



A Precipitation Radar and Soil Property based Soil Moisture Proxy

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The effects of different soil moisture states on the environment and climate system are well known. General hydrological processes like runoff generation heavily depend on this essential climate variable. Therefore, exact knowledge on state and development of this variable is crucial for a wide range of applications. However, gridded soil moisture products' temporal resolution mostly is limited to daily data sets. E.g., Soil Moisture and Ocean Salinity (SMOS) or the Soil Moisture Active Passive (SMAP) Mission's products actually recorded by the instrument are of daily resolution, whereas the 3-hourly Level 4 data is the output of a land surface model. In contrast, measurements of precipitation, which is the main driver for soil moisture, are available at sub-daily temporal resolution. Precipitation radar stations even have sub-hourly sampling rates that allow detection of short precipitation events.

This study presents a simple soil moisture proxy derived from an hourly precipitation radar product. The aim is to take advantage of the high detection rate and finer temporal (and spatial) resolution of the precipitation measurements compared to existing gridded soil moisture products. The proxy is based on the German RADOLAN weather radar dataset with intensity, spatial and temporal resolution of 0.1 mm, 1 km and 1 hour respectively. In particular, for the retrieval of soil moisture an Antecedent Precipitation Index is calculated from the precipitation data. This index uses a dampening coefficient to simulate the dry-down period in-between precipitation events. Empirical values in dependency of different soil properties control the dampening factor. The index is compared to soil moisture measurements at the Munich North Isar test site, where soil properties, soil moisture and other environmental variables were recorded in an extensive field campaign 2017 and 2018. Furthermore, the portability of the results to other regions is evaluated using measurement data from the International Soil Moisture Network (ISMN) sites.