

The Center for In Situ Exploration and Sample Return (CISSR)
Speaker Series

presents

Speaker: Kyle McDonald

Topic: In Vivo Biophysical Measurements for Application
to Radar Studies of Forest Ecosystems

CORRECTED Date: Friday, May 24, 2002

Time: 1:30 - 3:00 p.m.

Location: JPL Bldg. 306-302

Abstract:

The importance of boreal regions in regulating regional and global carbon cycles is becoming well established. The annual duration of frost-free period bounds the period of photosynthetic activity in boreal landscapes, thus affecting the annual carbon budget and the interannual variability of regional carbon fluxes. Recent evidence also indicates that these regions are quite sensitive to subtle changes in climate, producing measurable changes in energy and trace gas exchanges with the atmosphere and feedbacks with regional and global climate. As radar backscatter is sensitive to the dielectric properties of the scattering medium, and the dielectric properties of moist media change dramatically with freeze-thaw state, radar offers a unique opportunity to monitor growing season length in the boreal zone from spaceborne platforms. Moreover, field experiments have demonstrated that varying degrees of correlation exist between vegetation dielectric properties and vegetation water status. Thus, it may be possible to couple radar measurements of forest canopies to vegetation water status via the vegetation dielectric properties. Knowledge of actual vegetation transpiration, canopy water conductance and xylem water potential provide essential information for estimating carbon, water and energy budgets, and water availability. The possibility for direct measurement of these parameters for large

plant communities by remote sensing techniques would close a gap in our ability to provide essential input parameters for characterizing water relations and canopy carbon budgets in ecology.

To investigate the linkages between biophysical processes in boreal forest, the environmental controls driving them, and landscape radar backscatter response, Kyle McDonald and his team have conducted a variety of field experiments examining vegetation function and potential linkages to radar backscatter. This has included the establishment of a network of eight monitoring stations along a north-south transect across Alaska. The Alaska Ecological Transect (ALECTRA) extends from the Brooks Range in the north, through Alaska's central Interior, to the Kenai Peninsula in the south. Station locations have been chosen to represent a variety of landscape and growth conditions. At these stations, the team monitors vegetation component, soil, and air temperatures, and xylem sap flux in several individual trees. They have also investigated the relationship between vegetation water status and dielectric constant, both along ALECTRA and as part of other field studies. During this talk, Kyle will discuss the design and implementation of the instrumentation, and he will present the measurement results. He will also discuss the utility of these measurement suites for interpretation of vegetation biophysical processes and its linkage to spaceborne radar measurements.

Biography:

Kyle McDonald is a Research Scientist in the Terrestrial Science Research Element (Sec. 3242) of JPL's Earth and Space Science Division. He received a Bachelor of Electrical Engineering degree from the Georgia Institute of Technology in 1983, an M.S. in numerical science from Johns Hopkins University in 1985, and an M.S. and Ph.D. in Electrical Engineering from The University of Michigan, in 1986 and 1991, respectively. He joined JPL upon graduation in 1991. His present research activities involve application of microwave remote sensing techniques for monitoring seasonal dynamics in boreal ecosystems, as related to ecological and hydrological processes. He has been a Visiting Scientist at the Bayreuth Institute for Terrestrial Ecosystem Research (BITÖK), University of Bayreuth, Germany, and is Faculty Affiliate at the University of Montana Flathead Lake Biological Station, Polson, Montana. Kyle has been a Principal and Co-Investigator on numerous NASA Earth Science Enterprise investigations. He has been a BOREAS science team member, an NSCAT/ADOES instrument team member, and he is an Ocean Vector

Winds Science Team member. He is a member of the NASA Cold Land Processes (CLP) Steering Committee and the NSF's Arctic-CHAMP Science Steering Committee.

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