HMF-Geophysics

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There is growing awareness within the hydrologic community of the role that geophysical methods can play in studying the near-surface of the earth. In parallel, there is growing interest within the geophysics community in using geophysical methods for hydrologic applications. The goal of HMF-Geophysics, over the time period Sept 05 - Sept 08, is to put in place the infrastructure needed to develop and maintain partnerships between the hydrologic and geophysical communities. This will advance the use of geophysical methods for advancing hydrologic science.

We are in Year 2 of a 3-year pilot project to develop a working model for HMF-Geophysics. Our current model, still in early stages of refinement, involves one central facility and 10 to 20 nodes. In response to a request from a hydrologist working in a watershed, the central facility undertakes the feasibility study required to determine how/if geophysical methods could be of use, and evaluate the science "value-added" of geophysics. Once it is clear that the geophysics can contribute in a significant way to addressing the science questions, the "matchmaking" takes place to form a research partnership between the hydrologist and one or more of the geophysics nodes. The nodes, currently 12 in number, are individuals at universities who have volunteered to be part of HMF-Geophysics by using their equipment, and/or software, and expertise in research partnerships with hydrologists. Under the current model the nodes apply to NSF, in collaboration with CUAHSI, for support for equipment and/or for personnel to assist with the fieldwork/partnerships. Stanford is acting in this pilot phase as the first central facility for geophysics so as to better determine what is needed at the central facility.

As a way of refining the model for HMF-Geophysics, we are seeking to develop partnerships with groups actively engaged in watershed research. This summer saw the successful completion of two such partnership-projects. The first, conducted within the USDA Reynolds Creek Experimental Watershed, ID, saw the application of the electromagnetic induction (EMI) technique in determining soil properties over small watersheds, in association with Scott Jones of the Soil Physics group at Utah State University. Typically, these properties are determined through analysis of aerial photography and pedon description, however, both are limited in this application due to their low resolution. By integrating EMI with directed soil sampling, it was possible to produce a high-resolution map of ground conductivity over the entire 37 ha of the Reynolds Mountain East watershed. Current work is examining the best ways to calibrate these data to predict properties such as water content, clay percentage and saturated hydraulic conductivity.

The second partnership-project, in association with Roy Haggerty's group at Oregon State University, was conducted along Mack Creek in the H. J. Andrews Experimental Watershed, OR. Here the goals of the group are to improve the understanding of the hyporheic zone processes associated with denitrification and to quantify the influence of the hyporheic zone on whole-stream nitrogen cycling. One of the challenges is the inability of direct sampling to delineate the structure of the subsurface, due to both remote location and stream sediment and rock load. The electrical resistivity imaging (ERI) technique provided a means to image the structure of the hyporheic zone and so better constrain subsequent hydrological observations and modeling. A number of 2D resistivity transects were collected within the stream channel. The in-stream nature of these transects along with topographical constraints and fallen trees made for a challenging survey. Current work is aimed at the production of a 3D model of resistivity variations to provide depth to bedrock along the area of interest.

In Year 2, we will be working with a number of the WATERS test-bed projects to determine how/if geophysical methods could assist in meeting the science objectives of the projects.

More details on the activities of HMF-Geophysics, and contact information, are given at our website:
http://hmfgeophysics.stanford.edu

CUAHSI Hydrologic Measurement Facility

Today's technology for tomorrow's hydrologic science discovery

www.cuahsi.org/hmf.html

The goal of the CUAHSI Hydrologic Measurement Facility (HMF) is to facilitate access to advanced instrumentation and expertise to support hydrological sciences (broadly defined) and large-scale research (e.g., Critical Zone Observatories). The effort is organized around three topic areas: water cycle sciences, geophysics, and biogeochemistry. 2005-2008 NSF funding supports needs assessment and pilot service activities in geophysics. In 2006, the HMF submitted an NSF proposal to support activities in water cycle sciences and biogeochemistry. In a parallel effort, the HMF is actively pursuing a methods "Handbook" publication to support hydrologic methods dissemination and successful application.

Recent CUAHSI HMF Milestones

- Community Instrumentation Survey (365 Participants), Fall 2005
  http://www.cuahsi.org/docs/EOS-survey-20060119.pdf

- White Papers Documenting Blue Ribbon Committee Findings, Released May 2006
  http://www.cuahsi.org/hmf/whitepapers.html

- HMF Committee and Blue Ribbon Committee Meeting, May 2006
  Governance Structure and Prioritize Instruments for Pilot Phase Developed

- CUAHSI Executive Committee Meeting and Community Survey, June 2006
  Evapotranspiration and Biogeochemistry Supported for NSF Submission

- CUAHSI HMF Water Cycle and Biogeochemistry Nodes Propoal
  Submitted to NSF Geosciences Instrumentation and Facilities, September 2006

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