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Title: NASA 1990 Multisensor Airborne Campaigns (MACs) for Ecosystem and Watershed Studies

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The Multisensor Airborne Campaign (MAC) focus within NASA's former Land Processes research program was conceived to achieve the following objectives: 1) to acquire relatively complete, multisensor data sets for well-studied field sites, 2) to add a strong remote sensing science component to ecology-, hydrology-, and geology-oriented field projects, 3) to create a research environment that promotes strong interactions among scientists within the program, and 4) to more efficiently utilize and compete for the NASA fleet of remote sensing aircraft. The successes of the first MAC, the 1989 Geologic Remote Sensing Field Experiment (GRSFE), were reported on at the last Airborne Geoscience Workshop. Four new MACs were conducted in 1990: 1) the Oregon Transect Ecosystem Research (OTTER) project along an east-west transect through central Oregon, 2) the Forest Ecosystem Dynamics (FED) project at the Northern Experimental Forest in Howland, Maine, 3) the MACHYDRO project in the Mahantango Creek watershed in central Pennsylvania, and 4) the Walnut Gulch project near Tombstone, Arizona.

The OTTER project is testing a model that estimates the major fluxes of carbon, nitrogen, and water through temperate coniferous forest ecosystems. The focus in this project is on short time-scale (days-year) variations in ecosystem function. Four intensive field campaigns (IFCs) were conducted in 1990 to capture the seasonal variability along the transect. Data from the following airborne sensors were acquired in at least one of the IFCs: Daedalus Airborne Thematic Mapper, Airborne Visible-Infrared Imaging Spectrometer (AVIRIS), Advance Solid-state Array Spectrometer (ASAS), Airborne Synthetic Aperture Radar (AIRSAR), Airborne Tracking Sunphotometer (ASTP), Thermal Infrared Multispectral Scanner, NS-001 thematic mapper simulator (TMS), the Fluorescence Line Imager (FLI), and the Compact Airborne Spectrographic Imager (CASI). A novel component of the project was the use of an ultralight aircraft carrying several spectrometers for low altitude remote sensing. The Pilot Land Data System is being used to receive, archive, and distribute OTTER aircraft data to project participants. Much of the field data for OTTER is being archived at OSU in cooperation with the NSF Long-Term Ecological Research (LTER) program.

The FED project is concerned with modeling vegetation changes of forest ecosystems using remotely sensed observations to extract biophysical properties of forest canopies. The focus in this project is on long time-scale (decades to millenia) changes in ecosystem structure. The first FED IFC was conducted in September, 1990, and another is planned for June, 1991. Data from the following airborne sensors are being acquired: ASAS, AVIRIS, AIRSAR, NS-001 TMS, TIMS, ASTP, Push-Broom Microwave Radiometer (PBMR), and Electronically Scanned Thinned Array Radiometer (ESTAR). A helicopter mounted with spectrometers, the Airborne Laser Polarimeter System (ALPS), and a scatterometer was used for low altitude remote sensing. A geographic information system (GIS) will be used to integrate of all these data sets.

The MACHYDRO project is studying the role of soil moisture and its regulating effects on hydrologic processes. The focus of the study is to delineate soil moisture differences within a basin and their changes with respect to evapotranspiration, rainfall, and streamflow. The emphasis will be on measurements of soil moisture in a spatial and temporal context by using a combination

of *in situ* and remote sensing techniques in a small basin in Pennsylvania. The usefulness of AIRSAR and passive microwave radiometers for measuring the distribution and changes in soil moisture are being assessed. A combination of remotely sensed and traditional point measurements of hydrologic variables are used in conjunction with distributed hydrologic model(s) in two different ways: 1) to use these data as input to the model(s) to close the water balance equation; or 2) to compare model simulation results (i.e. soil moisture) with remotely sensed estimates.

The Walnut Gulch project is focused on the effects of soil moisture on the energy and water balance of arid and semiarid ecosystems and their feedbacks to the atmosphere via thermal forcing. The main objective of this study is to assess the usefulness of multispectral remotely sensed data in providing estimates of surface soil moisture, albedo, and radiative temperature at different spatial and temporal scales that can be used in conjunction with simple process-based hydrologic models for studying the land-surface-atmosphere exchange in these ecosystems. Measurements of land-surface and atmospheric properties were obtained with the aid of ground-based and airborne sensors over a three week period during the "monsoon" season in Arizona. These data sets will be distributed among the participating scientists for further analysis.

The 1990 MACs have produced some of the most complete airborne multisensor data sets ever assembled for ecological and hydrological research. Once they are suitably prepared for analysis and quality controlled, these data sets will be made available to the scientific research community through PLDS and other agency data systems. It is hoped that these data will be used by many scientists outside of the projects which generated them to better understand the biophysics of remote sensing, to simulate EOS data, and to begin the sorts of Global Change analyses that will be done with EOS data.