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Monitoring drought impact on vegetation with Sentinel-1

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With the Copernicus Sentinel-1 series, for the first time high temporal and spatial resolution backscatter time series have become available. Sentinel-1 backscatter observations are sensitive to changes in water content and structural changes in vegetation and soils and provide complementary information next to optical remote sensing datasets such as Leaf Area Index. However, most studies have looked at the sensitivity of Sentinel-1 backscatter to vegetation water dynamics at very local scale. Furthermore, no specific focus has yet been on monitoring drought impact on vegetation with Sentinel-1. Here we will present results of a study over Europe which assesses the potential of Sentinel-1 to monitor drought impact on vegetation.

In this study we use the record summer drought of 2018 as a case study. This drought led to decreased yields in northwestern Europe, and to decreased GPP in for example grasslands and forests (Fu et al., 2020). We have calculated anomalies of co-, and cross-polarized backscatter, and the ratio thereof, the so-called cross-ratio (CR) of 2018 with the reference year of 2016 which had normal conditions. These anomalies were compared to anomalies calculated with Copernicus Global Land Service LAI anomalies and ESA CCI soil moisture anomalies and analyzed per land cover type. The results show very strong negative anomalies in VV, VH backscatter and CR from June to November over central and northwestern Europe, similar to those observed in LAI. However, differences in patterns can be seen between LAI and CR, especially over forest areas. Although LAI showed stronger anomalies in the Netherlands and western Germany in July, CR shows stronger anomalies in eastern Germany and Czech Republic, and especially over forests. These differences in patterns may be related to the penetration depth of microwaves, and the sensitivity to vegetation water content of the above ground biomass.