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Session B: Biogeosciences

for Poster Presentation

Application of Spaceborne Synthetic Aperture Radar to Monitoring Seasonal Ecological and Hydrologic Processes in Boreal Forest

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Freeze/thaw transitions in boreal landscapes drive critical dynamics in ecosystem and hydrologic activity. A capability for accurate, repeated, and reliable monitoring of landscape freeze/thaw dynamics would improve our ability to quantify the interannual variability of boreal hydrology and river runoff/flood dynamics and to assess the period of photosynthetic activity in boreal and arctic ecosystems, thus improving estimates of annual carbon budgets and of the interannual variability of regional carbon fluxes. Results from BOREAS experiments have indicated that the boreal forest has a net annual carbon flux near zero. A first step in assessing and monitoring year-to-year changes in the boreal carbon flux is to determine the annual variation in growing season length. We apply imagery from the ERS spaceborne Synthetic Aperture Radars (SARs) to estimate landscape freeze/thaw dynamics over selected areas of the BOREAS region of Canada. A temporal series of freeze/thaw maps are derived that provide fractional estimates of frozen and thawed landscape. The inferred landscape freeze/thaw state is validated against temperature measurements obtained from a distributed temperature monitoring network and from meteorological observations. We examine the relationships of radar-estimated thaw patterns with topography and landcover. SAR-derived timing of spring thaw is compared with initiation of streamflow. Ecological process models are used to estimate Net Ecosystem Exchange (NEE) and Net Primary Productivity (NPP) on the landscape scale. Model results are compared with timing and spatial distribution of freeze and thaw events. As the timing of spring thaw is a major factor influencing the net annual carbon flux, we seek to incorporate the radar-based measure of landscape freeze/thaw dynamics as direct input to ecological process models to provide a capability for improved ecosystem carbon flux estimates at regional scales using spaceborne radar.

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