperature (TIR) to estimate the surface microwave effective temperature,
- the TIR-Tair difference at noon for soil moisture disaggregation,

- the Antecedent Precipitation Index (API) for soil moisture disaggregation.

The analysis was made on synthetic data sets covering the whole earth surface during a one year, or more detailed data set locating in south of France. Results showed that a significant improvement in moisture can be obtained by better defining the bare soil fraction or constraining either the vegetation optical thickness or the effective temperature. The improvement is the most significant in temperate and semi arid areas. The gain offered by the additional information depends on the accuracy on the measured brightness temperature. When its accuracy is 1 K, the moisture retrieval accuracy decrease by almost 0.01 m3/m3. However, when microwave brightness temperature accuracy decreases, the interest of using external data decreases, strongly. With a 3K error, there is no interest of using additional value.

For the dis aggregation, it is possible to obtain soil moisture at high resolution using cofactors as the API or TIR-Tair difference. However, the resulting accuracy is satisfactory when the soil properties are taken into account, only.

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