Planning of a Large-scale Soil Moisture Network for the Validation of Remotely-sensed Surface Soil Moisture Data from the L-band Passive Microwave Radiometer SMOS: Skjern River Catchment, Western DK

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Hydrological models are important for the assessment of water resources especially under a changing climate. Currently however, problems exist with closure of the water balance at catchment scale – the scale on which sustainable water management strategies should be addressed. One of the major uncertainties is soil moisture, a key variable which is difficult to assess due to its pronounced scale-dependent spatial and temporal variability. Thus, there is an urgent need for the acquirement of global soil moisture data. The passive L-band microwave radiometer SMOS (foreseen launch in Nov. 2009) is promising to deliver continuous large-scale soil moisture data which, when downscaled and assimilated into hydrologic models, has the potential to ameliorate these models. However, the data first needs to be calibrated and validated and the planning of such activities is presently ongoing in all parts of the world. One such validation site is situated in the Skjern River Catchment in Western Denmark. Two interesting characteristics distinguish this area from other SMOS validation site – its short distance to the coast line in two directions and the very sandy soils. At present, the catchment is broadly investigated through the Danish Hydrological OBservatory and Exploratorium (HOBE). Within this project an airborne campaign with the passive L-band microwave radiometer EMIRAD is planned for spring 2010 to acquire soil moisture data at intermediate scale (ca. 500 – 1000 m spatial resolution) and support the SMOS validation activities. Furthermore, the installation of a soil moisture network designed to provide in-situ soil moisture data feasible for upscaling and comparison with SMOS soil moisture data at large scale is currently ongoing. The final network will consist of 3 individual measurement clusters of 10 data loggers holding 5 sensors each (Decagon ECH_2O), operating in wireless mode within an approximate extent of 6 km, respectively. Before the actual installation, thorough planning on suitable network locations has been conducted according to the following steps: (1) choice of one SMOS pixel to be validated (ca. 44 x 44 km), (2) detection of potential areas for the 3 network clusters within the selected SMOS pixel and (3) placement of the 10 loggers within each respective cluster. In planning steps (1) and (2) the SMOS measuring principle was taken into consideration, while in step (3) an analysis was carried out to locate the most representative combinations of predominant environmental conditions and their respective fractions within the selected SMOS pixel. Analyzed data included information on land use, top- and subsoil types, whereas topography in the area is homogeneously flat and thus assumed to be negligible. Combining these environmental parameters revealed a small number of new classes all together covering over 80 % of the selected SMOS pixel. The plan is now to distribute the available loggers of the network within these representative classes taking their individual fractions into account. In the following this theoretical analysis has to be checked in the field to decide on the final network locations. Furthermore, practical issues (installation permission, sensor removal during agricultural practice, etc.) need to be tackled. By considering the SMOS measuring principle and prevailing environmental conditions of the area already in the planning of the soil moisture network, we hope to be able to acquire valuable in-situ measurements fulfilling the requirements for feasible SMOS validation, and thus being a supporting step towards the urgently needed clarification of the behavior of soil moisture at catchment scale.