

# Water data: access and application for place-based education



Emily Geosling and Jonathan Pollak

The Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI)



## WATER IS EVERYWHERE

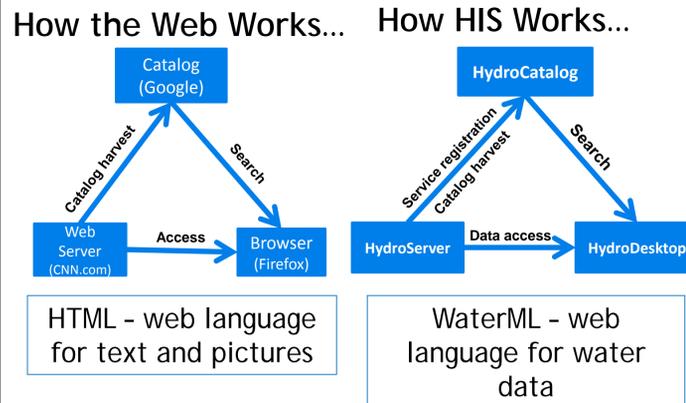
*Water is everywhere.* This sentiment underscores the importance of instilling hydrologic and earth science literacy in educators, students, and the general public, but also presents challenges for water scientists and educators in distributing, accessing, and interpreting water data. Scientific data about water is collected and distributed by many different sources, from federal agencies, to scientific investigators, to citizen scientists. As competition for limited water resources increases, increasing access to and understanding of the wealth of information about the nation's and the world's water will be critical.

The CUAHSI Water Data Center (WDC) maintains a web based system for sharing hydrologic data that can help address this need. The WDC is building upon a large prototype - developed over the past decade - to create and maintain production quality water data resources.

## What is CUAHSI HIS?

The CUAHSI Hydrologic Information System (HIS) is an internet-based system for sharing hydrologic data. It consists of three components: a client (HydroDesktop), a data server software stack (HydroServer), and a central metadata registry (HydroCatalog). These components use a suite of web services, WaterOneFlow, and a type of XML, WaterML, to transmit data. WaterML has been designated a recognized international standard for time-series data by the Open Geospatial Consortium.

HIS uses a "Service-Oriented Architecture (SOA)" like those mandated by US government agencies for distribution of government-collected data. The SOA provides an environment similar to search engines like Google, but specifically for water data sources:



**HydroCatalog: Access over 100 hydrologic data sources including over 25 universities, state and provincial agencies, and multiple federal agencies with *one catalog!***



## Data Access and Analysis with HydroDesktop

A services-oriented architecture enables different data access clients to be customized for specific purposes. Currently, the main data access client is HydroDesktop, a program for the Windows that combines an open-source GIS package with a data discovery client that searches the HIS Central catalog.

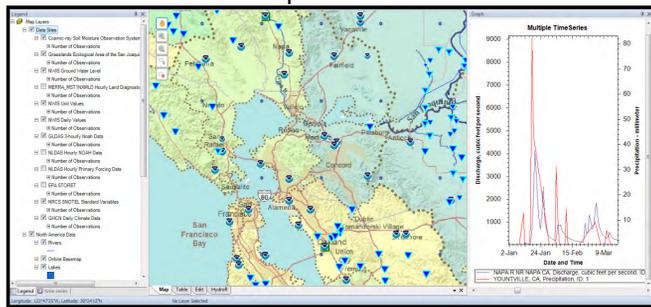
You can use the HydroR plug-in to perform analysis.

HydroDesktop searches for data by:

- Geography (Bounding box or GIS Coverage)
- Time
- Property Measured
- Data Source

HydroDesktop is free and open source!  
Visit [www.HydroDesktop.org](http://www.HydroDesktop.org)

## GIS Layers Map Interface Data Values



A screenshot of HydroDesktop showing the Legend, Map Interface, and a Graph showing data values that have been downloaded.

## Browser-based HydroClient for Data Access

We are currently developing a client that is browser-based (no installation required!) and will work on both PC and Mac interfaces. This will allow geographic search for data and the ability to download datasets, from all the catalogue sources.

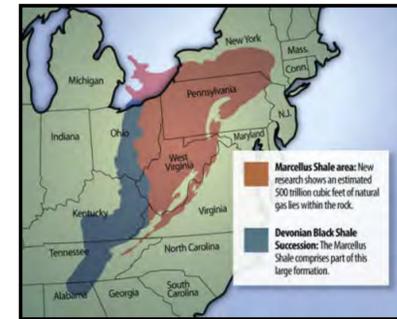
**Browser-based client will be released Summer 2015 @ [data.cuahsi.org](http://data.cuahsi.org)**



## Place-Based Education with Water Data

### Case Study: Hydraulic Fracturing in Pennsylvania

Hydraulic Fracturing is a technique for extracting gas by fracturing bedrock using pressurized liquids. The potential impact on water quality is both a concern for citizens as well as an opportunity for students to investigate this issue by examining data.



Above Image Source: Buffalo Business First

The WDC has worked with two groups in the Pennsylvania area with a focus on "fracking" in the Shale bedrock of the Eastern United States:

- The Shale Network
- Wilkes University

## The Shale Network



Locations of observations in the Shale Network database as seen in HydroDesktop.

The Shale Network is a Research Coordination Network funded by the National Science Foundation that is collating data to determine whether or not evidence of impacts to water quality can be seen in existing data sources. Led by Dr. Sue Brantley of Penn State University, the Shale Network includes academics as well as citizen scientists.

Learn more at: [www.shalenetwork.org](http://www.shalenetwork.org)

## Wilkes University Education Module

Dr. Thomas Barnard of the Institute for Energy and Environmental Research (IEER) worked with CUAHSI staff to develop an educational module that walks students through examining data related to "fracking" and water quality in the Susquehanna River Basin. The .pdf is available on both the WDC ([wdc.cuahsi.org](http://wdc.cuahsi.org)) and IEER ([energy.wilkes.edu](http://energy.wilkes.edu)) websites.

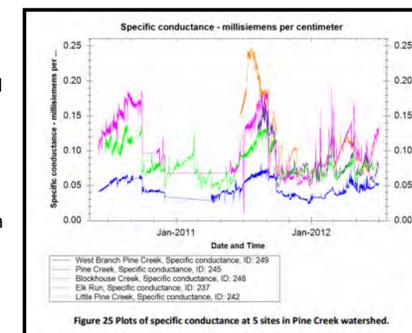
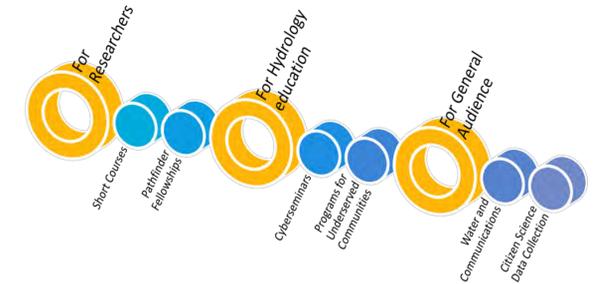


Figure 25 Plots of specific conductance at 5 sites in Pine Creek watershed.

A graph of specific conductance from Dr. Barnard's education module as captured in HydroDesktop.

## Broadening Education in Hydrologic Science

Water science reaches the core foundations of the biological and physical sciences. Across the geosciences there is low recruitment and diversity in the as well as little public understanding of the true scope of the hydrologic cycle. However, CUAHSI hosts a spectrum of programs aimed at increasing innovative research as well as public understanding of water science.



### Short Courses

Week-long courses in highly specific research methods and instruments, in both virtual formats—e.g. Laser Specs for Field Hydrology and Biogeochemistry—as well as hands-on courses hosted at a member university—Watershed Management at Biosphere 2. Upcoming courses include Wireless Sensor Bootcamp at UC Berkeley and an online workshop and poster session on Data Management.

### Pathfinder Fellowships

Awarded to graduate students, this fellowship is awarded for research that expands beyond the traditional research focus on a single field site or modeling approach. This also deepens ties within the community by allowing students to work with colleagues from other universities or research centers.

### Programs for Underserved Communities

As part of the Water Data Center grant, CUAHSI will increase STEM education activities in the hydrologic sciences for underserved communities, especially native populations. For example, we support Salish Kootenai College's Hydrology degree program, the first of its kind at a tribal college in the US.

### Cyberseminars - Online Learning

CUAHSI supports "beyond the classroom" learning that provides access to expertise that is not available in a traditional college education, adding broader perspectives and learning opportunities to a specialized knowledge base. Through cyberseminars, we provide access to new types of training and the opportunity to see the research and interact with world-class scientists.

### Let's Talk About Water film & education events

"Let's Talk About Water" (LTAW) is a film symposium that brings together experts and the public to talk about the complex water issues facing society by effectively using documentaries and popular films to promote water and Earth science education. CUAHSI provides grants to university groups to help run these events.

### Citizen Science Data Collection

In the future, we aim to make the scientific process accessible to all. Scale and usability of the database out of the Water Data Center for research applications and localized management is a critical component of understanding—and thereby effectively managing—water resources, working together with scientists and the interested public.

## ACKNOWLEDGEMENTS

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