

**Summary of the Mid-Atlantic CUAHSI Workshop**  
**Philadelphia Airport Marriott**  
**February 23, 2002**

Participants of the meeting:

<b>Name</b>	<b>Institution</b>
Laura Toran	Temple
Claire Welty	Drexel
Paul Imhoff	Delaware
Jim Smith	Princeton
Blythe L. Hoyle	Bryn Mawr
Ken Potter	Wisconsin
Andrew Miller	U Md/BC
Doug Miller	Penn State
Chris Duffy	Penn State
Doug James	NSF
Matt Becker	SUNY Buffalo
Marc Parlange	Johns Hopkins
Upmanu Lall	Columbia
Tim Reilly	USGS - NJ
Karen Salvage	SUNY Binghamton
Ying Fan	Rutgers
Tom Johnson	Academy of Natural Sciences
Robert Traver	Villanova
Enriqueta Barrera	NSF
Qizhong Guo	Rutgers
Dave Stedfast	USGS - NJ
Michel Boufadel	Temple
Jeanne M. VanBriesen	Carnegie Mellon

The meeting opened at 9:00 AM. Many of the participants were unfamiliar with the goals and objectives of CUAHSI, so a good portion of the morning was spent giving condensed versions of the Fall AGU presentations on CUAHSI. Claire Welty, Ken Potter, Laura Toran, Marc Parlange, and Upmanu Lall went over the history of CUAHSI and the objectives of four of the five standing committees (Science Planning, Observatories, Measurement Technology, and Information Systems).

The audience had several questions about leveraging and partnering with existing hydrology programs in other government agencies. However, the need for longer term monitoring over the *entire* hydrologic cycle was recognized. Also, there was a recognized need for universities to band together in a coordinated effort that would advance the science, instead of pursuing piecemeal efforts attached to other programs.

The group also discussed the need to add social sciences to the program (such as the different fields of study around the LTHO sites). This not only adds relevance, but also can be a driver for deciding on scale of approach and interaction with other agencies.

The remainder of the morning was focused on presentations and discussion of several of the existing programs in the mid-Atlantic region. Doug Miller presented an example of infrastructure development from the HERO (human-environment regional observatories) network. HERO is a collaborative effort among several universities and government agencies to build an intelligent networking environment for data management and develop protocols for observing, collecting, reporting, storing, and sharing data. The participants are The University of Arizona, Kansas State University, Pennsylvania State University, and Clark University along with NOAA and the USGS. Part of the program is the Geographic Visualization Science Technology and Applications Center (GeoVISTA) at Penn State.

Another group that is learning to share data to improve monitoring is the Pennsylvania Health Alliance, which has developed a cooperative program for reporting risks from West Nile virus. This program is an example of linking between hydrology and health assessment.

Chris Duffy discussed the Susquehanna River Basin Experiment (SRBEX). SRBEX attempts to integrate remotely sensed information, surface properties data, and a number of climate, mesoscale atmospheric, and hydrology models to evaluate the models' ability to simulate actual hydroclimatic conditions and their potential for predicting the effects of future changes in atmospheric composition and other factors which may affect climate. This site is an example of one that could be considered for partnering with an LTHO to leverage data collection.

Dave Stedfast of the USGS New Jersey District reviewed the national programs that provide a wealth of hydrologic data: NAQWA (chemical assessments), NASQAN (which has been declining), stream gauging, old RASA studies (which pre-date web access), and research sites. The Delaware River Basin NAQWA is in the report-writing phase, and that the Coastal NAQWA is beginning an intense monitoring phase in 2004. The NAQWA model for data collection phases might be of use to the LTHO program of CUAHSI. The investigations have intense sampling periods, followed by less frequent sampling, and data interpretation report writing; this provides long term coverage and more sites to be investigated without over-taxing resources.

After lunch several topics for the breakout (smaller) group discussion were considered. Quite a few people wanted to discuss design and issues related to creating a LTHO in the mid-Atlantic region. Two groups agreed to discuss these topics. A third group discussed how the CUAHSI plan would be implemented (what the next stages of funding would likely look like). The summary of these discussions follows at the end of this document.

Several points were emphasized in the wrap-up discussion

- We need to leverage not only data, but also management schemes from existing programs.
- Scale includes not only size, but also land-use variation, particularly in our region; this brings in a social-science component.

- No sites are likely to be pristine. The option to manipulate some of the sites would be beneficial.
- When describing LTHOs, it is important to emphasize synergy among sites, and not to isolate them.

One of the outcomes of this workshop was that everyone expressed interest in meeting again. We agreed to try to meet (whether with CUAHSI sponsorship or not) once or twice a year. It was suggested that many of the regional hydrologists could get together at the AWRA national meeting in November 2002, which will be held in Philadelphia.

The workshop adjourned at 5:00.

## Report of subcommittee on planning for Long-Term Hydrologic Observatory

The committee consisted of: Michel Boufadel and Andrew Miller (recorders), Qizhong Guo, Blythe Hoyle, Doug Miller, and Karen Salvage

Our committee discussed this planning effort in the context of both basic science and regional concerns.

### **Goal 1: Basic Science**

The basic science goal is to better understand and quantify the water cycle at various temporal and spatial scales. This would include characterization of mass balance, sources and sinks in the landscape, and characteristic travel or transport times for water and for dissolved and particulate materials including sediment, carbon, nutrients, and contaminants. Additional constituents of concern might include pathogenic organisms affecting human health and "emerging contaminants" such as antibiotics and trace-level endocrine disruptors.

### **Goal 2: For the mid-Atlantic region**

To quantify anthropogenic and natural factors affecting the hydrologic cycle and water quality across scales. Natural factors influencing spatial variability include geologic or physiographic landscape patterns, and anthropogenic factors include urbanization, deforestation, agriculture, mining, dam construction, and groundwater extraction. Urbanization currently plays a key and expanding role in the region as the increased extent of impervious area causes water to bypass the subsurface flow paths that otherwise would allow filtration of surface contaminants.

There is a time-transgressive, historical dimension to any characterization of long-term hydrologic processes and patterns. Landscape change is an important driver causing altered watershed response to hydrometeorological inputs, but it will also be necessary to sort out natural climatic variation from secular climatic trends, including those attributable to anthropogenic influence on climate change. Each phase or wave of land-use disturbance may take some time to ramify through the landscape, and there may be imprints of more than one phase of disturbance that are still working their way through the landscape. (Thus, in some watersheds we may still be seeing the legacy of nitrate concentrations from earlier agricultural land use that are still working their way slowly through the groundwater system, even if more recent land use in some of those same areas has caused changes in the nitrate concentrations currently reaching recharge zones. A similar argument could be made concerning sediment storage and remobilization and disequilibrium relationships between channels and floodplains.) Channel change in response to development is one well-known result of land-use change and often results in efforts to introduce stream restoration projects, so the basic science questions also have immediate practical implications.

For areas where anthropogenic disturbance is important, we need to understand the role of engineering infrastructure as an influence on hydrologic processes and patterns. This can be treated as a basic science question rather than simply as an applied problem.

### **Method of Analysis**

In order to make progress toward achieving these two goals, mechanistic (i.e., process oriented) studies need to be conducted in small watersheds, while statistical approaches should be used to scale up these results for larger watersheds and regions.

We discussed two alternative strategies for selection of study sites. One involved selection of a large, centrally located study watershed (e.g. Delaware or Susquehanna River basin) with nested small watersheds. The other involved identifying a stratified sample of small and medium-size watersheds distributed over a range of physiographic and land-use categories throughout the region. In either case we would need well-gauged watersheds with sub-basins used as experimental sites. Criteria discussed for site selection included

- a) The sub-basins need to be located at an optimum distance from most universities in the region. The sub-basin would be used for site visits by various earth science classes.
- b) Sub-basins that are to be compared should have approximately equal drainage areas with different geomorphic, hydrologic, and biochemical characteristics. The presumption is that if we control for enough other factors we can make paired-basin comparisons for the effects of individual factors (e.g. such as urban vs. rural land cover). However a range of watershed sizes and scales would also be needed for comparison.

In order to study these watersheds effectively we would need spatially extensive GIS coverages for topography, soil properties, vegetation types, underlying aquifer properties, etc. We also need to combine remote-sensing data layers, some obtained using new technology (e.g. for sensing soil moisture, radar-based precipitation fields, etc.), with point or plot measurements made in field studies, so as to calibrate the remote sensing data. In order to assess the effects of landscape change over time, we would need multiple time slices in our GIS coverage based on historical information.

Because we cannot sample large basins in a comprehensive way, we would need to develop conceptual and mathematical models to scale-up the results. We would seek to simulate both event-based and continuous time series data on hydrologic flux rates, and to examine both long-term averages and extreme or transient events.

### Description of a Mid-Atlantic LTHO...

The subcommittee consisted of: Rob Traver (recorder), Matt Becker, Upmanu Lall, Tom Johnson, Jim Smith, and Claire Welty

What is special to the Mid Atlantic region is the existence of an urban corridor. The "Science Question" can be focused on change issues, both natural and anthropogenic. The effect of gradients of intensity of human activities is of interest. An experimental design needs to be focused around the science question, this is a cyclic process to define both.

Scale of the LHTO is crucial to the design. A combination of Large, Small and Tiny is needed. We liked the idea of the different orders, i.e. some headwater (1st order) down to the larger sites. Besides size, a variety based upon land use, geology, ecology, etc. is needed. It is probably easier to hit these using multiple 1st order sites. The larger sites will by definition be a combination.

LTHO management was discussed. We foresaw a fulltime manager, and a mechanism to encourage data collection, and to identify where we have gaps in the process. A first step is to determine what is already available, e.g., among USGS, NWS, states, and municipalities, etc. Encouraging of volunteer systems, monies for small researchers to collect a few additional parameters and post them, are all elements of interest. There was a lot of discussion about the idea of partnering with USGS by paying USGS to expand their network. The organization would need to set / negotiate parameters, time scale, methods, etc. A lot of this could be modeled after excellent existing programs such as the USGS, i.e., this does not need to be recreated. Continuing maintenance is a concern.

## Implementation Plan for CUAHSI Infrastructure

Subcommittee: Laura Toran (recorder), Chris Duffy, Doug James, Marc Parlange, Tim Reilly, Ying Fan, Jeanne VanBriesen

This group started out discussing the possible mechanisms for universities to propose to work on CUASHI sites and take advantage of CUAHSI infrastructure (such as Measurement Technology and Information Systems). Implementation of the Education Program through workshops and fellowships seemed straightforward.

The large proposal that CUAHSI members are working on will describe the elements of the focus areas. These descriptions will contain specific examples, which should both support the CUAHSI concept and provide guidelines for university researchers to develop the proposals to actually implement the plan. The review process for these proposals was not discussed in detail, but one model from the Atmospheric Technology Division (an NSF-funded "equipment" program) is that proposals are submitted to NSF, but the panel meets where the equipment facility is rather than Washington, so they can interact with the managers there.

The discussion then moved to alternate strategies for initiating the first LTHO(s). One idea was to put a lot of emphasis on the measurement technology initially. By getting equipment into the hands of more researchers, CUAHSI could create immediate stimulus and provide for stronger LTHO proposals. Part of the group supported this idea, but an alternate idea supported by the group was to propose a large-scale campaign right from the start. The Susquehanna River Basin (under study in SRBEX discussed above) could be proposed as an example with varied geology and hydrology. We left this topic for further discussion in the other break-out groups. Alternately, the Arizona center SAHRA (studying Sustainability of semi-arid Hydrology and Riparian Areas) could be proposed as an example of leveraging on-going programs.

The theme of interacting with agencies and leveraging existing sites and programs repeatedly came up in discussion throughout the day. It may be that a subcommittee should be started to explore this topic *and make it clear to the rest of the community how CUAHSI is handling this*. Even though we have made contacts with other agencies, including the USGS, the implications of that contact and execution of cooperative programs are not clear to participants.