Pattern and frequency of topsoil saturation as an indicator for the storage function of agricultural soil profiles

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Within the last four decades significant advances, simultaneous on the development of remote sensing sensors and on data interpretation techniques, lead to improved and reliable results in the field of soil moisture retrieval from microwave data. Unfortunately most of these studies are focused on the retrieval of top (X- and C- band microwave) or shallow soil layers (L-band) water content. Some authors also use this information as input data or for adjustment of hydrological models. Only a very few studies are known, that take benefit from the potential of microwave data to map the spatiotemporal variation in topsoil water content or to identify regions with deficits in infiltration capacities that are frequently prone to waterlogging. These information layers have the potential to get converted in spatial indicators for the assessment of the distributive hydrological function of soils within agricultural landscapes.

For our investigations we employed six semi-homogeneous data series for the spring season of the year 2004 respective 2005 composed out of 29 SAR-scenes from the microwave instruments on board of European satellites ERS2 and ENVISAT. Both are operating on C-band. Except of one series only VV-polarisation was used. Caused by view angles varying between data series, differences in soil roughness (ploughed or harrowed), topographic effects and the evolution of vegetation during the campaigns, soil moisture was on information between others. Hence advanced statistical techniques like principal component analyses (PCA) to recover soil moisture information out of the datasets had to be employed.

Results permit the identification of areas with different behaviour concerning infiltration of precipitation and generation of overland flow. Combined with soil maps it should also be feasible to indicate if local affinities to the generation of runoff are natural or man made (soil compaction). Altogether this information can be used to assess the local health of soils or to assist the development of sustainable and adapted practices for agriculture and water management within the investigated landscapes.