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# Sentinel-1 backscatter sensitivity to vegetation dynamics at the field scale.

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Vegetation monitoring is pivotal to improve our understanding of the role vegetation dynamics play in the global carbon-, energy- and hydrological cycle. And with the increasing stress on food supply due to the growing world populating and changing climate, vegetation monitoring is of great importance in agricultural areas. By closely tracking crop conditions, droughts and subsequent crop losses could be mitigated. Sensors operating in the microwave domain are sensitive to several surface characteristics, including soil moisture and vegetation. Hence, spaceborne microwave remote sensing provides the means to monitor vegetation and soil conditions on different scales, ranging from field scale to global scale. However, it also presents a challenge since multiple combinations of soil and vegetation characteristics can lead to a similar measurement. Copernicus Sentinel-1 (S-1) is a series of two satellites, developed by the European Space Agency (ESA) , which carry C-band Synthetic Aperture Radars. The C-SAR sensors provide VV, HH, VH and HV backscatter at a 5 m by 20 m spatial resolution. The temporal revisit time of the two satellites is 3-6 days. With their unique capacity for temporally dense and spatially detailed data, the S-1 satellite series provides for the first time the chance to investigate vegetation dynamics at high temporal and spatial resolution.

The aim of this study is to assess the sensitivity of Sentinel-1 backscatter to vegetation dynamics. The study is performed in the Hydrological Open Air Laboratory (HOAL), which is a 66 hectare large catchment located in Petzenkirchen, Austria. In the HOAL several vegetation parameters were measured during the course of the growing season (2016) at the overpass time of S-1a. Vegetation height was obtained ten times for the whole catchment, using georeferenced photos made by a motorized paraglider and a Land Surface Model. In addition, vegetation water content, Leaf Area Index and soil moisture were measured in four different cropfields. An in situ soil moisture network provides continuous soil moisture measurements at 31 locations within the catchment.
Different polarizations and ratios thereof were calculated and compared, both spatially and temporally, to the in situ measurements of vegetation height, LAI, vegetation water content and soil moisture. Preliminary results show a clear spatial pattern in cross-polarized backscatter, which is related to different crop types. Time series analysis suggests that a ratio between cross- and co-polarized backscatter is affected by both vegetation water content and vegetation structure. This presentation will provide a comprehensive assessment of Sentinel-1's capability for monitoring of vegetation over croplands, using in situ reference data obtained over a full growing season.