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Downscaling SMOS with Sentinel-1 data – an example from West Denmark

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Soil moisture is an important component of the hydrological cycle. The amount of water stored in the unsaturated zone is related to evapotranspiration, infiltration and surface water flow and hence soil moisture is an important variable for estimating groundwater recharge. These estimates are of great value for calibration and validation of hydrological models that serve as tools for groundwater management.
Soil moisture is variable in time and space and through scales. In this study, we combine high resolution Sentinel-1 data with coarse resolution SMOS data to downscale satellite retrieved soil moisture to catchment scale. The radiometric SMOS data relates to soil moisture and has a resolution of 40km. The high resolution radar backscatter from Sentinel-1 reflects the spatial heterogeneity of soil moisture. A linear relation between the radiometric retrieved soil moisture and radar backscatter is assumed with parameters that relate to the spatial heterogeneity. These parameters can be estimated using time series.
We apply this approach to an area in West Denmark. In the investigation area, three different kinds of vegetation cover are present: forest plantation, heathland and farm land. Ground-based observations of catchment- and point-scale soil moisture derived with the cosmic-ray method and probes are used to validate the downscaled data.