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Soil moisture on Polish territory - comparison of satellite and ground-based measurements

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Assessment of water resources due to changing climatic conditions in time and space is still very uncertain. The territory of Poland has a limited resource of waters, occasionally resulting in small agricultural droughts. From the other side intense rainfalls, floods or run-offs, causing soil erosion are observed. Therefore, it is important to predict and prevent of this adverse phenomena. Huge spatial variability of soil moisture does not allow for accurate estimation of its distribution using ground-based measurements. SMOS soil moisture data are quite much inherently consistent in time and space, but their validation is still a challenge for further use in the climate and hydrology studies. This is the motivation for the research: to examine soil moisture from SMOS and ground based stations of the SWEX network held over eastern Poland. The presented results are related to changes of the soil moisture on regional scales for Poland in the period 2010-2013. Some results with SMOS L2 data are extended on continental scales for Europe. Time series from ground and satellite SMOS data sources were compared by regression methods. The region of Poland indicates clearly some genetic spatial distributions in weekly averaged values. In continental scales, the country territory contrasts evidently to Lithuania and in Polesie, and indicates seasonal cycling observed in archives and well known traditional records. The central part of Poland is repeatedly susceptible on droughts with soil moisture values ranging from about 0.02 to 0.20 m3 m-3. SMOS data allows on creating systematic drought data for Poland and watching annual changes, and differences to other drought services kept on national scales for agricultural purposes. We bound that drought susceptibility to the content of sand clay components and the land use there. Lack of rainfall in the late 2011 summer, caused a significant deficit of water in soil moisture content (below 0.05 m3 m-3) throughout the entire country except the estuaries of great rivers Odra and Vistula. Like other authors, we have noted significant biases in SMOS soil moisture. However, general trends and their dynamics in SM values are in good agreements of SMOS to SWEX_Poland network stations. It was shown that the SMOS satellite measurements are consistent and reliable, so can be used to detect areas of dry and moist soil. In Poland, the trends indicating the agricultural droughts and floods are depicted by SMOS L2 very well. In near future, SMOS L2 (and further products) are going to be used on regional studies related to the ELBARA Penetration Depth experiment and planed a Sentinel 1 supersite in Poland, with special focus on Polesie, which is unique wetland in Poland and Ukraine.

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