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ASCAT soil moisture validation with in situ data: comparing the suitability of permanent and temporary sensors

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Soil moisture (SM) is defined as the amount of water that is stored in the soil. It is one of the most important variables influencing land surface processes such as runoff, subsurface flow and infiltration. It is moreover directly linked to vegetation condition and consequently influences agricultural productivity, forestry and ecosystem health [1][2].

Remote sensing has proven to be a valuable tool for monitoring SM at different spatial scales. Satellite-based SM retrievals are used in numerous applications, e.g. numerical weather prediction, runoff prediction and climate models, and are often calibrated and validated based on in situ SM measurements. Those measurements are commonly done using sensors that are installed in the region of interest, either individually or grouped in networks. Since footprints of spaceborne microwave sensors used for SM retrieval usually cover areas of a few hundreds of square kilometers, validation networks should be designed such as to best represent the footprint. Consequently, stations are often placed at different topographic, hydrologic and land cover conditions. However, due to logistic reasons, stations are usually installed on permanent grasslands or at field boundaries. SM measurements from inside agricultural fields are only rarely available, although those areas may dominate the satellite footprint and can be assumed to experience different hydrologic conditions due to regular soil cultivation activities.

In the Hydrological Open Air Laboratory (HOAL) in Petzenkirchen (Austria), soil moisture is measured in an agricultural catchment. Two types of stations are maintained: around 20 stations are installed permanently in grasslands or at field boundaries. Furthermore, 11 stations are installed temporarily inside fields. Those stations are taken out and reinstalled according to tillage and planting. All of the stations cover different topographic conditions [3].

In this study, we carried out a comparison of the permanent and temporary SM sensors for the years 2014-2017. We analyzed how the different sensors react to precipitation events and what drying characteristics they show. Moreover, satellite SM observations from the Advanced Scatterometer (ASCAT) [4][5] were compared to the in situ data. The results of this study are beneficial for the design of future SM networks and help to better understand dynamics in situ SM data when using it for the validation of satellite SM.

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