H24B CC: 520 A Tuesday 1530h

Planning Continental-Scale Environmental Networks

Presiding: **R P Hooper,** Consortium of Universities for the Advancement of Hydrologic Sciences (CUAHSI)**; M Larsen,** U.S. Geological Survey

H24B-01 1530h

Long Term Ecological Research (LTER) Network Planning Activities

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Following a very successful two decades of science, the Long Term Ecological Research (LTER) Network has begun to address new initiatives that can be pursued because of the special capabilities of this organized network of scientists and sites. The LTER Network is now well poised to address the new environmental challenges that have been proposed by the ACERE report, the NRC Grand Challenges, the LTER 20-year review, and the LTER National Advisory Board. The major goal of planning activities is to prepare the LTER Network and associated sites to address major national environmental challenges in an integrated, coordinated manner. This will be accomplished by meeting the following specific objectives: Objective 1: Develop a plan for synthetic science using the LTER network as a foundation. This effort will include the development of plans for: 1A. New initiatives in long-term thematic, regional, and network-scale science, 1B. Increasing the capabilities of scientists/sites (e.g., cyberinfrastructure, technical expertise) to perform the necessary research, education and outreach for the new environmental challenges, and 1C. Integrating additional non-LTER sites and networks to further the research, as well as identifying criteria to guide the addition of new sites to the LTER Network funded by NSF. Objective 2: Envision and plan for education, training, outreach, and knowledge exchange activities that can most fully extend LTER science to its ultimate application. We will develop plans for: 2A. Incorporating education/outreach at all levels into the research programs, and 2B. Exchange of knowledge among scientists, policymakers, and resource managers to develop a shared understanding of ecological challenges and the science and policy required to address those challenges.

H24B-02 1545h

NEON: Developing a Platform for Regional to Continental Scale Biological Inquiry

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Climate variation, introductions of alien species, and patterns of land use are some of the important interacting drivers of biological change that are affecting our nation's ecosystems. Many of these drivers operate over large spatial and temporal scales, and our understanding of how these phenomena interact to drive biological change is limited by our inability to link traditionally local and short-term ecological approaches to larger and longer scales. Similarly, our ability to forecast such changes and respond to their consequences is constrained. The National Ecological Observatory Network (NEON) is a proposed shared-use research and education platform intended to improve our capacity to understand and predict biological phenomena operating from regional to continental scales. NEON is envisioned as a system of field and laboratory-based facilities distributed across the United States, which will provide the physical infrastructure and human capabilities necessary to coordinate and integrate research and education campaigns on the following types of issues: (1) biodiversity, species composition, and ecosystem functioning; (2) ecological aspects of biogeochemical cycles; (3) ecological implications of climate change; (4) ecology and evolution of infectious disease; (5) invasive species; and (6) land use and habitat alteration. Themes such as data sharing, multidisciplinary collaboration, and the development of technologies for sensing, forecasting, and visualizing biological information are central to the NEON concept. Development of the NEON science plan and the design of the network itself are proceeding through a variety of workshops and community planning meetings. A national project office is expected to form toward the end of 2004 to lead the development and creation of NEON. Ultimately, the project office will reside within an independent national organization devoted to the coordinated operation of NEON for the scientific community.

H24B-03 1600h

Collaborative-Large scale Engineering Assessment Networks for Environmental Research: The Overview

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A networked infrastructure for engineering solutions and policy alternatives is necessary to assess, manage, and protect complex, anthropogenic ally stressed environmental resources effectively. Reductionist and discrete disciplinary methodologies are no longer adequate to evaluate and model complex environmental systems and anthropogenic stresses. While the reductonist approach provides important information regarding individual mechanisms, it cannot provide complete information about how multiple processes are related. Therefore, it is not possible to make accurate predictions about system responses to engineering interventions and the effectiveness of policy options. For example, experts cannot agree on best management strategies for contaminated sediments in riverine and estuarine systems. This is due, in part to the fact that existing models do not accurately capture integrated system dynamics. In addition, infrastructure is not available for investigators to exchange and archive data, to collaborate on new investigative methods, and to synthesize these results to develop engineering solutions and policy alternatives. Our vision for the future is to create a network comprising field facilities and a collaboration of engineers, scientists, policy makers, and community groups. This will allow integration across disciplines, across different temporal and spatial scales, surface and subsurface geographies, and air sheds and watersheds. Benefits include fast response to changes in system health, real-time decision making, and continuous data collection that can be used to anticipate future problems, and to develop sound engineering solutions and management decisions. CLEANER encompasses four general aspects: 1) A Network of environmental field facilities instrumented for the acquisition and analysis of environmental data; 2) A Virtual Repository of Data and information technology for engineering modeling, analysis and visualization of data, i.e. an environmental cyber-infrastructure; 3) A Mechanism for multidisciplinary research and education activities designed to exploit the output of the instrumented sites and networked information technology, to formulate engineering and policy options directed toward the protection, remediation, and restoration of stressed environments and sustainability of environmental resources; and 4) A Collaboration among engineers, natural and social scientists, educators, policy makers, industry, non-governmental organizations, the public, and other stakeholders.

H24B-04 1615h

Designing Observatories for the Hydrologic Sciences

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The need for longer-term, multi-scale, coherent, and multi-disciplinary data to test hypotheses in hydrologic science has been recognized by numerous prestigious review panels over the past decade (e.g. NRC's Basic Research Opportunities in Earth Science). Designing such observatories has proven to be a challenge not only on scientific, but also technological, economic and even sociologic levels. The Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI) has undertaken a "paper" prototype design of a hydrologic observatory (HO) for the Neuse River Basin, NC and plans to solicit proposals and award grants to develop implementation plans for approximately 10 basins (which may be defined by topographic or groundwater divides) during the summer of 2004. These observatories are envisioned to be community resources with data available to all scientists, with support facilities to permit their use by both local and remote investigators. This paper presents the broad design concepts which were developed from a national team of scientists for the Neuse River Basin Prototype. There are three fundamental characteristics of a watershed or river basin that are critical for answering the major scientific questions proposed by the NRC to advance hydrologic, biogeochemical and ecological sciences: (1) the store and flux of water, sediment, nutrients and contaminants across interfaces at multiple scales must be identified; (2) the residence time of these constituents, and (3) their flowpaths and response spectra to forcing must be estimated. "Stores" consist of subsurface, land surface and atmospheric volumes partitioned over the watershed. The HO will require "core measurements" which will serve the communities of hydrologic science for long range research questions. The core measurements will also provide context for shorter-term or hypothesis-driven research investigations. The HO will support "mobile measurement facilities" designed to support teams of investigators to explore new and more narrowly focused hypotheses, including but not limited to, experimental campaigns for identifying constitutive relations across scale, or testing of theoretical models. The core measurement data will be available to the community in as quickly as possible. Science teams which develop new non-core data will have priority for a specific period of time (e.g. completion of PhD or publication priority) before it is made available to the wider community. Core data will be subject to quality assurance standards to ensure comparability across all HO's. Collection of the core data and its publication will be carried out by scientists and technicians employed by the HO, independent of the local investigators. Criteria for selection among proposed HO's include (1) effectiveness of design to estimate characteristics at large scale, (2) breadth and interdisciplinary nature of hypotheses, (3) proportion of proposed data collection that will be core data, (4) leveraging of existing data and local resources, (5) institutional support of government and stakeholders, (6) innovation of proposed interpretive frameworks, such as models, and use of benchmark models as performance metrics, (7) innovative sensors and instrumentation networks, and (8) education and outreach opportunities.

H24B-05 1630h

Hydrologic science, the USGS, and national observatory networks in the United States

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Hydrologic research requires long-term monitoring and investigation of fundamental processes that govern the movement of water and constituents in the atmosphere and on the earth's surface. Numerous multiyear investigations have advanced our knowledge by using watershed-scale studies to characterize and quantify fluxes of water and constituents. Historically, most of these studies have been conducted by researchers in narrow subsets of scientific disciplines, and have been focused on small, undisturbed watersheds. As the U.S. population surpasses 300 million in 2004, hydrologic-process understanding must be expanded to include larger scale, anthropogenically disturbed environments. These types of studies present significant challenges to our scientific understanding because of factors such as: 1) the great number of human-derived constituents and contaminants in our Nation's water, many previously unknown or unmeasurable; 2) the complexities of rivers and aquifers that transcend ecologic, climatologic, and political boundaries; 3) the lack of stationarity in hydrologic and climatologic trends; and 4) the need for a multidisciplinary approach involving scientists with varied expertise. The future of field-based hydrologic science requires a combination of large-scale hydrologic monitoring and investigation that crosses the traditional interfaces of scientific discipline, as well as land-use, political, and geographic boundaries. Federal, academic, and other researchers will need to collaborate. Federal agencies such as the USGS have a record of conducting and publishing detailed scientific investigations that contribute to our scientific knowledge. Equally important, since the 19th century, the USGS and other Federal agencies have collected, archived, and provided publicly available, high-quality, internally-consistent, long-term data sets. The USGS has a history of collaboration with national observation networks such as the LTER and IRIS, and embraces future collaboration with similar networks such as those proposed by CUAHSI. A joint effort that combines the strengths of Federal and university-based monitoring and research can yield nationally consistent, scientifically sound results that are cost- effective. The 21st century will present us with major challenges to our environment and natural resources because of continuing population and climate-change pressures. Our ability to successfully confront these issues will be greatly enhanced by wide-ranging cooperation among researchers from the Federal and academic sectors of the scientific community. The challenge will be to find an effective approach for CUAHSI to interact synergistically with Federal hydrologic programs. These interactions could involve the conduct of long-term monitoring, data management, instrument development and deployment, and research. They must be done in a manner that serves the needs of CUAHSI, the customers of the Federal agencies, and the advancement of hydrologic science.

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