THE SENSITIVITY OF MULTIFREQUENCY (X, C AND L-BAND) RADAR BACKSCATTER SIGNATURES TO BIOLOGICAL VARIABLES OVER CORN AND SOYBEAN FIELDS

X. Jiao[*a] H. McNairn[a] J. Shang[a] E. Pattey[a]

[a] Agriculture and Agri-Food Canada, research branch, 960 Carling Avenue, Rm. 4135Q, K1A 0C6, ottawa, Canada

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ABSTRACT:

The objective of this study is to investigate the sensitivity of synthetic aperature radar (SAR) backscatter signatures to crop biological variables. The study was based on a comprehensive data set collected over corn and soybean fields in eastern Ontario (Canada) during the 2008 growing season. The data consisted of TerraSAR-X dual-polarized stripmap data (X-band), RADARSAT-2 Fine beam quad-polarized data (C-band) and ALOS PALSAR dual-pol data (L-band). A wide range of plant variables, such as leaf area index (LAI), destructive biomass, canopy height and surface volumetric soil moisture were measured to coincide with remote sensing acquisitions and key phenological growth stages. Analyses were conducted based on statistical correlation and a simple backscatter process model (the water cloud model). The results of this study show that for both corn and soybean, C-band cross-polarization (HV) was best correlated with LAI; backscatter increased with increasing LAI until LAI reaches 4 m2/m2. Beyond this value, the backscatter was no longer sensitive to LAI. When LAI was smaller than 1 m2/m2, it was affected by both soil moisture conditions and leaves. Once LAI exceeded 1 m2/m2, the soil contribution was negligible. The backscatter signatures were affected by radar frequency and polarization. This study explored the interaction of multi-frequency backscatter with the crop canopy in order to quantify the relationship between backscatter and crop biological variables.

TOPIC: Microwave remote sensing
ALTERNATIVE TOPIC: Remote sensing applications