Geophysical Research Abstracts
Vol. 16, EGU2014-5974, 2014
EGU General Assembly 2014

Using the SnowScat instrument to investigate the influence of canopy water dynamics on backscatter from maize.

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In this study, we investigate the potential to monitor canopy water dynamics using high (9-18GHz) frequency scatterometry. SnowScat was developed by Gamma RS (Switzerland), and is a ground-based fully polarimetric, coherent stepped-frequency, continuous wave scatterometer that operates in the range 9-18GHz. Every winter since 2009, it has been deployed in Sodankylä(Finland) to investigate the potential use of scatterometry to measure snow mass and structure, grain size and type, as well as snow pack morphology. The proposed study is its first deployment in an agricultural setting.

From July to September 2013, SnowScat was installed on a tower above a maize canopy in Flevoland in the Netherlands. The objective of the field campaign was to characterize the backscatter response of vegetation in response to natural variations in moisture availability. The full frequency range was swept every hour and data were collected for all polarizations, for five azimuth and five elevation angles. The azimuth angle was varied from perpendicular to almost parallel to maize row direction. Elevation angle was varied from 30 to 70 degrees in increments of 10 degrees. A HOBO weather station was installed to measure precipitation, solar radiation, wind speed and direction, relative humidity and air temperature. Vegetation stage, structure and geometry were monitored weekly. Destructive vegetation sampling and dielectric property measurements were used to monitor canopy water content. The soil moisture profile was monitored at two locations, and a hand-held probe was used for regular surface soil moisture measurements. Ancillary data include soil and canopy temperature profiles as well as NDVI.

Here we present a review of the meteorological and hydrological conditions during the experiment, and a description of their influence on soil and canopy geometry, water content and dielectric properties. Finally, we analyze the impact of soil and canopy characteristics on backscatter as a function of frequency, polarization, and azimuth and elevation angles.