

CHARACTERIZATION OF CANOPY PHYSIOLOGY AT BOREAS WITH SAR

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ABSTRACT

The Boreal Ecosystem - Atmosphere Study (BOREAS) is a multidisciplinary field and remote sensing study the goal of which is to obtain an improved understanding of the interactions between the boreal forest biome and the atmosphere in order to clarify their roles in global change. The two principal BOREAS field sites, both located within Canada, are located in the southern boreal ecotone, encompassing Prince Albert National Park, Saskatchewan, and in the northern boreal ecotone near Thompson, Manitoba. This paper presents research carried out as part of BOREAS to characterize forest ecophysiological processes as observed by the JPL AIRSAR, SIR-C/X-SAR and the ERS-1 SAR.

We have installed automated measurement systems in four different forest stands within the BOREAS field sites. The three stands instrumented in the southern region are dominated by trembling aspen (*Populus tremuloides*), black spruce (*Picea mariana*), and jack pine (*Pinus banksiana*), respectively, while the one stand in the northern region is dominated by black spruce. These stands have each been instrumented with sensors that provide continuous *in situ* monitoring of tree xylem water flux and vegetation tissue and soil temperatures. Since their installation in the autumn of 1993 and winter of 1994, these sensors have provided a continuous record of vegetation hydrologic activity. In addition, since April 1994, three of these stands have been instrumented for continuous monitoring of dielectric constant within the hydroactive tissue of a single tree trunk.

During the 1994 Spring Thaw Focused Field Campaign, we obtained additional *in situ* measurements including detailed dielectric profiles of the trunks from selected trees at each site, as well as diurnal water potential observations and porometry. Synthetic aperture radars (SARs) have been imaging these sites while *in situ* data collection has been underway. Imagery has been obtained by sensors including SIR-C/X-SAR, AIRSAR and ERS-1 SARs.

The ground-based *in situ* observations are examined to establish the physiologic state of the forest canopies. SAR imagery is examined to determine the response of the radar backscatter to the observed canopy physiology. Comparisons are made between stands in the southern test site and also along the north-south gradient between the northern and southern sites. Data derived from the ground-based measurements are used in concert with the SAR imagery to examine the radar response to canopy physiological state as related to such issues as vegetation freeze/thaw state and growing season length.

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