

An investigation of multi-sensor radar backscatter sensitivity to spring thaw dynamics with respect to landscape complexity

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We investigate radar backscatter characteristics as measured by ERS (C-band, VV polarization, 200m resolution) and JERS-1 (L-band, HH polarization, 100m resolution) Synthetic Aperture Radars (SARs) during spring thaw transitions in boreal landscapes for three regions in Alaska and Canada. We perform multi-scale analyses to assess trade-offs in spatial and temporal resolution between these SARs and spaceborne scatterometer measurements from Quikscat (Ku-band, 25km spatial resolution). We compare the time series SAR and scatterometer data series for available contemporary data. ERS and JERS SAR backscatter characteristics observed during seasonal transitions are examined with respect to landscape complexity, exploring areas of varying landscape and topographic character. An assessment of sub-25 km variability is explored, examining the dynamics in the spring thaw transition occurring at high spatial variability which may not be observable with the lower resolution scatterometer.

We classify the time series radar imagery according to landscape freeze-thaw state, employing a temporal change discriminator based on seasonal differences in backscatter relative to wintertime frozen and summertime thawed conditions. Scaling assessments of the relationship between the SAR and SeaWinds backscatter and derived freeze/thaw state maps provide a means for determining sub-grid spatial variability in land cover, terrain and spring thaw processes, based on semi-variogram analyses.

Results show that JERS and ERS backscatter are sensitive to the spring thaw transitions. However, JERS exhibits a larger transitional dynamic range than does ERS and is more sensitive to varying land cover classes. These findings demonstrate the importance of landscape heterogeneity when considering development of remote sensing techniques for monitoring phenological processes in boreal ecosystems.

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