

CUAHSI Hydrologic Measurement Facility Survey 2005

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The Consortium for the Advancement of Hydrologic Sciences (CUAHSI) has undertaken establishment of a new Facility to serve to advance hydrologic measurement within the research community: The Hydrologic Measurement Facility (HMF) (see EOS; 86 (47) 22 Nov 2005). To provide community guidance for this effort a survey was conducted seeking the broad opinion of the research community. The survey assessed the level of support for community instruments and facilities, and sought out technologies and methodologies that could make major advances in the hydrologic sciences. 363 responses were returned between Nov 1, 2005 and January 15, 2006, more than 7 times that obtained in the 2002 HMF survey.

Respondents were asked what was most needed in order to make progress in hydrologic sciences. Of the 23 questions with possible scores ranging from -100 to 100 (positive indicating support) there was overwhelming support (>75) for:

1. Improving the integration between measurement and modeling methods (80.6);
2. Improving spatial resolution of measurements (79.7);
3. The ability to make more/better measurements, e.g. through distributed sensor networks (77.3), and
4. Improving our ability to measure and quantify the subsurface (76.4).

There was more support for providing access to equipment costing over \$20,000 with accompanying technical support for both deployment and data interpretation than there was for standard equipment. There was general support (50-75) for improving methods for determining measurement uncertainty (67.4); improving temporal resolution of measurements (67.0); the development of cross-scale, multi-process observational platforms (64.6); improving hydrological models (56.4); improving the methods of sensor calibration (54.0) and developing new tracer methods (53.4). The only computational resource surveyed, access to supercomputers, had low interest to the respondents (-7.4).

Respondents identified and prioritized what the aims of an HMF should be. The strongest response was received for conducting research and development into new cutting edge hydrological measurement devices (62.7). Other areas drawing strong support were; development of new methods (59.1) and instruments (57.6); comparisons of sensors (56); provision of a comprehensive handbook of measurement techniques (51.7) and integration of measurement and modeling approaches (50.8). Respondents had a low level of interest in standard equipment rental and servicing or a technical team to set up basic watershed monitoring.

There was strong support for a single HMF research and development center (59% of respondents), while less than 4% wanted a simple rental facility. Nearly half the respondents indicated that the HMF should put high priority on providing access to high-cost equipment for the community. The community also showed strong support for the

HMF providing technical assistance, troubleshooting services and assistance with experimental design and equipment choice. When asked if there were similar community facilities that served as a good model, the most common response was, NCAR (National Center for Atmospheric Research). The Hydrologic Instrument Facility (HIF) of USGS was also suggested. It is noteworthy that CUAHSI has now signed a Cooperative Research and Development Agreement (CRADA) with HIF to provide access to standard hydrological measurement equipment, resolving this need which was ranked as a lower priority at no direct cost to CUAHSI or the NSF. Additional aspects of the HMF that attracted the most interest were the provision of sabbatical/post-doc opportunities and the provision of measurement technique workshops. The latter was enthusiastically echoed in a number of write in comments, including, “YES!!!! Training is important.”; “... you have to learn this (equipment problems) the hard way”; and “A high priority would be training on high-tech equipment”.

The survey finally addressed the issue of developing a shared pool of equipment. The NSF has long held that this would be a highly desirable function of the HMF, allowing the NSF to purchase equipment that they could be assured would be broadly accessible to qualified researchers. The consensus view was that the instrumentation should be owned and maintained by CUAHSI under the HMF umbrella, and that provision should be made to allow the entire community of individual PI's to lease or share this equipment. When asked if they had equipment they would be willing to share, 72 responded positively, representing a remarkable opportunity for broader use of existing instruments. Many of the respondents identified concern over lending equipment, due to the possibility of damage or misuse of the equipment. Researchers are keen to see equipment properly used, in the hands of properly qualified people, providing the correct interpretation of data. Other issues that were brought up as needing to be addressed were insurance (especially the cost), and routine maintenance and transportation costs. 66% of respondents felt that the HMF structure should provide the logistical support for shared instruments of collaborative purchases. When asked what type of equipment people would most like to have access to, some of the most common responses were, atmospheric profilers (RASS, LIDAR, SODAR), geophysical equipment both ground based and airborne, auto samplers, weather radar and atmospheric flux towers. Interestingly, while limited support was found for standard equipment, numerous respondents identified standard equipment as that which they would like to have access to, including, automated soil moisture sensors, weather stations, pygmy/flow meters, pressure transducers, data loggers, temperature probes, and rain gages. This corroborates the 2002 survey results where similar requests were prominent. The recent agreement with the Hydrologic Instrument Facility (HIF) of USGS should meet these needs.

This survey was extremely useful in providing guidance for the CUAHSI HMF. As a community, assuming the survey required 15 minutes to complete, the community invested almost one person-month of effort in providing its opinions. This remarkable grass-roots effort is heartening, and provides a mandate that defines the core of the HMF mission. The HMF must address the following needs:

1. Identification and purchase of high-cost equipment for community use under the CUAHSI HMF umbrella. With support dedicated to developing the method and producing the correct interpretation of the data.

2. Provision of a facility/laboratory for instrument research and development specifically targeted at hydrology.
3. Support of distributed measurement of hydrologic parameters under the CUAHSI HMF umbrella.
4. Facilitation of the development and dissemination of methodologies for hydrologic measurement in watersheds, including ways of better linking measurements and models, and ways of better assessing uncertainty in measurements.

A full report of survey results, including all written comments submitted, will be published as a CUAHSI technical report. The HMF welcomes any and all comments, ideas, and offers of assistance as this facility takes shape. The survey is a means to achieve a higher level of scientific productivity through the appropriate acquisition and application of measurement technology to hydrology. The survey supports and parallels many other HMF activities. At this time there are three white paper teams developing strategic mission statements on instrumentation for hydrologic investigations of The Water Cycle (Jennifer Jacobs); Geophysics (Rosemary Knight); and Biogeochemistry (Breck Bowden). In addition an editorial team is being assembled to oversee the creation of an on-line Handbook of Hydrologic Methods (John Durant). The HMF is developing a Virtual Marketplace of Hydrologic Instrumentation (John Selker). Finally, on the Sunday and Monday prior to the Spring AGU meeting in Baltimore the HMF will host a Workshop on Strategic Investments in Hydrologic Instrumentation (John Selker); from which will be identified a core set of technologies to be sought through NSF grant funds. Additional information will be sent to the community as the components mature. We invite you to contact the leaders of each of these efforts if you would like more information, or to be involved. This is a project for the community, of the community.

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Footnote on distribution of respondents:

Of those surveyed scientists identified themselves with the following categories, 45% from hydrology, 15% soil science, 12% geophysics, 11% biogeochemistry, 3% ecology, 3% geomorphology and 11% other. 68% were from universities, 17% Federal Government, 10% private sector and the rest from other places. Over 65% of those surveyed had been conducting research for more than 10 years and 67% recognized research as their major work responsibility. 86% of the total number of respondents identified themselves with conducting field experimental work, 75% with mechanistic modeling, and 71% with applied modeling, indicating a response from the breadth of the community. 70% had been involved routinely or actively with fieldwork for hydrology. A significant portion of the respondents had not received previous funding from NSF, with 32% having been Principal Investigators and 39% having been Co Principal Investigators.

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