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**MONITORING SEASONAL CHANGE IN TAIGA FORESTS
USING ERS-1 SAR DATA**

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Sensitivity of radar backscatter to the dielectric and geometric character of forested regions suggests significant changes in backscatter are expected with season due to freezing temperatures, snow, wind, leaf fall and drought. The first European Remote Sensing Satellite, ERS-1, offers a unique opportunity to monitor a complete seasonal cycle for the Alaskan taiga forest ecosystem with synthetic aperture radar. During the 3-day repeat Commissioning Phase of ERS-1, from August 1991 to December 1991, ERS-1 SAR data were collected in the region of Manley Hot Springs, Alaska, along the Tanana River, west of Fairbanks. In parallel with the SAR data collection, meteorological data from three weather stations positioned in three forest stands were collected continuously, along with *in situ* measurements of the dielectric and moisture properties of the canopy and of the ground cover which were collected during each overflight. The *in situ* data were collected in floodplain forest stands dominated by balsam poplar, white spruce, and black spruce.

The largest changes in radar backscatter (about 3 to 4 dB) are detected in early winter as a result of freezing of the soil and vegetation. These changes are explained using radar backscatter models and are due to large changes in the dielectric properties of the soil and vegetation as the trees and the soil freeze. Less dramatic changes in the dielectric properties of the soil and vegetation occur in the summer when periods of warm, sunny, and dry conditions give way to periods of heavy rain showers, and ERS-1 radar backscatter typically drops by 1 to 2 dB during these summer transitions. In winter, dry snow covers the ground and the radar backscatter values increase again by 1 to 2 dB because of volume scattering from large ice crystals forming rapidly in the depth hoar layer. Phenologic changes are more difficult to detect but deciduous trees have a different temporal radar response after leaf fall. Night/day passes reveal large diurnal changes in radar backscatter from the forest during refreezing periods, and negligible variations in winter when day and night air temperatures are similar. Finally, examination of the separability in radar backscatter of the different tree species shows that ERS-1 has only limited capabilities for mapping forest types.

These results from the Commissioning Phase as well as preliminary results from the 35-Day Repeat Phase will be presented.

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