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Radar-Based Measure of Interannual Vegetation Phenology for Monitoring Global Change Responses of Vegetation

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Recent results from the BOREAS indicate the boreal forest has a near net zero annual carbon flux -i.e., carbon intake through photosynthesis nearly balances carbon release through respiration. A change in temperature due to global warming may upset this balance in either direction. Keeling et al. (1996) recently reported an observed phase advance in their measured seasonal atmospheric CO_2 cycles suggesting a lengthening of the growing season. Jacoby et al. (1 996) report wide annual growth rings in the last century in 450 year old Siberian pine trees-another indication of a lengthening of high latitude growing season. A first step in assessing and monitoring year-to-year changes in the boreal net carbon flux is to determine the annual variation in growing season length.

In this project, we are integrating maps of the freeze/thaw state of the boreal forest landscape derived from spaceborne imaging radar observations with local and regional scale carbon flux models over a period of years to determine the interannual variability in growing season length. Our initial objective is to assess the utility of using radar-derived freeze/thaw state as a surrogate for growing season length, and a long term monitor of variations in growing season length relating to climate change within the global boreal forest, These results should improve our understanding of site morphologic, terrain, and latitudinal effects on freeze/thaw status which should improve our ability to predict regional carbon exchange processes. We are obtaining multi-temporal ERS-1 and ERS-2 imagery of north-south transects in the North American and Eurasian boreal forests. From these data, landscape freeze/thaw state are being inferred by monitoring shifts in backscatter relative to winter frozen conditions. The inferred landscape freeze/thaw state is being validated against temperature measurements obtained from a distributed temperature monitoring network and from meteorological observations located along the transects. A local scale model is being used to develop the relationship between freeze/thaw and ecosystem carbon flux, and a regi onal scale model is usi ng the freeze/thaw state as input to estimating regional carbon flux. As a final step, multi year estimates of annual boreal carbon flux will be determined using growing season periods derived from imaging radar.

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