Analysis of below forest soil moisture times-series data and Sentinel-1 C-band radar backscatter

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Biomass retrieval from SAR is one of the main applications of radar remote sensing. Different sensor configurations have been tested in recent years. They are ranging from single polarization SAR data to fully polarimetric and tomographic SAR data sets either at one radar band or at different radar bands. However, it must be said that especially fully polarimetric or multi-band sensors are mostly limited to experimental campaigns. Operational space borne SAR missions offer SAR data at one radar band with mostly on like (HH/VV) and one cross-polarization (HV/VH).

Algorithms to retrieve biomass information from these data sets comprise simple regression models as well as sophisticated semi-theoretical radar backscatter models. Since the 1990s, SAR data were regularly acquired by the space agencies (ESA, JAXA, CSA). Latest with the advent of the ESA SAR sensors using the ScanSAR technique (ENVISAT mission with the ASAR instrument and the Copernicus Sentinel-1 satellite series with the C-SAR instrument), C-band data coverage of land surfaces increased substantially. Thus, multi-temporal to hyper-temporal data sets became available. They have been exploited successfully for biomass mapping from regional to global scales using change detection methodologies.

Even the SAR data acquired by the latest SAR sensors are still containing ambiguous information. Besides the geo-physical variable of interest (e.g. biomass), other environmental factors may have an influence on the backscattered signals. Soil moisture is one of these environmental factors. There are authors, who assume that even at C-band (radar band used by ESA SAR satellites since the 1990s) the water content of the soil layer below forests may have an effect on the radar backscatter at C-band.

Since 2015, the Department of Remote Sensing at the University of Jena maintains a measurement network with 240 sensors measuring soil moisture and soil temperature in a managed forest in Thuringia, Germany. In parallel, all Sentine-1a and b data sets acquired over the region are collected. Additional meteorological information will be used for data interpretation and analysis. We intend to present the results of our ongoing research activities and try to answer the question, if an influence of soil moisture below forest on C-band radar backscatter has been found for our test site region. This may also help with the interpretation and analysis of biomass maps produced by the ESA DUE GlobBiomass and the ESA CCI Biomass projects, where the department has been and is involved.