

GENERAL SESSIONS

Characterizing Near-Surface Structure and Properties

The use of geophysical methods, for imaging structure and quantifying subsurface properties, offers a degree of subsurface coverage and scale of spatial resolution that are unattainable with more traditional hydrological characterization approaches such as borehole/log analyses and pumping or tracer tests. In this session we will discuss the advances have been made with respect to the use of geophysical methods in this regard, with focus on (i) new forms data acquisition, analysis and inversion to improve the resolution of geophysical images and derived subsurface models; (ii) the development of improved petrophysical relationships between one or more geophysical properties and K; (iii) the exploration of promising “new” geophysical techniques, such as NMR and spectral IP, to reveal information about subsurface properties; (iv) the use of dynamic geophysical data to monitor changes in hydrological state variables, which can then be used within a coupled inversion framework to link to the underlying property distribution; (v) work on the assimilation of multiple geophysical and hydrological data sets, and quantification of the uncertainty in the resulting property estimates. The purpose of this session is to explore the advances that we have made in this domain, specifically with regard to their relevance to the original “big-picture” hydrological needs. Of particular interest is doing this within a framework of uncertainty, such that the results are truly of use to decision-makers for designing effective management or remediation strategies.

Advances in Monitoring and Time-Lapse Imaging of Subsurface Processes

One approach to describing a subsurface process is to develop a subsurface model and then predict the process of interest. An alternate approach is to directly monitor or image the process. Recent advances in data acquisition hardware and software, and in sensor technology, are making it possible to adopt this latter approach in a wide range of settings. In this session we wish to highlight innovative uses of geophysics measurements for monitoring and time-lapse imaging for hydrogeologic applications. We invite presentations that demonstrate new approaches to acquiring, analyzing, inverting, and/or interpreting data, and welcome discussion of the challenge of obtaining data at the required spatial and temporal resolution. We anticipate that presentations will include field studies, laboratory experiments, theoretical and numerical modeling. We ask that all presentations (and abstracts) include a statement of 1) the hydrogeologic application of interest; 2) the significant scientific or technological advancements; 3) the outstanding research questions, and what could be done within our community in order to address them.

Thinking About Scaling Up: Geophysical Methods at the Watershed Scale

Numerous opportunities exist to characterize hydrological processes and state variables over watershed scales, including evapotranspiration, runoff, groundwater recharge and soil moisture, among many others. Development of environmental observatories and their associated instrumentation is accelerating within internationally funded programs, and there’s a critical need to develop new sensors and informatics infrastructure for these larger-scale processes.

Appropriate topics for this session include innovative environmental sensors and sensing systems, sensor networks, cyberinfrastructure to support sensors and data suppliers, and modeling approaches (such as data assimilation) that use the high-frequency and high-density data that environmental observatories promise. Methods that may be appropriate include techniques such as electrical resistivity tomography, electromagnetic induction, ground penetrating radar, near-surface seismics, air- and space-borne methods, and land-monitoring remote sensing platforms, among others. In addition, wireless sensor networks and distributed fiber optic technologies bridge the scales between ground-based measurements and remote sensing platforms. We welcome contributions dealing with the development and application of geophysical and remote sensing techniques and/or associated modeling.

HOMEWORK SESSIONS

The Use of Electrical Resistivity Measurements for Monitoring Subsurface Processes: Quantifying Noise and Uncertainty

The focus of the homework in this session is the characterization of data noise and the uncertainty associated with the inversion of electrical resistivity data. The data set provided includes two lines of Wenner measurements made with electrodes in the base of a recharge pond. The measurements recorded changes in the subsurface conductivity structure during and after a rainfall event prior to filling of the recharge pond; it captures periods of both increasing and decreasing water saturation. The homework: Invert the data, then characterize the measurement noise and/or the uncertainty of the inverted image.

The Ultimate Tomography Bake-Off Challenge Using Boise Hydrogeophysical Research Site Borehole Seismic and GPR Datasets

It is rare that many different investigators independently analyze a single dataset and then compare results to gain insight into uncertainty in solutions, differences in processing algorithms, or variations in petrophysical assumptions. Rarer still are instances when such an effort has been undertaken with field data. This session will focus on borehole-to-borehole, and borehole-to-surface tomographic inversion and will take advantage of the unique control database afforded by the Boise Hydrogeophysical Research Site. We have acquired a coincident seismic and GPR borehole-to-borehole, and borehole-to-surface dataset with a similar geometry and source characteristics selected to produce a similar wavelength in the saturated zone. The data will be available for download from the CGISS web page on November 15, 2011. Participants in this session are invited to download all or any subset of the data and use any preferred method for inversion. The objective will be to produce compressional and/or electromagnetic wave velocity tomograms and porosity distributions. "Control" data will consist of the results of previously analyzed VSP, VRP, and neutron-neutron probe surveys acquired in the two acquisition boreholes and in a coincident interior borehole. Participant's results will be compared with each other and with the "control" data. The objective of the session is not to determine the "right" answer but rather to better understand differences in analysis methods.

Designing the "Perfect" Field Experiment

The focus of this homework session will be to design a realistic hydrogeophysical field experiment for predicting, as accurately as possible, the transport of contaminants in a heterogeneous subsurface aquifer. Participants will be provided with a 3-D, fine-scale, synthetic model of the "true" aquifer hydrogeological properties, along with boundary conditions and the

nature of the source of contamination. They will then be responsible for designing all aspects of the experiment to predict contaminant transport. Any geophysical and/or hydrological method, or combination of methods, can be used. The participants are responsible for both simulating and analyzing the different data sets. Care should be taken to make the experiment realistic, keeping the cost and effort of the data acquisition in mind. Realistic petrophysical relationships should also be employed and all data should be noisy. Some estimate of the relative uncertainty of the corresponding predictions must also be obtained.