Title

Assessing the Potential of Spatial SAR Data in the Biomass Proxy: A case study on agricultural fields in the Netherlands

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Abstract

Providing farmers with the tools to monitor their crops continuously and reliably can aid the scaling of global food production to meet the ever-growing demand. The optical Normalised Difference Vegetation Index (NDVI) is commonly used to monitor crop greenness as an indicator for biomass, but it is limited by clouds and signal saturation. Synthetic Aperture Radar (SAR) imagery, which is not hampered by clouds, can be used to complement the NDVI. The Biomass Proxy (BP) combines the NDVI and SAR data, but spatial biomass estimations still strongly depend on the NDVI and therefore face the same limitations.

This study aims to assess the potential value of spatial SAR data to approximate the in-field biomass distribution. The SAR signal from Sentinel-1 and the NDVI signal from Sentinel-2 were analysed temporally and spatially for fields of maize, barley, oat, and spring wheat in the Dutch province of Flevoland. It was assumed that consistent SAR patterns in the spatial signal correspond to biophysical changes in the monitored crops. A framework to detect these patterns and include them in the BP was created based on combining cluster detection with spatial autocorrelation. The components of this framework demonstrate that backscatter intensity, phenological stage and crop type influence the probability of consistent patterns and that consistent patterns could not be observed from the spatial NDVI signal. Moreover, it was found that the BP's sensitivity to the input signals depends on crop type. With the knowledge of when and where consistent patterns occur, targeted research can be done to understand the spatial SAR signal better and, thereby, optimally use all available information.