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Using SMOS brightness temperature and derived surface-soil moisture to characterize surface conditions and validate land surface models.

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The SMOS satellite, operated by ESA, observes the surface in the L-band. On continental surface these observations are sensitive to moisture and in particular surface-soil moisture (SSM). In this presentation we will explore how the observations of this satellite can be exploited over the Iberian Peninsula by comparing its results with two land surface models : ORCHIDEE and HTESSEL.
Measured and modelled brightness temperatures show a good agreement in their temporal evolution, but their spatial structures are not consistent. An empirical orthogonal function analysis of the brightness temperature's error identifies a dominant structure over the south-west of the Iberian Peninsula which evolves during the year and is maximum in autumn and winter. Hypotheses concerning forcing-induced biases and assumptions made in the radiative transfer model are analysed to explain this inconsistency, but no candidate is found to be responsible for the weak spatial correlations. The analysis of spatial inconsistencies between modelled and measured TBs is important, as these can affect the estimation of geophysical variables and TB assimilation in operational models, as well as result in misleading validation studies.
When comparing the surface-soil moisture of the models with the product derived operationally by ESA from SMOS observations similar results are found. The spatial correlation over the IP between SMOS and ORCHIDEE SSM estimates is poor (~ 0.3). A single value decomposition (SVD) analysis of rainfall and SSM shows that the co-varying patterns of these variables are in reasonable agreement between both products. Moreover the first three SVD soil moisture patterns explain over 80% of the SSM variance simulated by the model while the explained fraction is only 52% of the remotely sensed values. These results suggest that the rainfall-driven soil moisture variability may not account for the poor spatial correlation between SMOS and ORCHIDEE products. Other reasons have to be sought to explain the poor agreement in spatial patterns between satellite derived and modelled SSM.
This presentation will hopefully contribute to the discussion of how SMOS and other observations can be used to prepare, carry-out and exploit a field campaign over the Iberian Peninsula which aims at improving our understanding of semi-arid land surface processes.