

CUAHSI ANNUAL REPORT

2013

UNIVERSITIES ALLIED FOR WATER RESEARCH





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Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.



CUAHSI
universities allied for water research

Consortium of Universities for the
Advancement of Hydrologic Science, Inc.
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Letter from the President

Entering a New Era for CUAHSI

Dear Colleagues,

In 2013, CUAHSI entered into a cooperative agreement with NSF to operate the Water Data Center (WDC), our first facility. Funds for this facility come from the Earth Sciences Instrumentation and Facilities, a funding source separate from the Hydrologic Sciences program. The CUAHSI WDC is the second facility serving our community, with CTEMPS (operated by University of Nevada-Reno and Oregon State University) being the first.

The CUAHSI WDC is the culmination of a decade of work to adapt modern web services technology to work on time-series data (such as a gage record or water-quality series), our most common data type. Our challenge now is to make sure the WDC continues to serve the research and education needs of our community. So explore and test our services for publishing, discovering, and downloading data. Use them in your classes and send us your suggestions. We look forward to your continued input and engagement as we work to refine these tools.

To assist in the rollout of the WDC, we are also expanding our training services. We recently completed a successful pilot short course for graduate students at Biosphere 2 and we have the capacity for more graduate student training. Let us know what courses would be useful and if you are interested in teaching or coordinating a course.

Finally, a major new initiative on community modeling is underway at CUAHSI in which a process is established to define objective benchmarks of model performance and test data sets that anyone can use to review suggested improvements to the current version of the model. Meaningful benchmarks must be defined by the community at large. Working groups will be forming. Their success depends upon your participation.

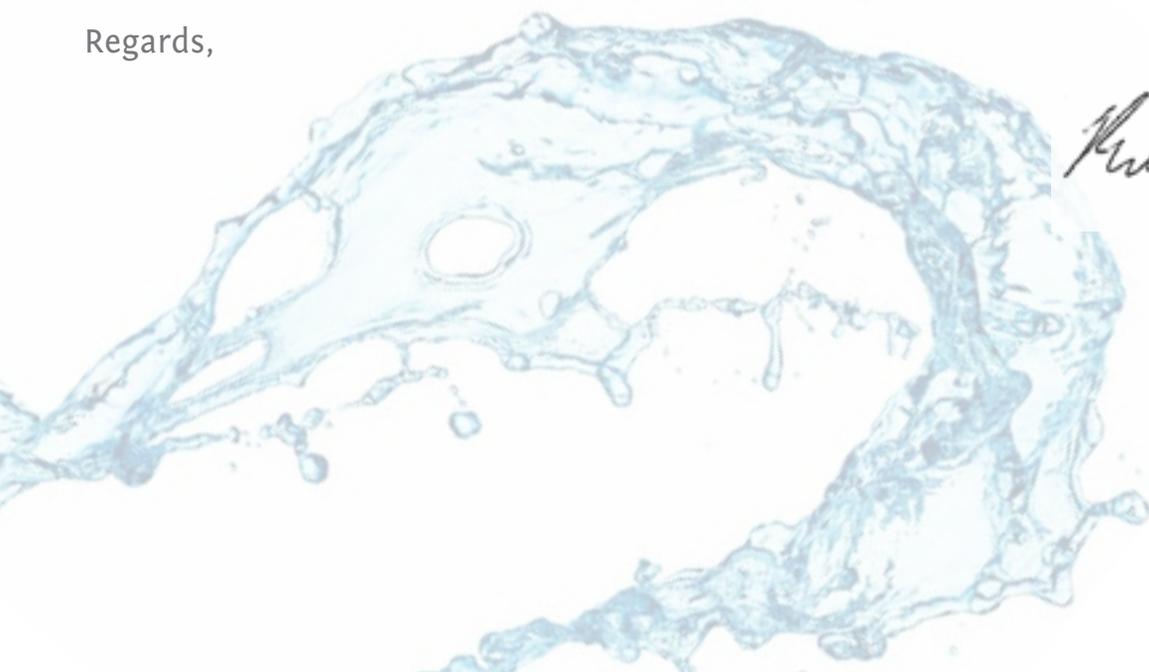
2014 will be a watershed year for CUAHSI as we transition from planning to executing services for the community. **Your engagement and feedback are the keys to our success!**

Regards,



Rick Hooper

Rick Hooper,
President



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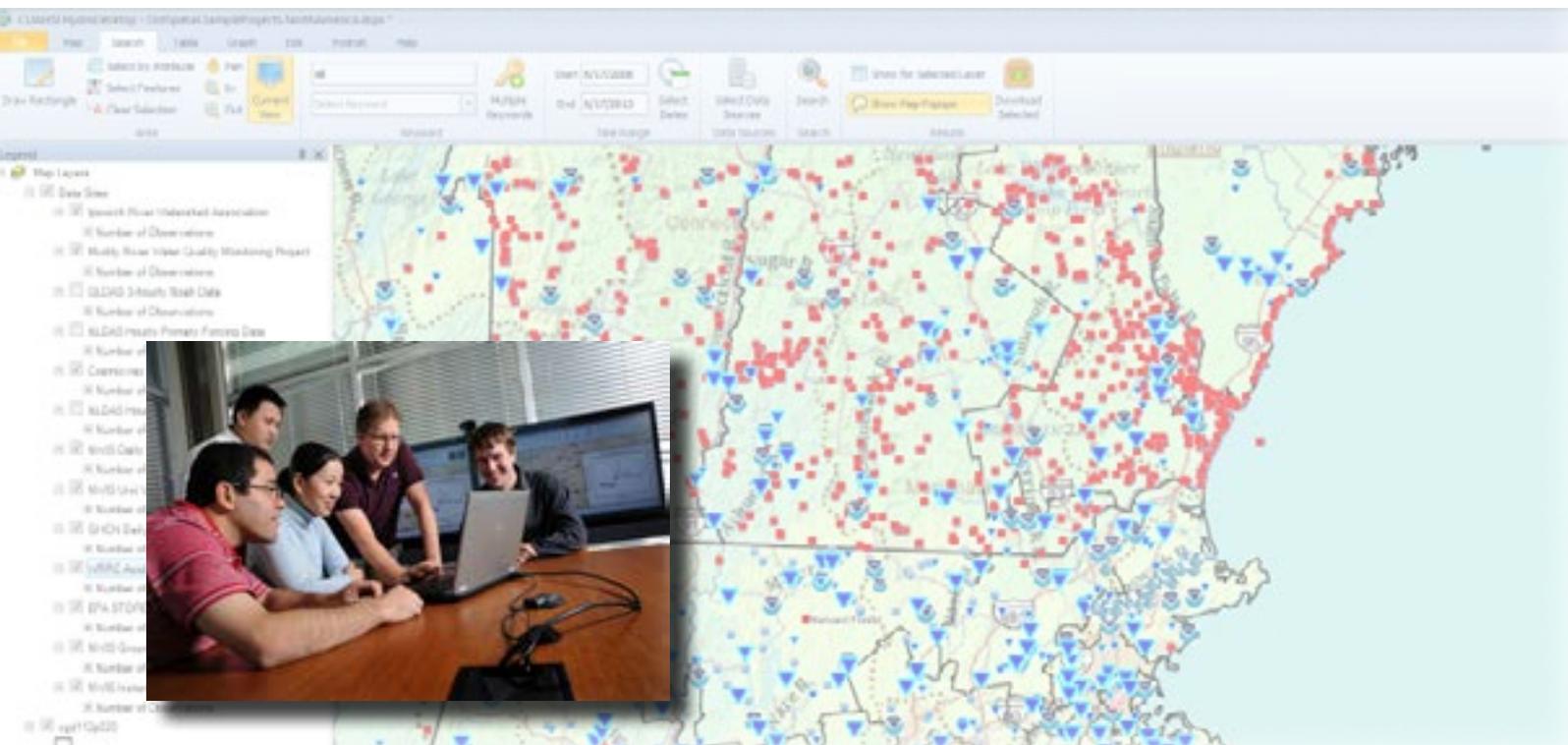
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Water Data Center

Improving upon the structure and substance of the CUAHSI Hydrologic Information Systems was one of the critical activities in 2013. The Water Data Center (WDC) facility was established with funding from NSF to maintain a central catalog of over 100 data providers. Services at the WDC focus upon providing researchers the ability to discover and download data, as well as the ability to share their own data. We are working to become the Google of water data!

As a facility, the WDC now has an interim full time director, and a dedicated permanent staff, including two professional software engineers, devoted to maintaining and improving the Hydrologic Information System (HIS) system. This team has implemented multiple improvements, including Microsoft Azure cloud technology to deploy data and automated testing procedures to ensure the health of the data sources, guaranteeing a faster and more reliable interface with greater computing power. The new search client to be released in 2014 will be web-based, using the simple OpenID sign-on and stabilized on the robust back end improvements implemented in 2013. The main thrust was enhancing the user experience through a catalog and data retrieval system that ensures high reliability, high persistence, high availability, and quick recovery. Long-term integrity of the catalog is paramount to the goal of this program.

***Check out the
new Water Data
Center portal at
wdc.cuahsi.org***

With the additional in-house resources for development, the WDC is providing long-term, free service for archiving and publicly disseminating data for the academic community. With much of the back-end work fully underway, expect to see greater focus on front-end improvements, such as user interfaces, in the coming year that will improve accessibility to our tools for all.

Hydroinformatics Conference 2013

A major community engagement activity in 2013 was CUAHSI's hosting and execution of the second biennial CUAHSI Conference on Hydroinformatics and Modeling, at Utah State

7,316,485
ANNUAL
DOWNLOADS

University, July 17-19 in Logan, Utah. This event allowed approximately 100 researchers to showcase advances in hydrologic data and information systems, modeling technology, and their use to advance hydrologic science, alongside workshops on data discovery, access and publishing with the Water Data Center. This conference followed the inaugural conference in 2011 that was held during the final year of the HIS research project. This was also a first opportunity to introduce the water science community to the services and staff of the newly established WDC.

HydroDesktop 1.6

HydroDesktop is a free and open source GIS application that enables access to our data catalog. The new 1.6 version

release in 2013 includes a new User Guide and educational materials online.

In the Spring, a cyberseminar series that covered data access, development, and data publication with HIS was attended by over 186 participants. Recordings of these webinars are available on the WDC website, along with new materials developed by educators at Brigham Young University and Wilkes University. These exercises were designed for college-level hydrology or civil engineering laboratory classes.

Ongoing data support and outreach

CUAHSI is always on the lookout for new and/or improved time-series data sources. For example, NASA is now making time series data available from the North American Land Data Assimilation System (NLDAS) and Global Land Data Assimilation System (GLDAS). These gridded data sources are transformed to time series through a process developed by a member of the CUAHSI community, Dr. John McEnery.

CUAHSI staff, board members, and the broader community have been involved in multiple activities aimed at promoting, extending, and supporting the WDC. Aside from our long-standing exhibitor presence at the Geological Society of America annual meeting and the American Geophysical Union annual meeting, we have engaged the community on a more extensive level at many events throughout the year, including, but not limited to:

- Shale Network Annual Workshop
- Global Earth Observation System of Systems (GEOSS)
- Institute for Sustainable Earth and Environmental Software (ISEES)
- ODM2 working group on water data standards

113 REGISTERED DATA SOURCES
+16% over 2012



***Most of the WDC
work in 2013
focused on a
massive “back-
end” overhaul;
substantial
front-end
improvements are
on the way!***

The Water Data Center now has a full development and support team with Dr. Alva Couch as Director, Marie Martin and Martin Seul as Software Engineers, and Jon Pollak as User Support Specialist. D. Scott Mackay of SUNY at Buffalo is the Chair of the Informatics Standing Committee.

Community Hydrologic Modeling Resources

CUAHSI continues to focus on the development of resources and initiatives to serve the broad and diverse hydrologic modeling community, enabling science across scale and discipline. Following up on the recommendations of the Community Hydrologic Modeling Platform (CHyMP) initiative was a high priority for CUAHSI in 2013 and resulted in the following activities.

1) Supporting the Advancement of Cyber-Infrastructure for Model Coupling and Execution

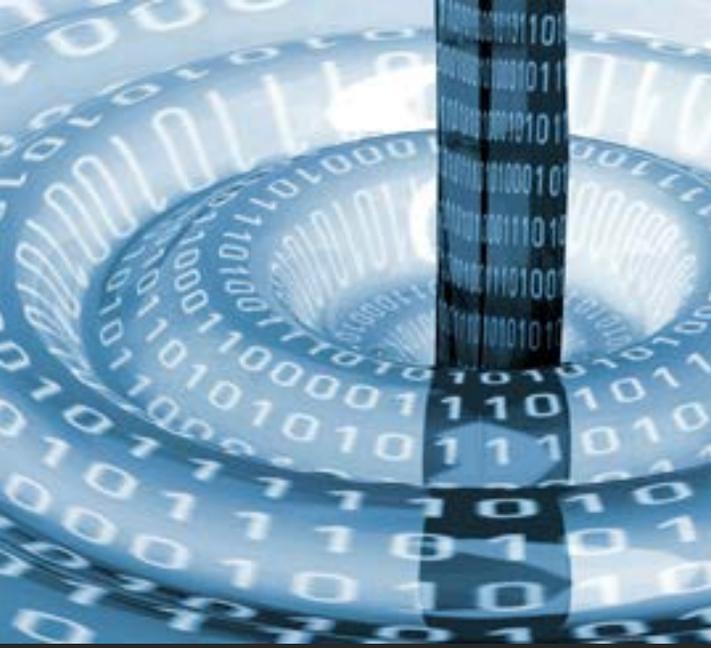
During the CHyMP initiative, several key needs for cyberinfrastructure development were identified. CUAHSI continues to support and participate in key hydro- and geoinformatics efforts that seek to lower barriers to use and access of models and data resources.

CUAHSI has played a coordination role in several projects and ongoing activities in NSF's EarthCube initiative to develop "community-led cyberinfrastructure that will allow for unprecedented data sharing across the geosciences." CUAHSI has been a partner on several EarthCube grants and workshops to ensure that the specific needs of hydrologists and hydrologic modelers are well represented – including a project that developed a "Roadmap" to better enable Earth System Modeling Coupling, and in particular atmospheric and hydrologic model coupling. CUAHSI is now a subcontractor on a new

"Building Blocks project" led by University of Colorado at Boulder that will explore interoperability among model platforms, or frameworks, and how they can be effectively coupled with the heterogeneous data resources that are needed to effectively parameterize and run state-of-the-art Earth System models.

In partnership with the National Center for Atmospheric research and Rutgers University, we have partnered on the Standards-based Cyberinfrastructure for Hydrometeorology (SCHIM) project to create better linkages between hydrologic and meteorologic data. CUAHSI is also a research partner in NCAR's development of the new Weather, Research, and Forecasting (WRF-Hydro) Framework used for flood forecasting and hydrometeorology, which will allow researchers to more effectively couple sophisticated hydrologic models with the WRF atmospheric model.





2) Catalyzing the Development of Community Data Resources

CUAHSI organized an EarthCube workshop on Envisioning a Digital Crust in January 2013, to help address one of the critical needs identified during CHyMP – the lack of current, comprehensive subsurface data for integrating soil and groundwater into large scale models. The workshop brought together more than 60 participants, many with 10+ years of experience in modeling, to scope requirements and a path forward.

The CUAHSI Water Data Center continues to collaborate with NASA on making remote sensing data – often important to modelers for forcing and validation in ungauged areas – more accessible to the hydrologic community.

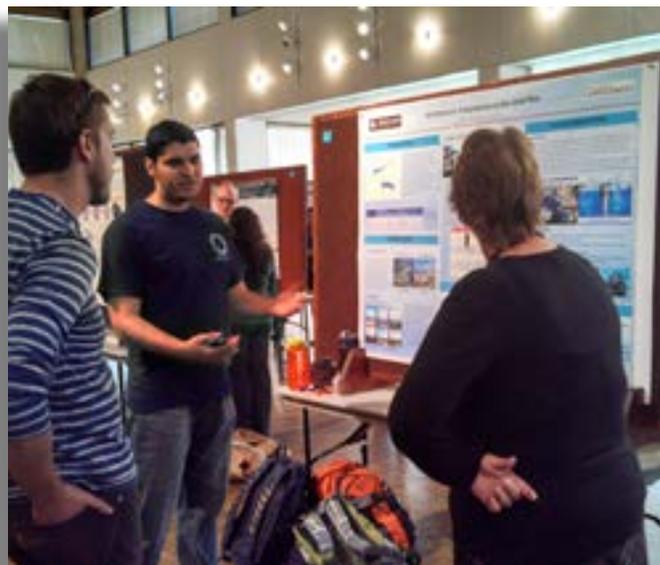
3) Engaging the Hydrologic Modeling Community in the NSF EarthCube process

To ensure this significant NSF investment will serve the needs of a sophisticated modeling community, CUAHSI has organized or co-organized end-user workshops to ensure that modelers' needs are communicated to EarthCube. As part of an EarthCube grant, CUAHSI organized an Early Career workshop for seven competitively selected Early Career modelers to participate in a visit to NCAR to learn more about the resources available through WRF-Hydro and the CSDMS modeling system at UC-Boulder.

CUAHSI continues to track and inform the community about the new developments in EarthCube, as a central place to access models and data in the earth sciences across the NSF directorates, by asking what the community needs for cyberinfrastructure and what can fill that need. Our goal with this work is to enable the community, in the face of limited resources, to engage in better research. All these frameworks are developing coupling standards and accessibility across data systems, opening up data discovery and access. Empowering the community to find solutions is a major thrust of NSF's strategy for promoting robust interdisciplinary research.

Dr. Jennifer Arrigo leads CUAHSI's efforts on Community Hydrologic Modeling Resources.

CUAHSI's 2013 community engagement activities are paving the way for scientists to work in a more supportive interdisciplinary environment



Education and Outreach

Our education and outreach efforts in 2013 were geared toward promoting activities around the new Water Data Center, initiating new ideas into our ongoing cyberseminar series, continuing our work with the *Let's Talk about Water* film education program, and providing ongoing support of graduate student research through the Pathfinder fellowship.

In 2013, the CUAHSI staff placed a greater emphasis on strategic communications and building greater rapport with the community. CUAHSI is more active than ever on social media with news, updates, and notifications. Additionally, a new website content management system was built in 2013 for an early 2014 launch. As usual, CUAHSI staff have attended dozens of conferences and provided personal engagement with CUAHSI's services. Highlights included a CUAHSI-organized early career scientist luncheon at AGU with 57 young researchers and board members.

Cyberseminars

Our semesterly cyberseminar series are ever-growing in popularity. In addition to growing numbers of attendees, we expanded the scope of the seminar series to include HIS training. We also piloted a new project approach this fall with the "Graduate Student Invitational" series which provided an opportunity for graduate students to contribute suggestions for exciting research they would like to see featured by CUAHSI in cyberseminars. More than 100 of these cyberseminars are now archived online for viewing at any time or for inclusion into your curricula, including the 2013 series: Complementary Methods and Models, Hydrologic Information Systems, and Multi-

disciplinary Approaches to Investigating River Processes. The CUAHSI Cyberseminars are held every Friday at 3pm eastern time for 4 - 6 sessions each semester.

Let's Talk About Water

CUAHSI collaborates with Linda Lilienfeld, an independent film researcher, on Let's Talk About Water (LTAW)—a unique film symposium that combines the power and inspiration of film with the knowledge of an expert panel. During LTAW events, the audience views a water documentary (such as "Chasing Ice," "Flow," "Gasland," or a "Civil

There were over 600 "attendees" at Cyberseminars in 2013

Action") followed by a moderated discussion with guests and panelists in an effort to address complex water issues facing their local communities and society at large.

The capstone of the LTAW program thus far was the 2013 Water Science Communication Workshop at Boston's

Museum of Science organized in conjunction with Emerson College, entitled “Strategies for Communicating Science.” This workshop highlighted successful interactions among communications professionals, scientists, and citizens groups that can help deepen the impact and successfully convey results of research.

Another signature CUAHSI program is the LTAW Challenge Grant awards. CUAHSI awarded six grants for events in 2013 to Cal State University – Chico, University of Idaho, University of Saskatchewan, Texas A&M, Syracuse University, and Rutgers University. The LTAW programs for international events as well as the 1-to-1 fund matching LTAW Challenge Grant program have been generously supported by the Johnson Family Foundation.

Pathfinder Fellowships

Each Fall, CUAHSI accepts applications from graduate students for the purpose of broadening their research beyond the “one site, one view” approach. Up to \$5000 in travel funds are awarded to each fellow to conduct comparative research, to collaborate with a research group using alternate approaches and modeling methods, or to work with researchers on adding an interdisciplinary dimension to a water science research project. This program has been ongoing for five years and many past Fellows have found these experiences invaluable to their research.

Emily Geosling leads CUAHSI’s efforts on Education and Outreach. Dr. Benjamin Ruddell of Arizona State University is the Chair of the Education & Outreach Standing committee.



Pathfinder Fellow Scott Jasechko, University of New Mexico, in Uganda



Pathfinder Fellow	University and Program	Research Topic and Travel Plans
Ashley Bandy	University of Kentucky, Department of Earth & Environmental Science	Mobility of 15N-tagged Escherichia coli within karst aquifers, Kentucky, USA; Travel to USDA-ARS; Bowling Green KY
Salli Dymond	University of Minnesota, Natural Resources Science & Management	13C in tree rings using a long-term soil-moisture record; Travel to Department of Biology; Southern Oregon University
Christian Guzman	Cornell University, Biological & Environmental Engineering	Investigating the impact of soil erosion in Ethiopia and cloud forests in Honduras for improved water quality management; Travel to Department of Environment & Development; Zamorano, Honduras
Scott Jasechko	University of New Mexico, Department of Earth & Planetary Sciences	Water resources and ecosystem growth at the source of the Nile River; Travel to Department of Civil & Environmental Engr.; Makerere University, Uganda
Alia Khan	University of Colorado-Boulder, Environmental Engineering	A bipolar comparison: Understanding black carbon impacts on snow-melt hydrology and water-quality in Longyearbyen, Svalbard.; Travel to Department of Arctic Technology; U. Centre in Svalbard, Norway
John Mioduszewski	Rutgers University, Department of Geography	Understanding arctic spring snow melt using a comprehensive methodology: Incorporating field work from Inuvik, NT; Travel to Environment Canada (NT), Climate Research Division
Jackson Webster	University of Colorado-Boulder, Environmental Engineering	Effects of Wild Fire on Mercury Transport and Sulfur Dynamics; Travel to Everglades National Park, S. Florida Water Mgmt. District

Instrumentation Training and Access

Instrumentation programs support advancing the use of instrumentation by the water science community through training, improved access, and encouraging the development of new technologies. CUAHSI organizes trainings on cutting edge instrumentation and measurement techniques in conjunction with university researchers, works with instrument providers such as the Center for Transformative Environmental Monitoring Programs (CTEMPS) to ensure community access and awareness, and collaborates with the US Geological Survey through a Cooperative Research and Development Agreement to support instrumentation development, access to USGS services for our member universities, and other outreach opportunities.

Optical Sensor Workshop

In February 2013, CUAHSI and USGS hosted a workshop entitled “Optical Water Quality Sensors for Nutrients: Concepts, Deployment, and Analysis.” This course was taught by Matthew Cohen and Ray Thomas, of the University of Florida, and Brian Pellerin, US Geological Survey, with 32 participants for a hands-on training held in Gainesville, Florida. A post-workshop survey suggested that the workshops are very informative and will help support research using these instruments within the next 2 years.

Tutorial during Hands-on Workshop, February 2013



HydroGeophysics

Two hydrologists were awarded grants this year to work with geophysicists in order to broaden the breadth of their work on water science. Andy Parsekian’s work led to an assistant professor position at the University of Wyoming (starting January 2014) and he will be part of the Wyoming Center for Environmental Hydrology and Geophysics (WyCEHG). Erich Hester worked with Kamini Singha and Adam Ward on evaluating the significance of preferential flow for surface water-groundwater exchange in stream and river systems.

Dr. Klaus Neumann of Ball State University is chair of the Instrumentation Standing Committee.

“I am seeing more and more how ERI [electrical resistivity imaging] can be used in all sorts of projects, and it is likely that little of this would have happened without the [HydroGeophysics] grant directing my attention to these technologies and opening my eyes to the possibilities.”

- Erich Hester, Virginia Tech, 2013

Program Development

Keep an eye out for new programs and services in 2014. These new programs follow extensive strategizing in line with the publication of the *Implementation Plan: 2013-2017*—focused on bringing the CUAHSI vision and mission to life.

Watershed Science Master Courses

CUAHSI and the University of Arizona are working together to conduct a pilot short course for graduate students, post-doctoral fellows, and professionals. This course will run in January 2014. The week-long course will focus on hydrologic and biogeochemical watershed processes including theory, experimental design, and modeling. The course will be team taught and will present a unique opportunity for participants to explore watershed hydrology and biogeochemistry through the Landscape Evolution Observatory (LEO) facility Biosphere 2. Participants will have the opportunity to run an experiment on site and to analyze data from this facility.

Instrumentation Cyberseminars and Virtual Poster Session

Early in 2014, CUAHSI and USGS will co-host an instrumentation workshop open to the wider community on Laser Specs for Field Hydrology and Biogeochemistry utilizing remote meeting software to bring in manufacturers such as Picarro Inc. and Los Gatos Research, user seminars on research applications, and a virtual poster session. These sessions will run from January 27 through February 28, 2014 and will be recorded and archived online.

You can guide future water science programs by proposing a short course, joining a standing committee, and utilizing the Water Data Center

SAVE THE DATE:

July 28 - 30, 2014

CUAHSI Biennial

“Water Across the Critical Zone: From Local to Global Hydrology”

National Conservation

Training Center

Shepardstown, WV

Research Support....

CUAHSI's core mission is to provide research support services for the water science community. We encourage researchers to include CUAHSI services, such as HIS data access and publication services and our education and outreach tools, in their proposals. These services are available to all NSF-funded researchers. CUAHSI also partners with our university colleagues on research projects that have the potential for community-wide benefit. CUAHSI staff may participate as Co-PIs on proposals which align with CUAHSI's strategic objectives and involve research that could be adapted to or inform the development of community services.

FUNDED PROJECTS

EarthCube Building Blocks: Earth System Bridge: Spanning Scientific Communities with Interoperable Modeling Frameworks

NSF Award #1343811

PI: Scott Peckham (UC-Boulder); Co-PIs: Jennifer Arrigo (CUAHSI), Gary Egbert (Oregon State), Cecelia Deluca (NOAA), David Gochis (NCAR)

This EarthCube Building Blocks project will draw from significant disciplinary and interdisciplinary expertise in the development, implementation and support of geoscientific modeling architectures and in the adoption of community standards in model development and data management. This team will integrate existing model architectures, model coupling standards, and data standards into a set of open-source Earth System Bridge building blocks that will transform the process of Earth system model coupling, and bridge the present technological gap.

EarthCube GEO Domain Workshop Proposal: Envisioning a Digital Crust for Simulating Continental Scale Subsurface Fluid Flow in Earth System Models

NSF Award # 1251557

PI: Jennifer Arrigo (CUAHSI); Co-PIs: Ying Fan Reinfelder (Rutgers University); Norman Jones (Brigham Young University)

In order to advance the understanding of the critical zone and deeper crust and to better couple the exchange of mass and energy between the surface and the subsurface, this project will hold 3-day workshop to develop a long-term vision of a digital representation of the continental crust of N. America and design concepts for prototype data model(s). The digital catalog of crustal structure, composition and permeability (as well as parameters from which permeability could be inferred) define the mechanisms by which to integrate vast amounts of disparate data types and to construct a coherent, 3D picture of subsurface structure and material properties, so that we can begin to represent subsurface fluid flow in Earth system models and elucidate its critical controls in the evolution of the Earth system from the past to the present and the future.

COLLABORATIVE RESEARCH: From Data to Users: A Prototype Open Modeling Framework

NSF Award #1245076

PI: Richard Hooper (CUAHSI)

This grant is part of a collaborative research project under EarthCube EAGER, being led by Xu Liang (U. of Pittsburgh). This EAGER award allows the construction of a prototype open meta-modeling framework that significantly reduces the time and effort on the part of users in the preparatory work for data and model comparisons, model testing and validations, for making fundamental knowledge discoveries in surface and ground water hydrological systems. In this

...and Collaboration

framework, components/modules interact via user-configured open interfaces that allow the addition and integration of hydrological models and data sources using a common meta-level architecture and scientific workflows. The proposed prototype is based on a recently completed modeling framework, HS-NWSRFS (Hydro-information System for improving the National Weather Service River Forecast System). It represents a collaboration between investigators from three institutions, NASA, and NWS Ohio River Forecast Center (OHRFC). The funded effort will significantly expand the present code into an open community framework prototype.

Facilities Support: The CUAHSI Water Data Center

NSF Award #1248152

PI: Richard Hooper (CUAHSI); Co-PIs: Alva Couch (CUAHSI); Diana Dalbotten (University of Minnesota); Antony Berthelote (Satish Kootenai College)

This Cooperative agreement supports the Consortium for the Advancement of the Hydrologic Sciences (CUAHSI) to construct and maintain a web-accessible water-data center (WDC) that builds off the prototype Hydrologic Information System (HIS) developed at the University of Texas. Over the next three years, WDC development will offer new access to water data holdings, discovery tools, archival and sharing/publishing capabilities and will build a consistent set of data format standards definitions, data format translators, analysis software tools, mobile platform applications and provide for user training and support. The WDC will provide access to a range of water data now held in a multitude of data formats and across numerous platforms with vastly different access tools. Data to be ingested in WDC will include the data holdings of the USGS National Water Information Service, EPA and NOAA's National Climate Data Center (NCDC), other federal and state agency data holdings, and academic and private foundation water data holdings.

The WDC will integrate the use of cloud computing and data services to facilitate data discovery and use and include tools for real time state-of-health monitoring of operational sensor networks. The WDC concept directly addresses NSF data policies and will be integrated into a growing network of geoscience information system services (e.g., Unidata, OpenTopography, EarthChem through participation in GEOs EarthCube initiative). WDC PIs will continue international efforts for developing and adopting consistent data standards for hydrologic observation web-base publication through participation in international standards-setting bodies (e.g., the Open Geospatial Consortium (OGC) and the Global Earth Observation System of Systems (GEOSS). The PIs also plan a set of outreach activities focused on Native Americans (in collaboration with tribal college and governmental partners) for building and development of water management data tools in support of the tribal resources management needs.

Collaborative Research: Standards-Based Cyberinfrastructure for Hydrometeorological Modeling: US-European Research Partnership

NSF Award# 1234680

PI: Richard Hooper (CUAHSI); Co-PI: Ilya Zaslavsky (SDSC)

This project is a Collaborative Research project. The partner NSF-funded project is being led by Dave Gochis (NCAR) and also involves Rutgers University. Additionally, this project is a collaboration with the EU-funded DHRIM project.

This project, Standards-based CyberInfrastructure for HydroMeteorology (SCIHM), seeks to link two disciplines--hydrology and meteorology--each of which has a sophisticated CI already developed within their respective disciplines. This linkage will be accomplished with hydrometeorology use cases in Europe and America that will be executed in both the European and American grid computing environments using federated data and computing standards. With research and development partners from several American and European institutions, the project is designed to take advantage of standards-based CI for hydrometeorological applications. In doing so, we will foster a unified standards-based hydrometeorological infrastructure where researchers and students from Europe and the US can rapidly simulate complex physical processes and predict extreme weather events and their hydrological, environmental and societal impacts, taking advantage of scalable on demand high-performance cloud-based computational resources and shared data space.

RESEARCH SUPPORT AND COLLABORATION, CONTINUED...

RCN-SEES: The Marcellus Shale Research Network

NSF Award #1140159

PI: Susan Brantley (Penn State); Co-PIs: Richard Hooper (CUAHSI); Candie Wilderman (Dickenson); Kathryn Jo Brasier (Penn State); Jorge Abad (University of Pittsburgh)

This project is to develop a sustainable RCN to organize and generate knowledge from water chemistry and flow data collected in Pennsylvania in the area of extraction of natural gas from the Marcellus shale. We will focus on the research hypothesis: Sustainable development of the Marcellus Shale will be enabled by creation of a database of geochemistry and hydrology developed by watershed groups, government agencies, industry stakeholders, and universities working together to document natural variability and potential environmental impacts. The proposal focuses on Pennsylvania, the site of the largest new shale gas play in the United States. The network will be led by two research universities, Penn State and Pitt, and a private liberal arts college, Dickinson, in collaboration with the Consortium of Universities for the Advancement of Hydrologic Sciences, Inc. (CUAHSI).

Collaborative Research: SI2-SSI: An Interactive Software Infrastructure for Sustaining Collaborative Community Innovation in the Hydrologic Sciences

NSF Award #1148453

PI: David Tarboton (Utah State University); Co-PIs: David Maidment (UT- Austin); Daniel Ames, (BYU); Jonathan Goodall (U. of South Carolina); Jennifer Arrigo (CUAHSI)

This project develops sustainable cyberinfrastructure for better access to water-related data and models in the hydrologic sciences, enabling hydrologists and other associated communities to collaborate and combine data and models from multiple sources. It will also help to provide a more comprehensive understanding of the interactions between natural and engineered aspects of the water cycle. These goals will be achieved through the development of interoperable cyberinfrastructure tools and the creation of an online collaborative environment, called HydroShare, which enables scientists to easily discover and access hydrologic and related data and models, retrieve them to their desktop, and perform analyses in a high performance computing environment. The software to be developed will take advantage of existing NSF cyberinfrastructure (iRODS, HUBzero, CSDMS, CUAHSI HIS) and be created as open source code. Its development will be end user-driven.

CUAHSI is providing community oversight through our Informatics Standing Committee, User Support and engagement through the HIS User committee, community engagement and dissemination through CUAHSI Hydroinformatics conferences and communication mechanisms, and supporting development of education and outreach materials related to HydroShare.

Geoinformatics: Development of Community-Based Ontology and Standards for Hydrologic Data Discovery and Exchange

NSF Award # 0949196

PI: Richard Hooper (CUAHSI); Co-PIs: Ilya Zaslavsky (SDSC); Michael Piasecki (CCNY); David Valentine (SDSC)

CUAHSI has been involved in the development of Water Data Services (WDS) through the CUAHSI Hydrologic Information Systems (HIS) project. The vision for WDS is to bring together the nation's (and, potentially, the earth's) water data in a federated system of servers linked using a services-oriented architecture. CUAHSI WDS is used by both academic researchers and by government data providers at both the Federal and State levels. A critical challenge in achieving this vision is understanding and reconciling structural and semantic differences across publishers of hydrologic data. The HIS project achieved interoperability between different data repositories by developing a common relational schema (Observations Data Model, ODM V1.1), an XML schema for exchanging hydrologic observations (Water Markup Language, WaterML V1.0), and a prototype ontology (V1.0) of hydrologic concepts that is used for data discovery purposes.



CUAHSI enables the university water science community to advance understanding of the central role of water to life, Earth, and society. CUAHSI focuses on water from bedrock to atmosphere, from summit to sea and from the geologic past, through the present and into the future.

Financial Overview

Awards

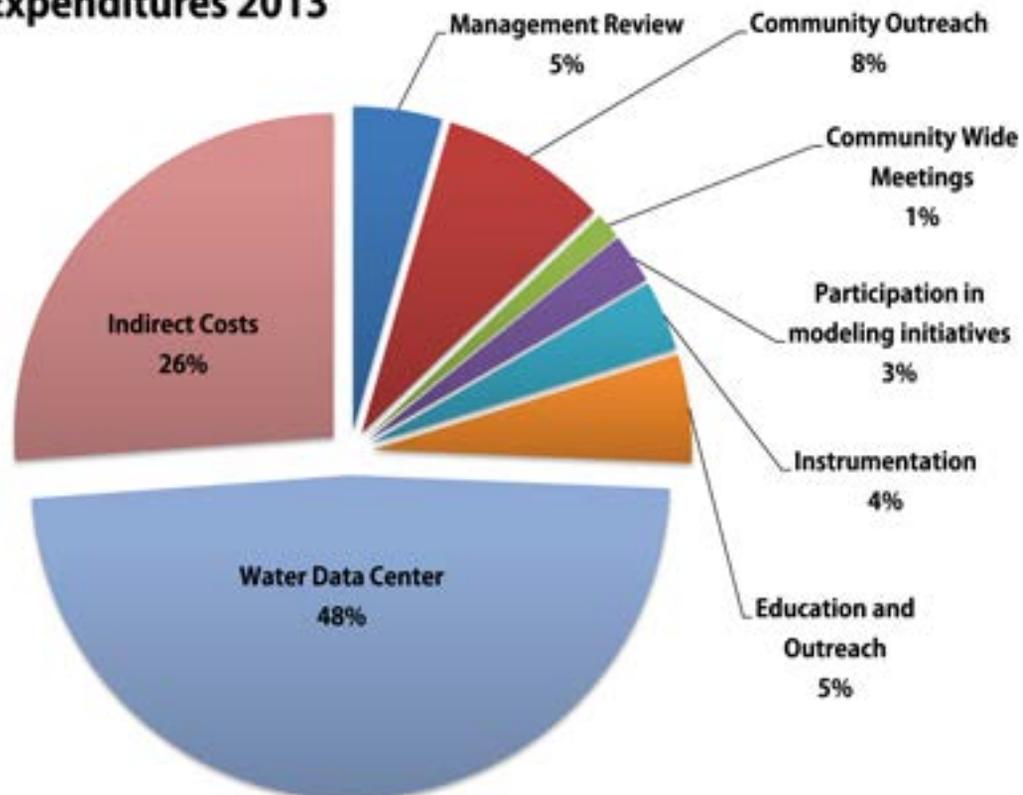
Most of the funding for CUAHSI's activities comes from a 5-year cooperative agreement with the National Science Foundation. This award funds most of the ongoing programs for education and outreach, instrumentation training, community engagement, and support for data services. The award amount from this cooperative agreement in 2013, the final year of this agreement, was \$ 1,145,204. CUAHSI was approved for a renewal cooperative agreement at the end of 2013. The Water Data Center is also funded by NSF through a separate cooperative agreement. The award amount for the WDC in 2013 was \$ 785,575.

CUAHSI also works with external foundations for additional programmatic funding and received a grant of \$34,800 from the Johnson Family Foundation for the Let's Talk About Water program, allowing 1-to-1 matching Challenge Grants for these events.

Membership

Membership fees are a vital source of external funds for an organization that is almost fully dependent on federal grants. These funds allowed some flexibility in spending priorities and chiefly served toward the creation of a six month reserve buffer in the case of an interruption of federal funding. Our current membership fund balance is \$ 160,408.

Total Expenditures 2013



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We envision a diverse and dynamic scientific community, enabled by shared infrastructure, developing an integrative understanding of interactions among water, earth, ecosystems, and society and the science necessary to achieve the sustainable management of water



CUAHSI

universities allied for water research

