

# HydroShare

An online, collaborative environment for the sharing of hydrologic data and models

David Tarboton, Ray Idaszak, Dan Ames, Jeff Horsburgh, Jon Goodall, Larry Band, Venkatesh Merwade, Carol Song, Alva Couch, David Valentine, Rick Hooper, Jennifer Arrigo, David Maidment, Tim Whiteaker

[dtarb@usu.edu](mailto:dtarb@usu.edu)

<http://his.cuahsi.org>

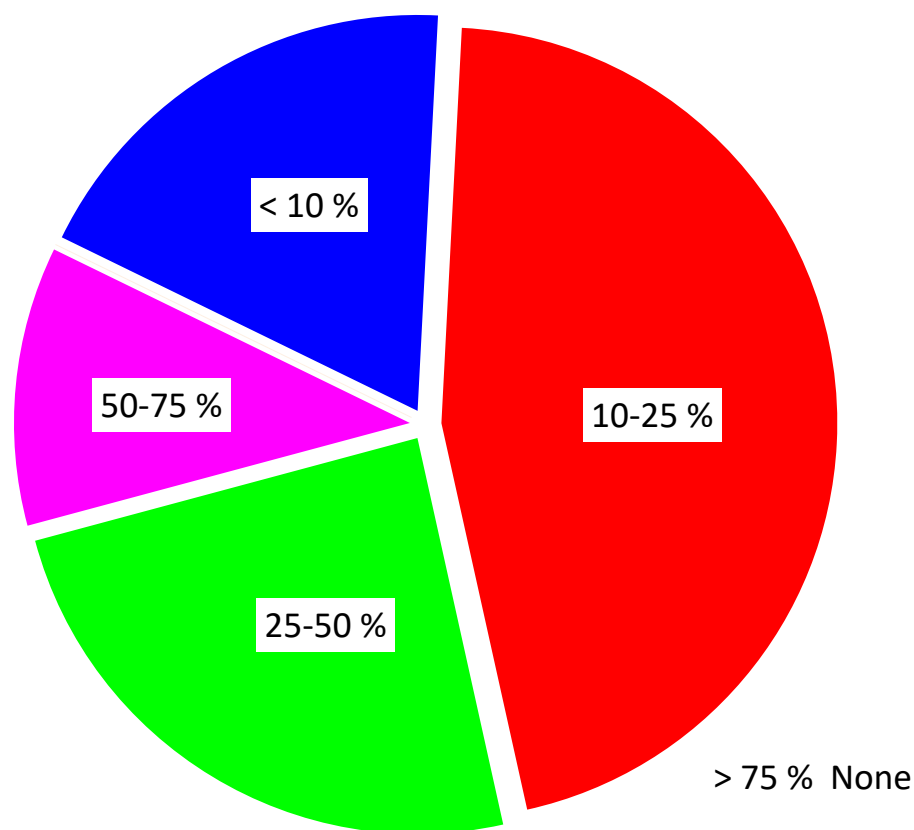


CUAHSI  
**HIS**

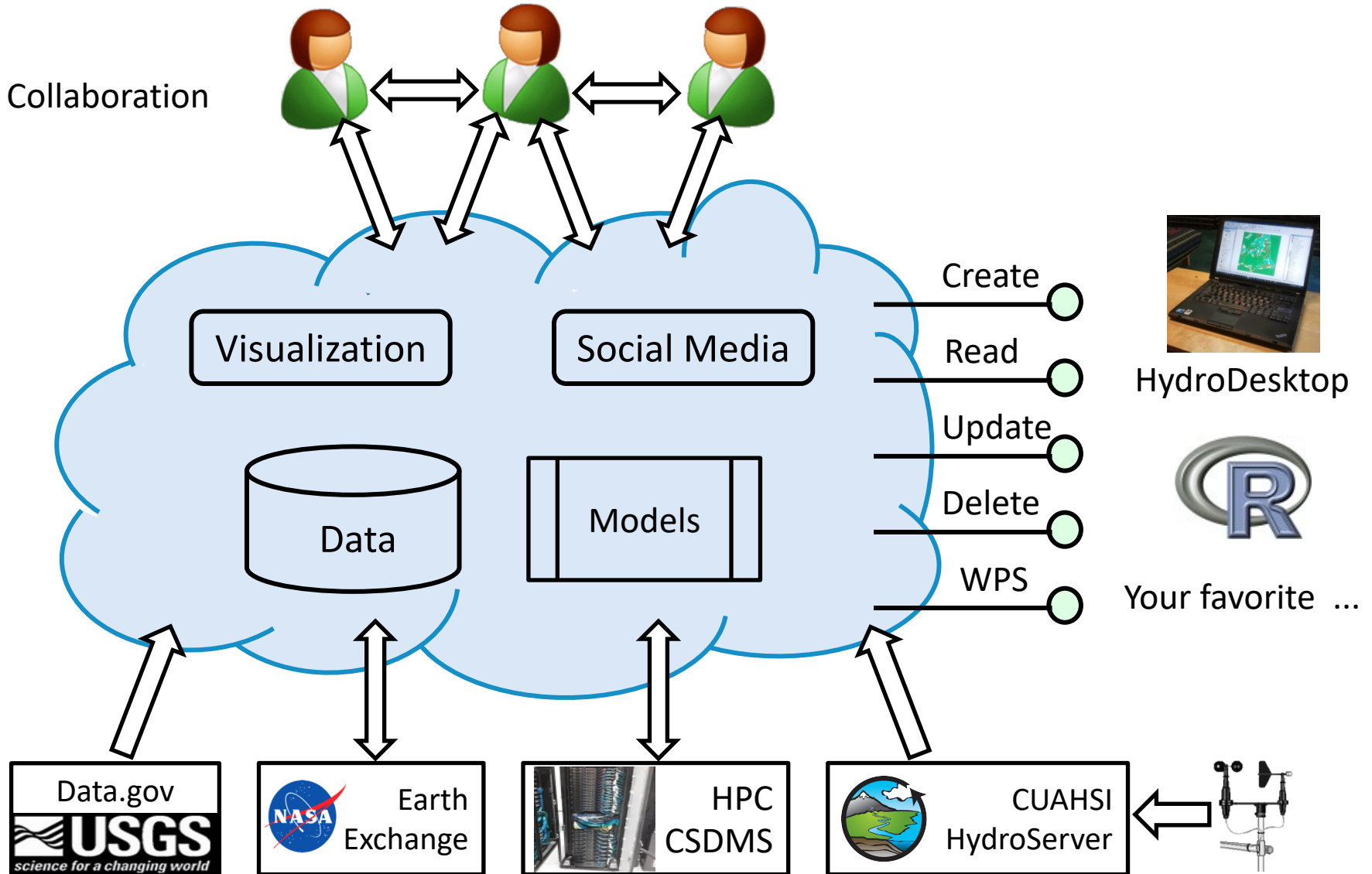
*Sharing hydrologic data*



**What proportion of your research time do you spend on preparing or preprocessing data into appropriate forms needed for research purposes?**



# HydroShare



# Can sharing data and models be as easy as sharing photos on Facebook or videos on YouTube?

The image displays two overlapping browser windows. The background window is a Facebook profile for David Tarboton, showing his profile picture, name, and bio. The foreground window is a YouTube video player showing a presentation titled "Hydrological investigation on the Carpathian Basin using HydroDesktop". The video player includes a search bar, navigation buttons, and a video player interface with a play button, volume, and progress bar. The video content shows a person presenting in front of a large screen displaying the same title and presenter information: "Boglárka BALÁZS, PhD student, University of Debrecen, Department of Physical Geography and Geoinformatics, Debrecen, Hungary". The video has 18 views and was published on Jul 4, 2012 by MapWindowNL.

Facebook Profile: David Tarboton

- Worked at Utah State University
- Studied Hydrology at Massachusetts Institute of Technol
- Lives in Logan, Utah
- Married to Debbie Tarboton

YouTube Video: Hydrological investigation on the Carpathian Basin using HydroDesktop

Video Player: 00:03 / 14:54, 18 views

Video Content: Hydrological investigation on the Carpathian Basin, Boglárka BALÁZS, PhD student, University of Debrecen, Department of Physical Geography and Geoinformatics, Debrecen, Hungary

# Can finding data and models be as easy as shopping on Amazon?

The image shows a screenshot of the Amazon.com website with a search for the book "Data, Models, and Decisions: The Fundamentals of Management Science" by David Berkeley. The page is annotated with several blue boxes and arrows pointing to specific features:

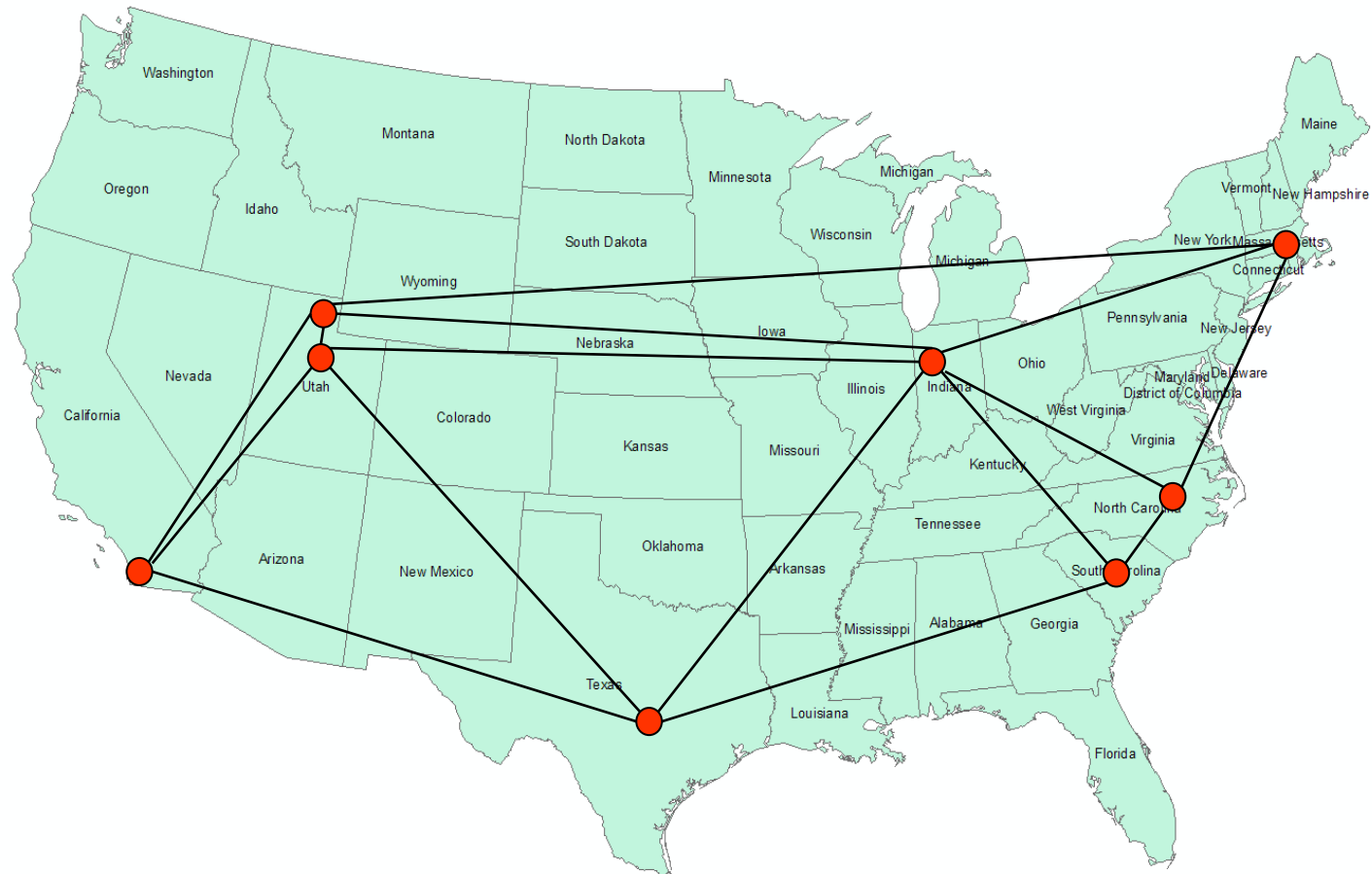
- Possible Filter:** Points to the search bar and the "Department" dropdown menu.
- Available Formats:** Points to the "Formats" section showing options like Hardcover, Paperback, and Unknown Binding with their respective prices.
- Prices (perhaps usage):** Points to the "Price history" chart showing the book's price over time from 1990 to 2010.
- Recommendations:** Points to the "Customers Who Bought This Item Also Bought" section, which lists related books like "Microeconomics" and "Principles of Corporate Finance".

Other visible elements on the page include:

- Navigation:** Amazon Prime logo, "Shop by Department" (Gateway, Gift Certificates/Cards), and a sidebar with categories like Engineering, Mathematics, and Kindle Store.
- Product Details:** Book cover, title, author, and a "Book Description" section.
- Price Information:** Current price of \$95.00 (new) and \$80.68 (used), with a "More Buying Choices" section.
- Additional Features:** "Textbooks" section, "Customers Viewing This Page May Also View", and "Customers Who Bought This Item Also Bought".

# HydroShare project team

- USU
- RENCI/UNC
- CUAHSI
- ISU (BYU)
- Tufts
- USC
- Texas
- Purdue
- SDSC



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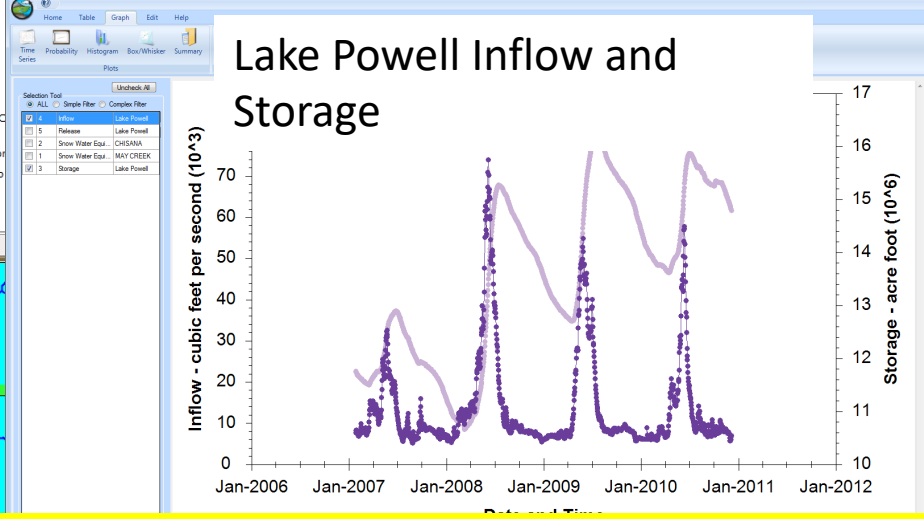
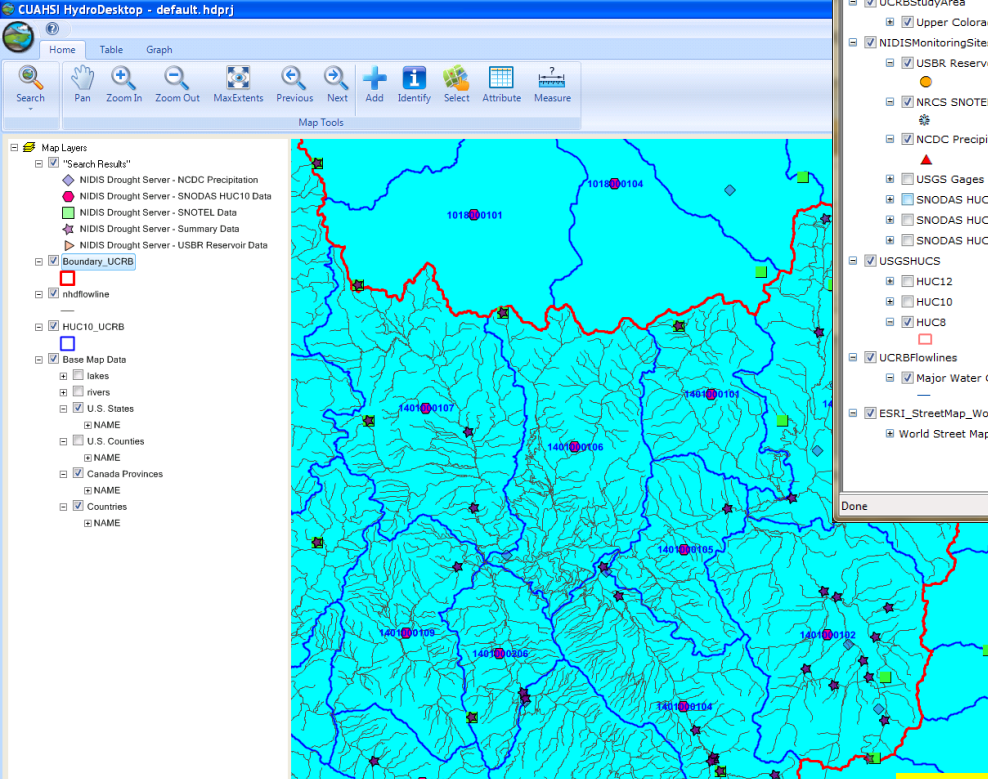
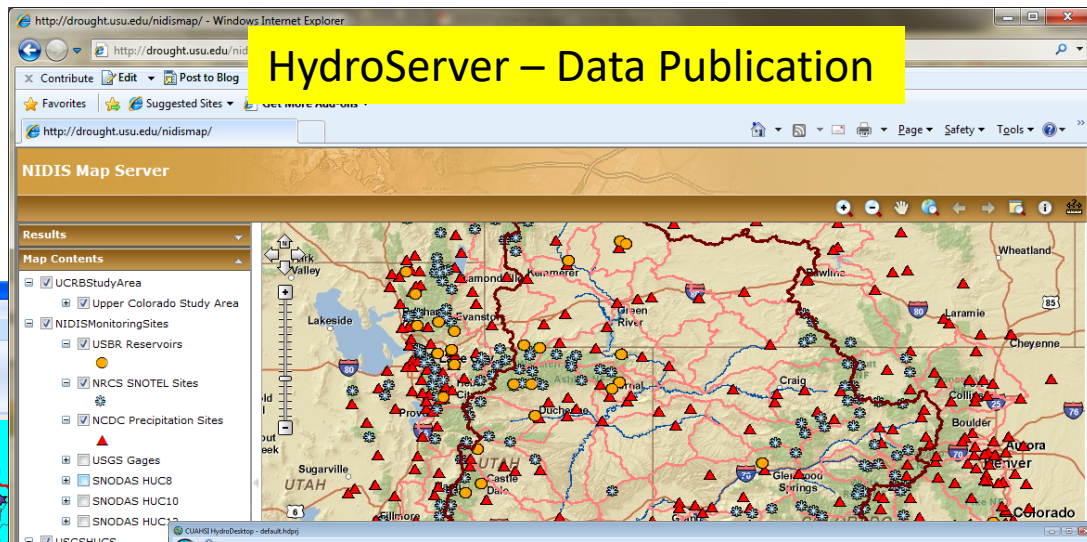
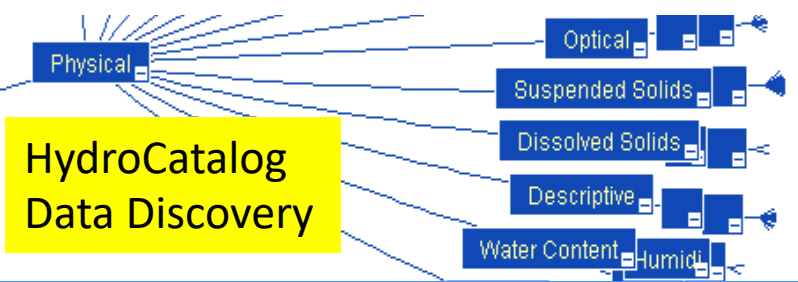
*Sharing hydrologic data*



OCI-1148453  
OCI-1148090  
2012-2017

# CUAHSI Hydrologic Information System

The CUAHSI Hydrologic Information System (HIS) is an internet based system to support the sharing of hydrologic data. It is comprised of hydrologic databases and servers connected through web services as well as software for data publication, discovery and access.

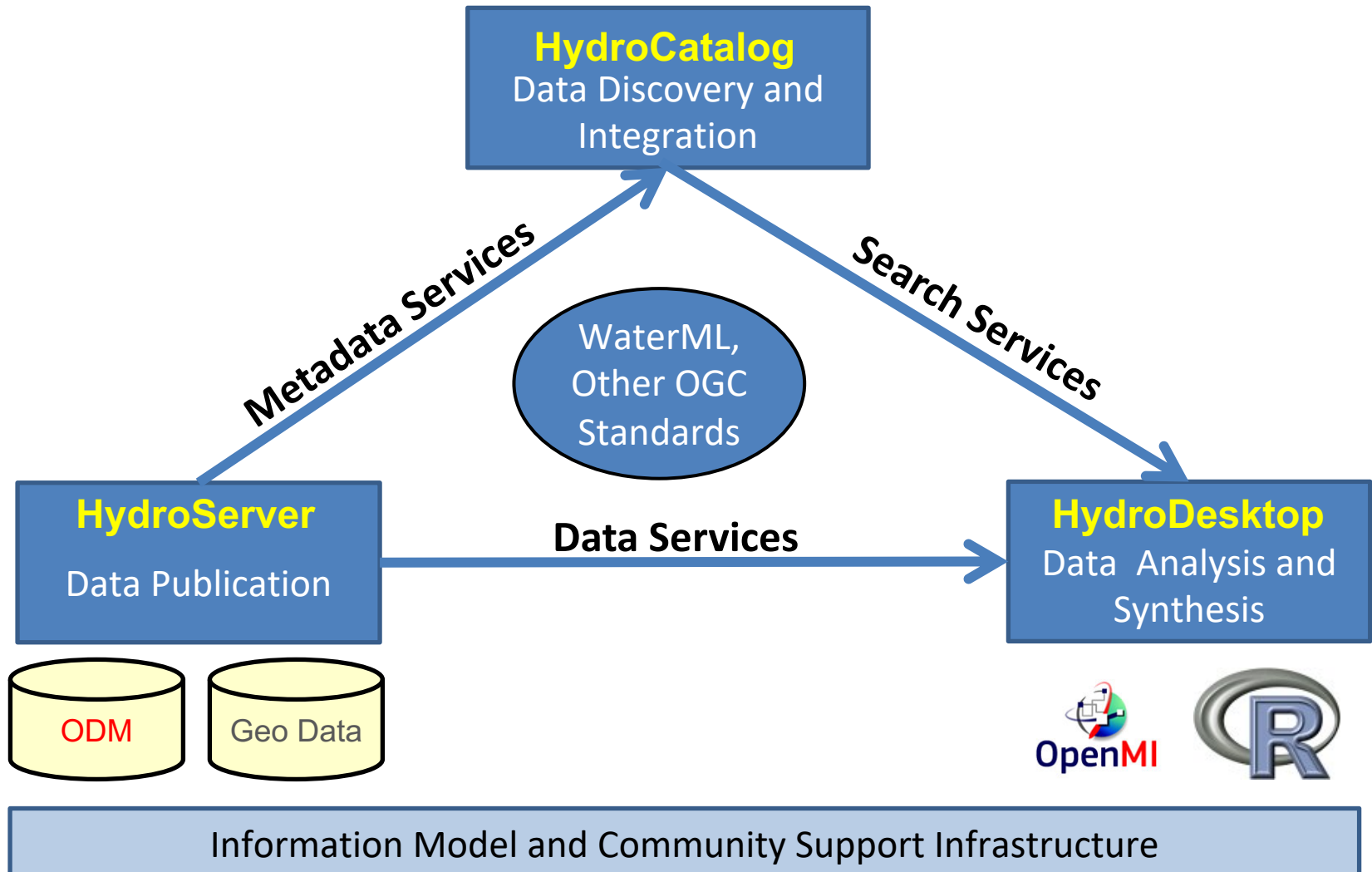


HydroDesktop – Data Access and Analysis

HydroDesktop – Combining multiple data sources

# CUAHSI HIS

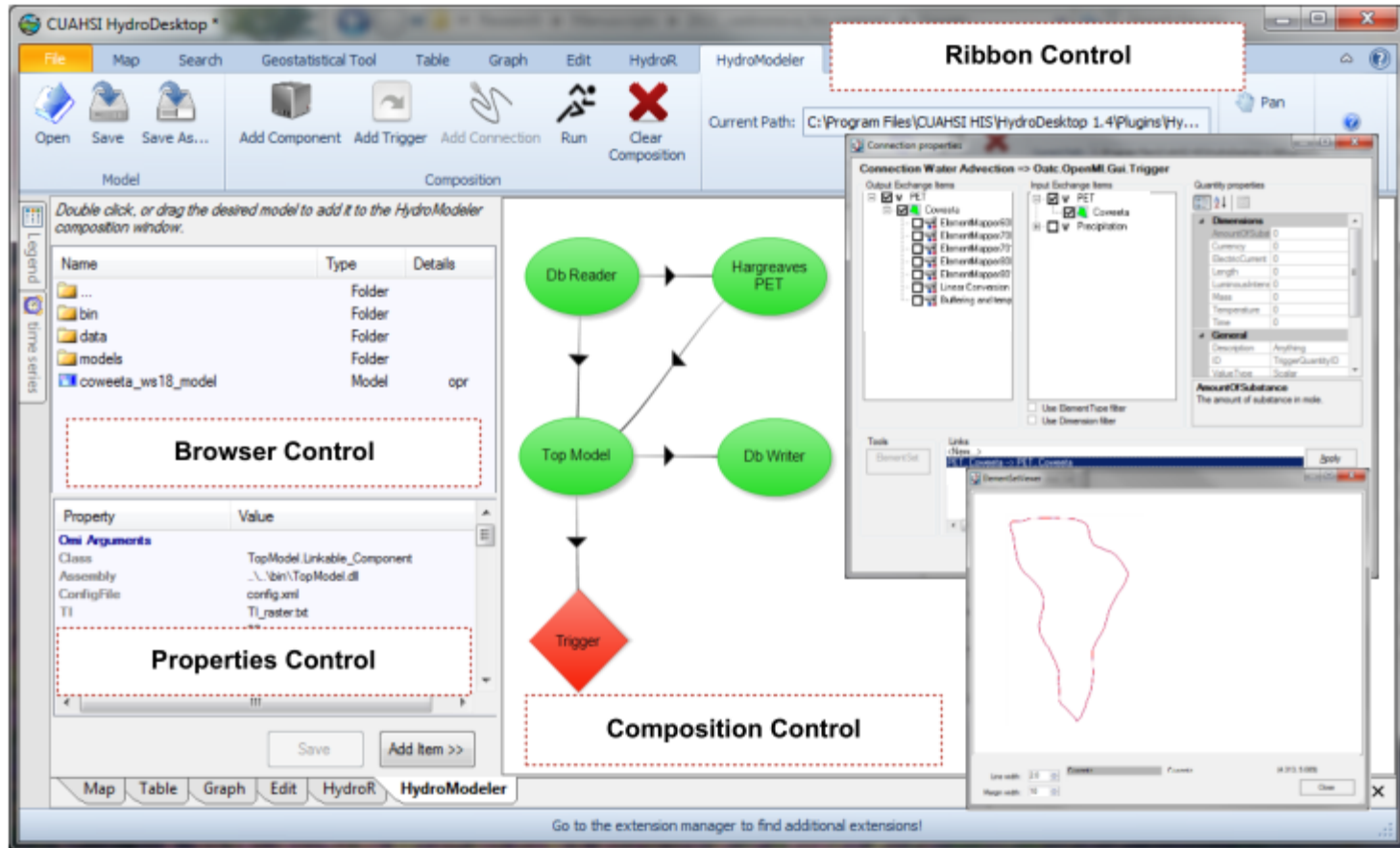
## Services-Oriented Architecture





# HydroDesktop and Modeling

An integrated modeling environment based on the Open Modeling Interface (OpenMI) standard and embedded within HydroDesktop



Integrated modeling within a Hydrologic Information System: An OpenMI based approach, Castronova, A.M., Goodall, J.L., Ercan, M.B. Environmental Modelling & Software, In Press. 10.1016/j.envsoft.2012.02.011.

# CUAHSI HIS Key Aspects

- **Storage** in a community data model
- **Publication** from a server (92 registered to date)
- Data **access** through internet-based services using consistent language and format
- Tools for **access and analysis**
- **Discovery** through thematic and geographic search functionality
- **Integrated modeling and analysis** combining information from multiple sources
- **WaterML** evolved into Open Geospatial Consortium Standard, being considered by WMO and used by USGS and EPA among others

# Open Development Model

http://hydrodesktop.codeplex.com/

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Register Sign In CodePlex H

CodePlex Open Source Community

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- <http://his.cuahsi.org>
- <http://hydrodesktop.codeplex.com>
- <http://hydroserver.codeplex.com>
- <http://hydrocatalog.codeplex.com>

★ 24 people are following this project (follow)

Download

CURRENT	1.1.390
DATE	Wed Jan 26 2011 at 7:00 AM
STATUS	Stable
RATING	No Ratings
	530 downloads
MORE	<a href="#">View all downloads</a>

Activity 7 30 All c

Page Views

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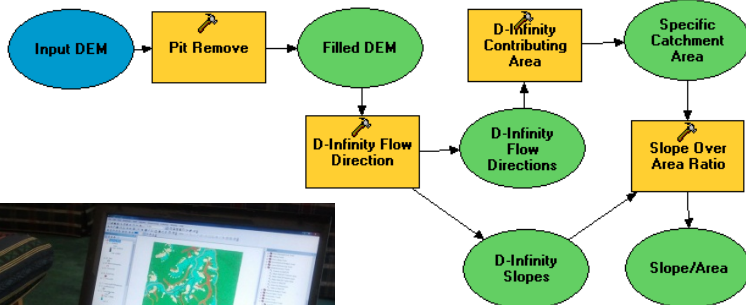
DOT SPATIAL MAP WINDOW

100%

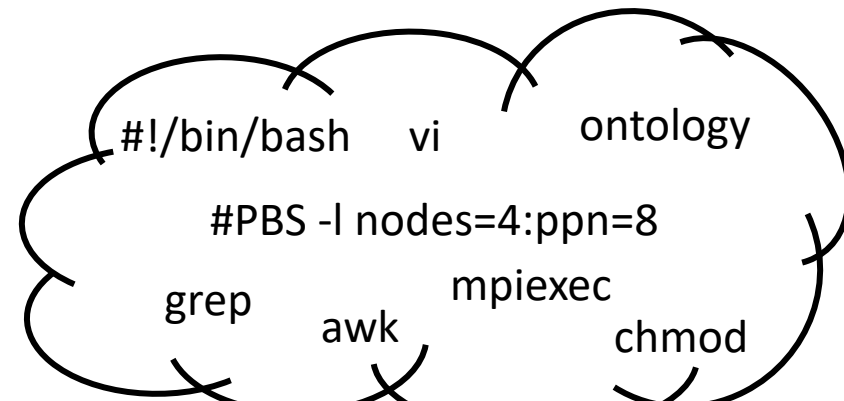
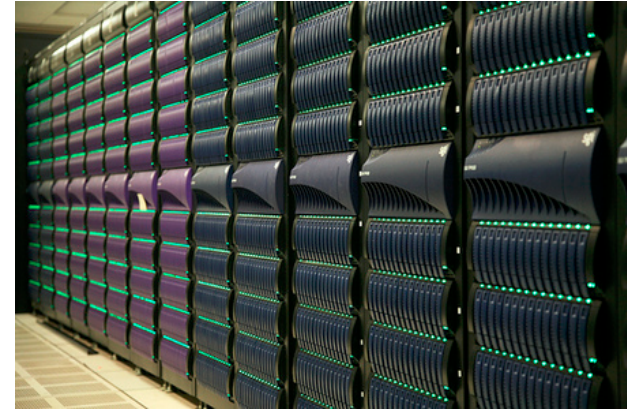
# A Digital Divide

## Researchers

- Experimentalists
- Modelers



## Big Data and HPC

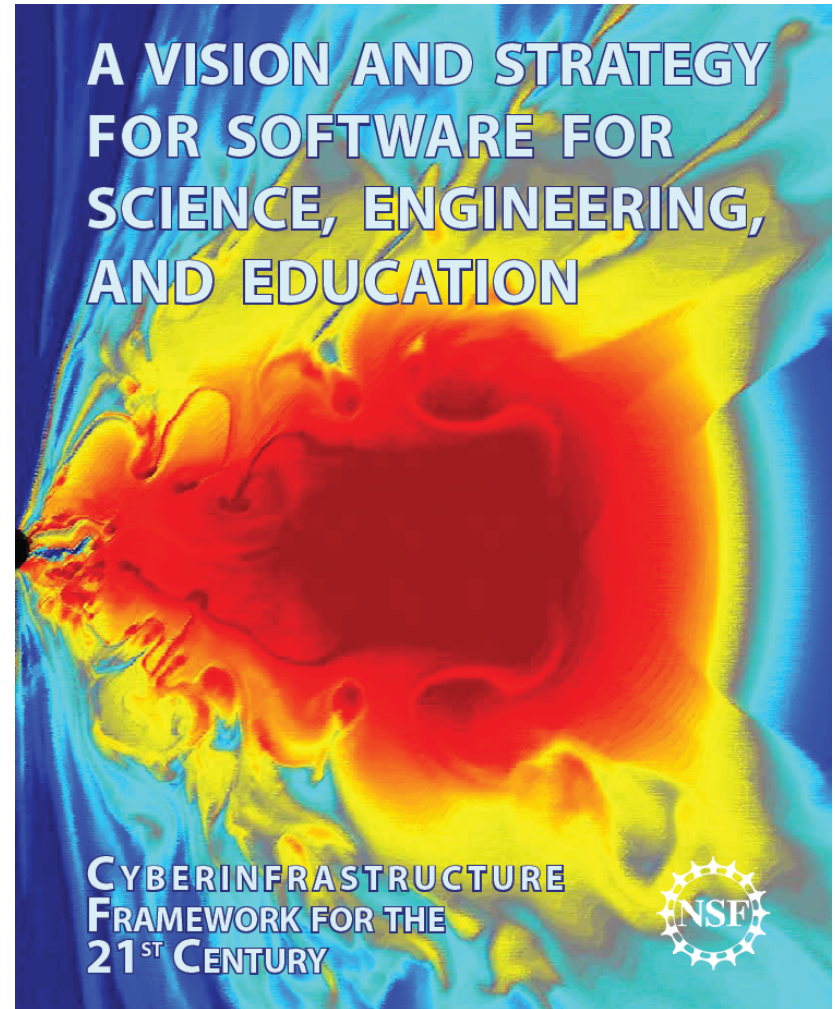


```
-bash-3.2$ ls tddata
logan      LoganOutlet.sbn  LoganOutlet.shp  LoganOutlet.shx
LoganOutlet.dbf  LoganOutlet.sbx  LoganOutlet.shp.xml
-bash-3.2$ ls tddata/logan
logan.tif
-bash-3.2$ ls
eric  logMffel  run.bash  taudem.bash  taudem_submit.sh
logMP  run_all.bash  run_taudem.sh  taudem_041959  tddata
-bash-3.2$ run_taudem.sh pitremove -z logan -fel loganfel
43058.ip-net
-bash-3.2$
```

# NSF vision

*“enabling software systems are needed to create an environment in which the barrier to access is low for innovation and new discovery”*

- Data Management and Preservation
- Software Sustainability



# Overlying Concepts

- HydroShare must change the way we do science
- HydroShare is a collaboration environment and social media site
- HydroShare must appeal to the community
- HydroShare is designed and governed to be responsive to community input
- ***HydroShare has to be dead simple to use***

# Functionality to be developed

1. A new, **web-based system** for advancing model and data sharing
2. **Sharing** features to HydroDesktop
3. Access **more types of hydrologic data** using **standards** compliant data formats and interfaces
4. Enhance **catalog** functionality that broadens **discovery** functionality to **different data types and models**
5. New **model** sharing and discovery functionality
6. Facilitate and ease access to use of **high performance computing**
7. New social media and collaboration functionality

# Extend HIS Data Formats

- Point Observations (Time Series in ODM/WaterML)
- Feature data set (Shapefile of points, lines or polygons and attribute tables)
- Raster data set (GeoTIFF file)
- Multidimensional space/time data set (NetCDF file)
- Geochemistry (ODM2)
- Generalize catalog to include these formats
- Adopt or develop appropriate web services or data delivery mechanisms





## Share and Collaborate

HydroShare is an online collaboration environment for sharing data, models, and code. Join the community to start sharing.



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# HydroShare

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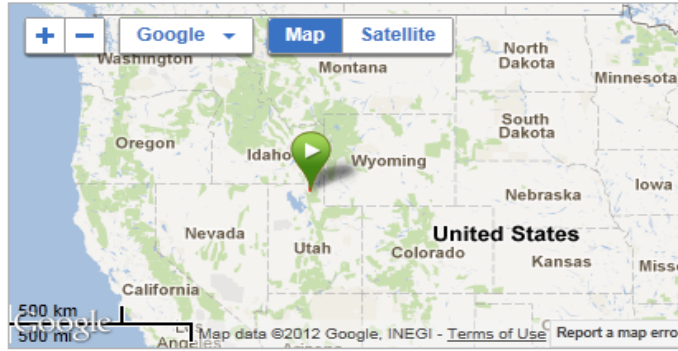
 Little Bear River ODM Database 6/6/2012

 Little Bear River Sites 6/6/2012

 Little Bear River Excel File 6/6/2012

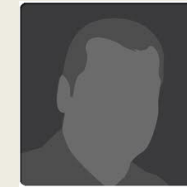
 Watershed delineation Workflow 6/6/2012

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**Abstract:** Time series of water quality sensor data in the Little Bear River, Utah, USA  
**Keywords:** Temperature, Dissolved Oxygen, pH, Specific Conductance, Turbidity

[View Details](#)



[Profile](#)

Jeff Horsburgh  
Utah State University  
jeff.horsburgh@usu.edu

Resources You May Like



[Little Bear River SWAT Model](#)  
Shared by: [David Tarboton](#)



[Little Bear River DEM](#)  
Shared by: [David Tarboton](#)

Announcements

**What's New at HydroShare:** Click [here](#) to visit the HydroShare blog to learn more about recent updates and new HydroShare features.

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# HydroShare



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	Type ▲	Title ▲	Date ▲	Abstract ▲
<input type="checkbox"/>		<a href="#">Little Bear River ODM Database</a>	6/6/2012	Utah State University is conducting continuous monitoring within the Little Bear River watershed of northern Utah, USA to investigate the use of surrogate ...
<input type="checkbox"/>		<a href="#">Little Bear River Sites</a>	6/6/2012	Shapefile of monitoirng sites in the Little Bear River watershed.
<input type="checkbox"/>		<a href="#">Watershed Delineation Workflow</a>	6/6/2012	TauDEM workflow to delineate watershed from DEM. Stream threshold is determined automatically to obtain objective drainage density estimate.
<input type="checkbox"/>		<a href="#">Little Bear River SWAT Model</a>	6/6/2012	This is a Soil and Water Assessment Tool model package that is ready to execute. All inputs and outputs are included in the model package.
<input type="checkbox"/>		<a href="#">Little Bear River DEM</a>	6/6/2012	2 m resolution Digital Eleva6tion Model derived from LIDAR.
<input type="checkbox"/>		<a href="#">Stream Metabolism R Script</a>	6/6/2012	This R script contains a set of functions that implement a one-station stream metabolism model
<input type="checkbox"/>				

Results 1 – 10 of 100 << 1 2 3 4 5 6 7 8 9 10 >>

# HydroShare

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This material is based upon work supported by the National Science Foundation (NSF) under Grant No. XXXXXXXX.

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## Little Bear River SWAT Model | [Resource Details](#)

[Open](#)
[Execute](#)
[Share](#)
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[Delete](#)



**Resource Type:** Model Package

**Created by:** Jeff Horsburgh

**Created:** 6/10/2012

**Keywords:** Little Bear River, Nutrients, Phosphorus, Water Quality, Model

**Size:** 100 MB

★★★★★  (76)

### Resource Description

**Abstract:** This is a Soil and Water Assessment Tool model package that is ready to execute. All inputs and outputs are included in the model package.

**Required Inputs:** High frequency (sub-daily) measurements of water temperature, dissolved oxygen, solar radiation, barometric pressure,

**Outputs:** Daily estimates of streamflow and water quality for subwatersheds in the Little Bear River.

**Citation:** Horsburgh, J. S. (2012), Little Bear River SWAT Model, Utah State University, Logan, UT.

### Comments

[Add Comment](#)



[Jeff Horsburgh](#): This model package is ready to execute.

### Shared With



[Jon Goodall](#)  
University of South Carolina

### Similar Resources



[Neuse River SWAT Model](#)

Shared by: [Jon Goodall](#)



[Neuse River Rhessys Model](#)

Shared by: [Larry Band](#)

# E.g. SWATShare

- A HUBZero based tool for publishing, sharing, and accessing Soil Water Assessment Tool (SWAT)

The screenshot shows the SWATShare web application interface. At the top, there is a navigation bar with links for Home, my HUB, Resources, Members, Explore, and About, along with a Need Help button. Below the navigation bar, a light blue banner indicates the current location: "You are here: SWAT Share".

The main content area features a heading "SWAT Share" and a descriptive paragraph: "SWAT Share enables users to upload, share and edit their SWAT input data, run their uploaded model, download the output file, and visualize output results."

Below the text, there is a toolbar with buttons for View, Upload, Edit, Run, and Visualization. The main interface is dominated by a map of the United States, showing a red-shaded region in the Midwest. A zoom control is visible on the left side of the map, and a "Welcome vmmerwade" message is displayed in the top right corner of the map area.

A property window is open over the map, displaying the following information:

Property	Value
User ID	mvittori
Model Name	term_project
Version	SWAT2009
HUC ID	05120205
Country	
State	
Dem resolution	30

On the right side of the interface, there is a "My Models" sidebar with a list of model names: cedar, demo, testcase, and testcase2.

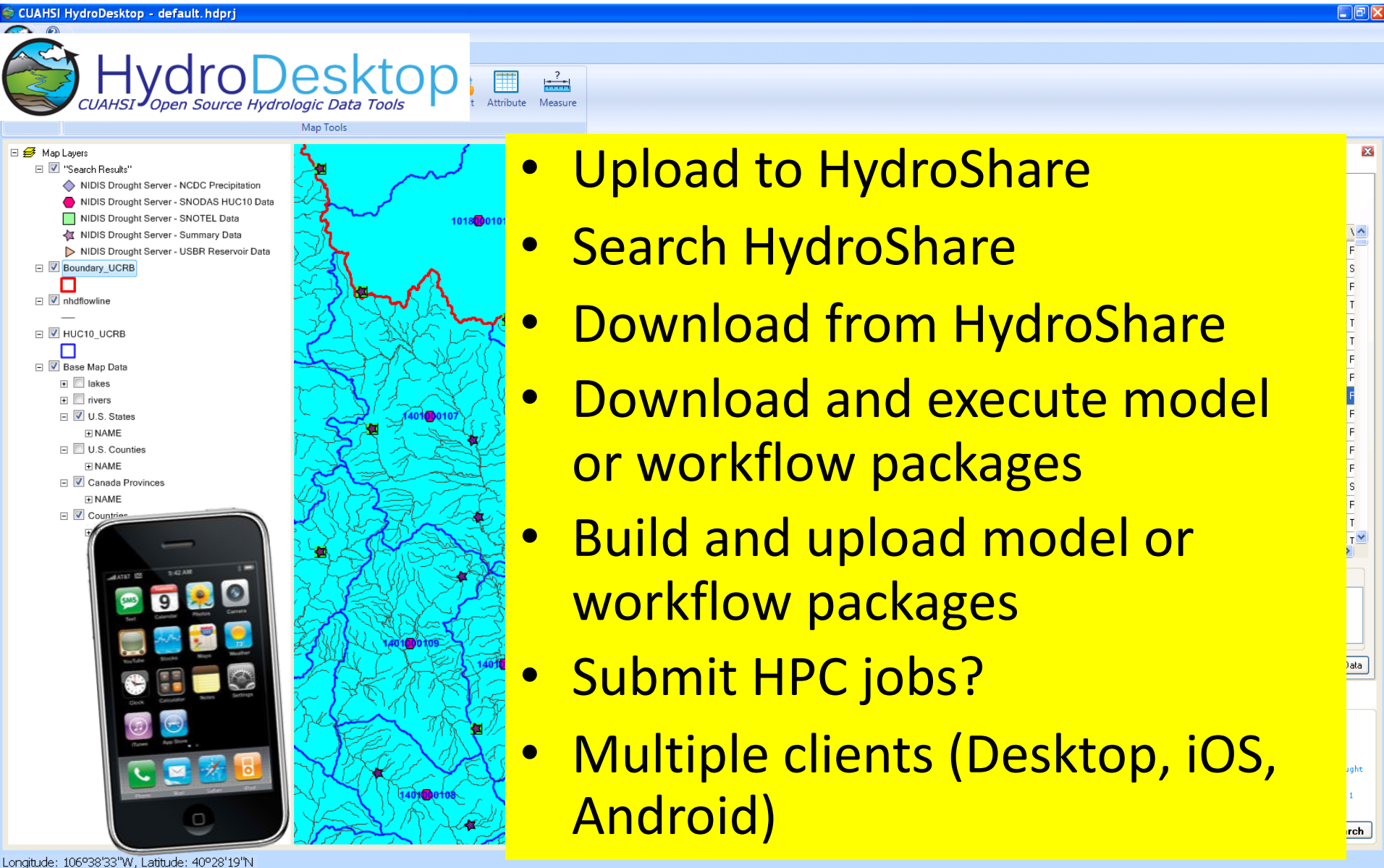
# Interoperable data sharing

- Tim Berners-Lee contends that the danger of social networking sites is that most are silos and do not allow users to port data from one site to another. He also cautions against social networks that grow too big and become a monopoly as this tends to limit innovation.

<http://www.scientificamerican.com/article.cfm?id=long-live-the-web>

- ***We need:***
  - ***Well defined APIs for client application developers***
  - ***Well defined data encoding and transfer formats to ensure that all data is portable***
  - ***Standard CRUD interfaces***

# Support Client/App Functionality



CUAHSI HydroDesktop - default.hdprj

HydroDesktop  
CUAHSI Open Source Hydrologic Data Tools

Map Tools

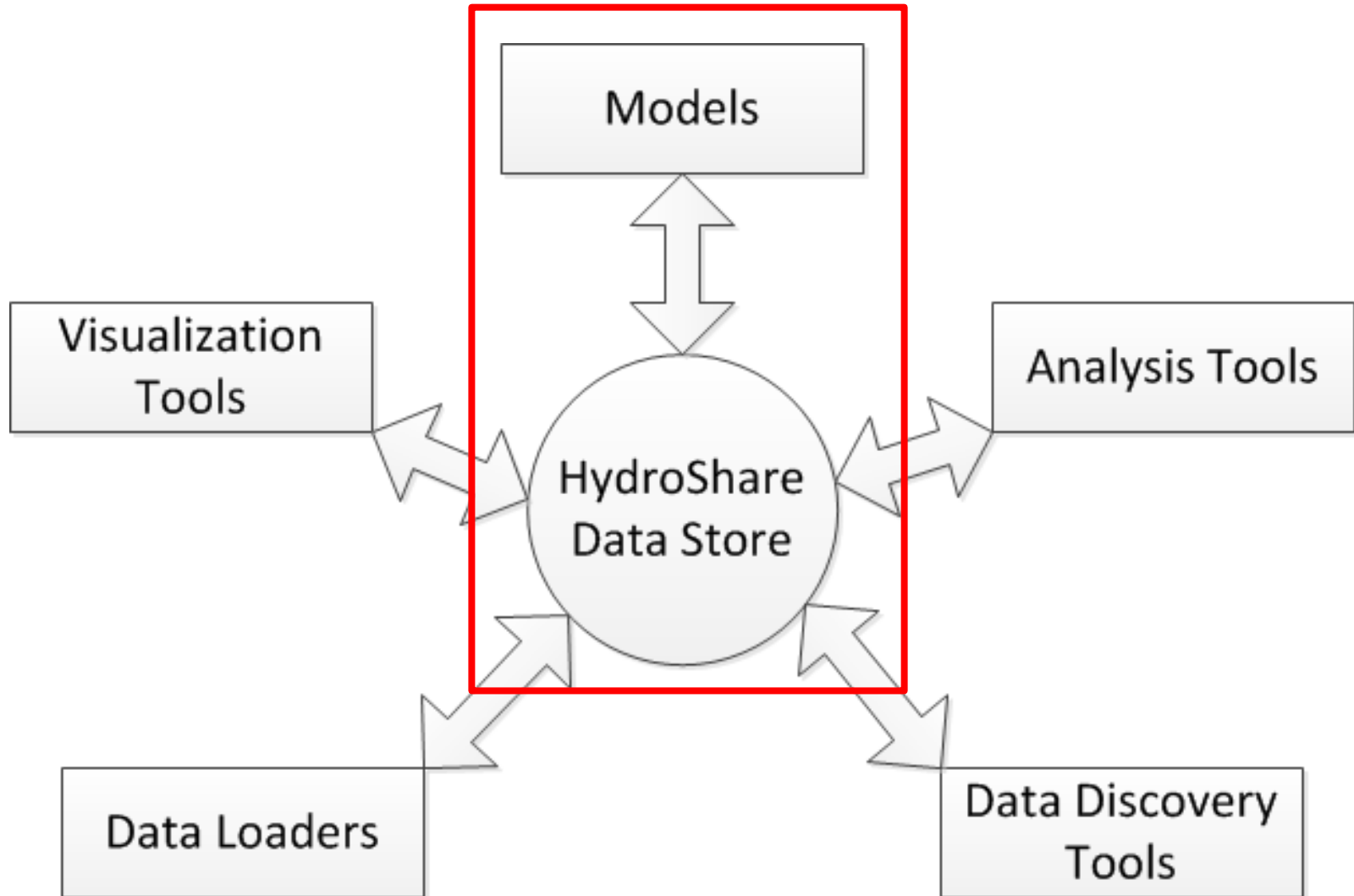
Map Layers

- Search Results
  - NIDIS Drought Server - NCDC Precipitation
  - NIDIS Drought Server - SNODAS HUC10 Data
  - NIDIS Drought Server - SNOTEL Data
  - NIDIS Drought Server - Summary Data
  - NIDIS Drought Server - USBR Reservoir Data
- Boundary\_UCRB
- nhdflowline
- HUC10\_UCRB
- Base Map Data
  - lakes
  - rivers
  - U.S. States
    - NAME
  - U.S. Counties
    - NAME
  - Canada Provinces
    - NAME
  - Countries

Longitude: 106°38'33"W, Latitude: 40°28'19"N

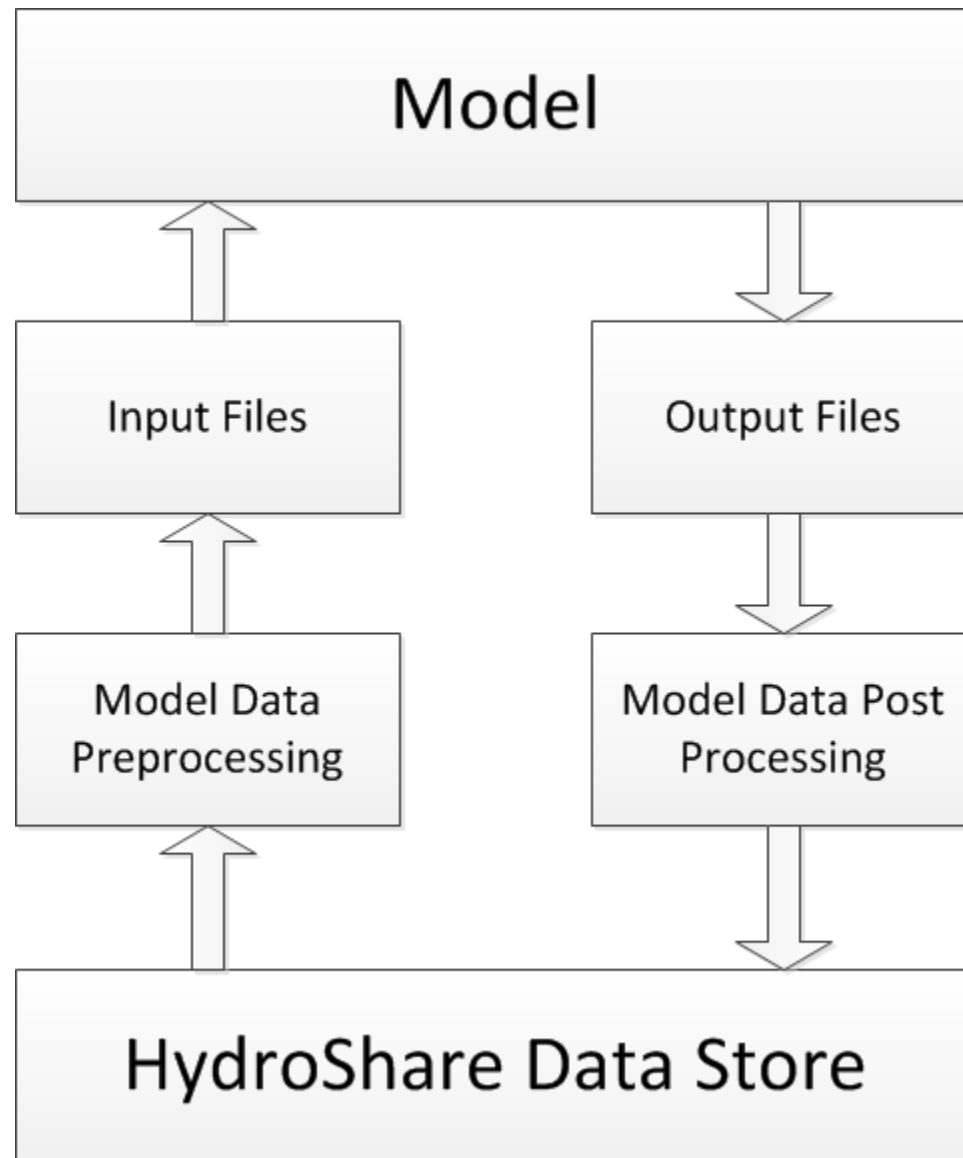
- Upload to HydroShare
- Search HydroShare
- Download from HydroShare
- Download and execute model or workflow packages
- Build and upload model or workflow packages
- Submit HPC jobs?
- Multiple clients (Desktop, iOS, Android)

# Using HydroShare for Modeling and Analysis

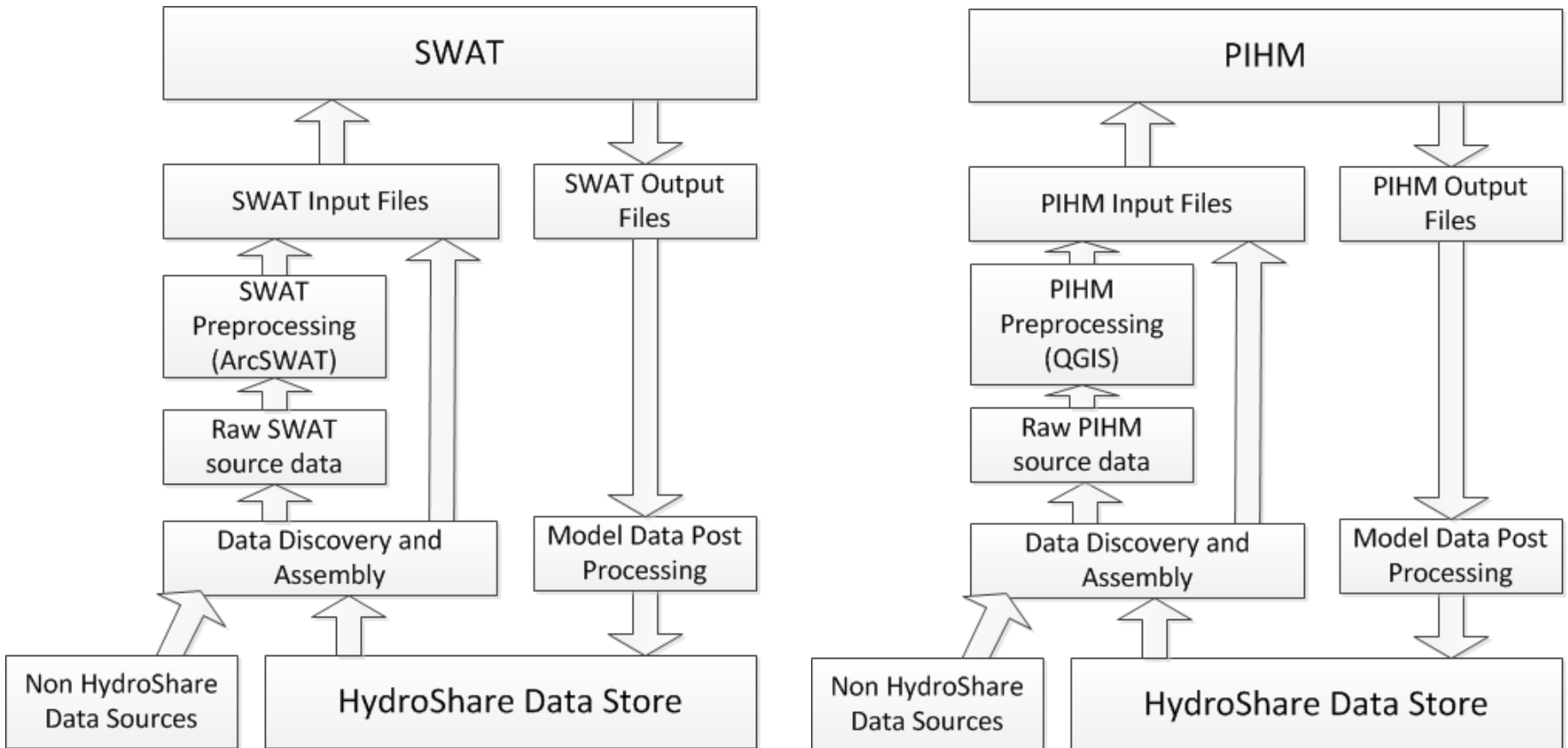




# General Model Execution Paradigm



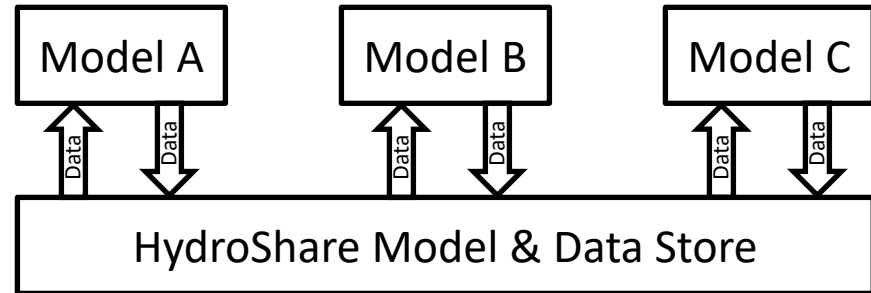
# Examples



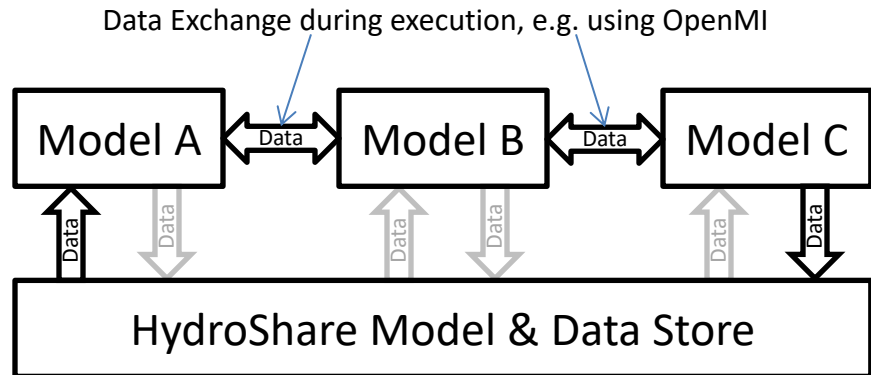
VIC, HSPF, Others ... You contribute your model

# Levels of Model Integration

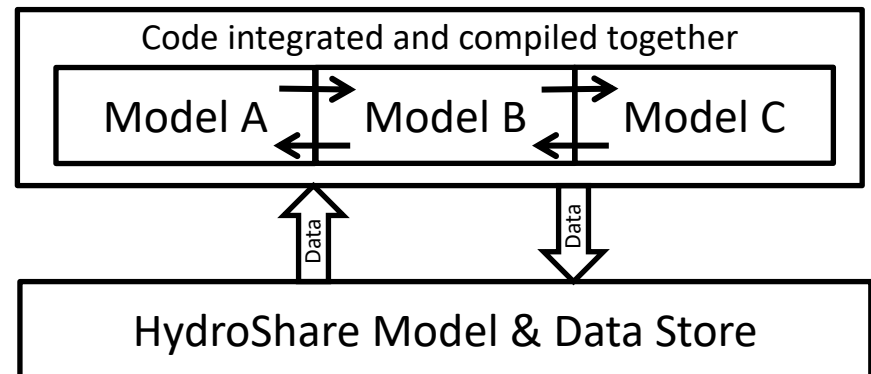
Data centric workflow



Loose coupling

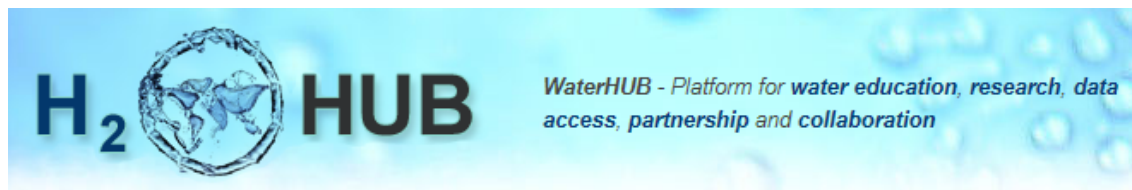


Tight coupling





# HUBzero Based Community Portal

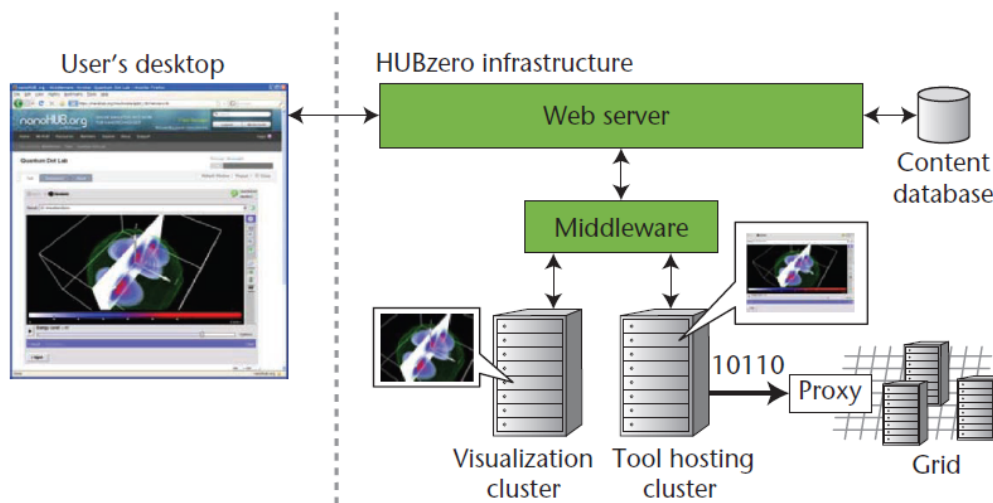


## Data & Model Resources

- Discovery & access
- Development
- Execution on local VM
- Execution on remote HPC
- Publishing
- Collaboration

## Web Portal

- Social networking
- Community collaboration
- Resource rating
- Documents & videos
- Learning modules



Architecture of HUBzero platform used to create dynamic web sites for scientific research and educational activities

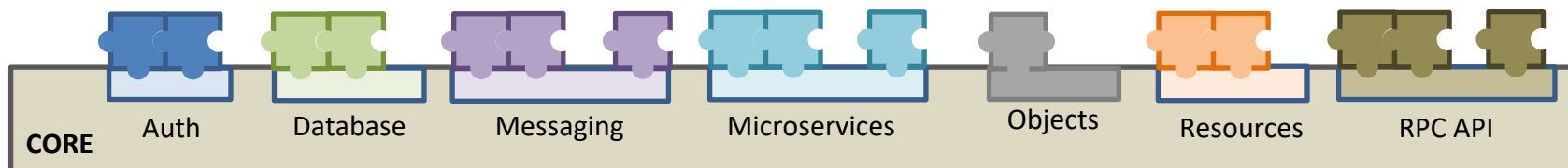
<http://dx.doi.org/10.1109/MCSE.2010.41>

<http://hubzero.org>

<http://water-hub.org>

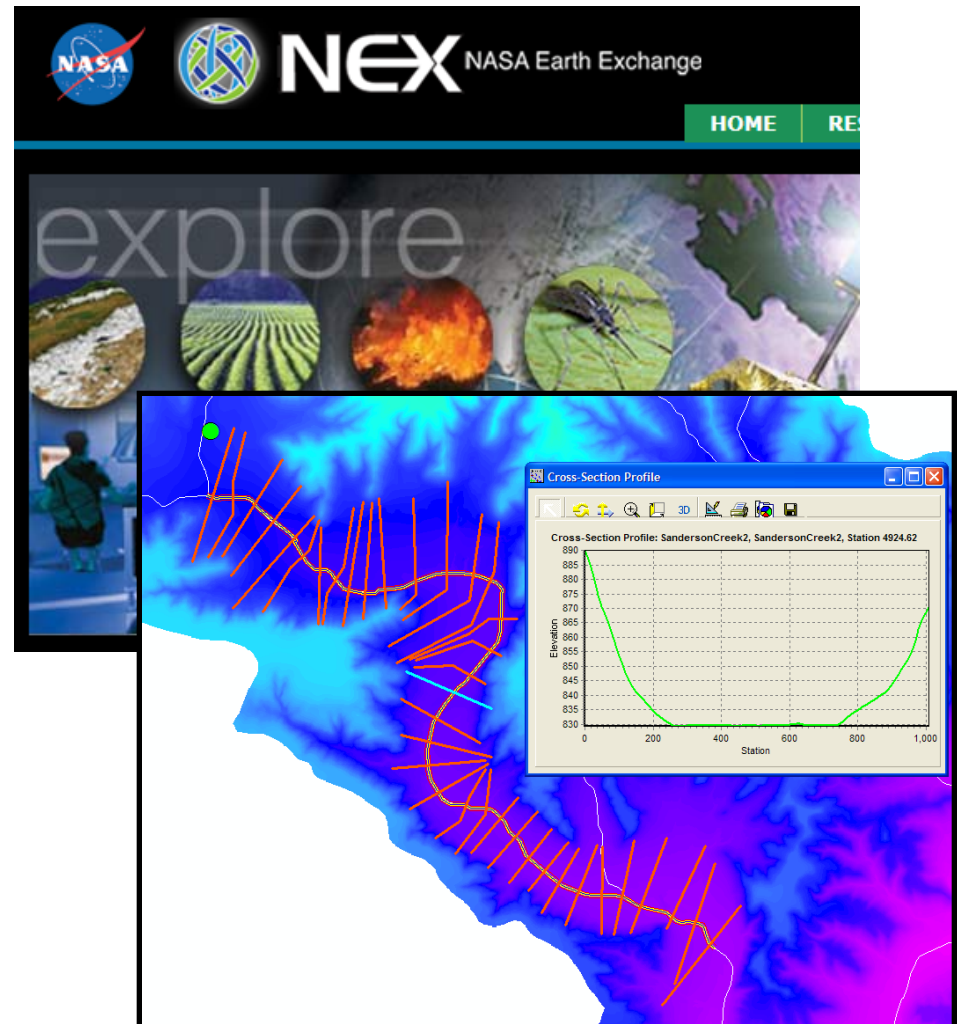
# Enterprise Integrated Rule-Oriented Data System

- Open source middleware with pluggable architecture produced by UNC Chapel Hill (i.e. production quality iRODS)
- Via microservices:
  - iRODS rules can automatically register available data
  - Programmatic capability to process data on upload/registration
    - Can automatically convert file formats (e.g. to create resources for visualization)
    - Can automatically assign unique and persistent identifiers
    - Can automatically parse metadata for semantic content and tag with additional semantic content
    - Can make metadata discoverable by other users/tools
- Access control is enforced at the file level
- Rules can be scheduled and run periodically



# Facilitating Access to Critical National Datasets

- NASA Earth Exchange
- National **River Morphology** Dataset
- Baltimore and Coweeta LTER
  
- Already part of HIS
  - USGS Streamflow
  - EPA
  - Others





# HydroShare

Share your work with others

Share

Your Resources

Explore

Discover Resources

Collaborate

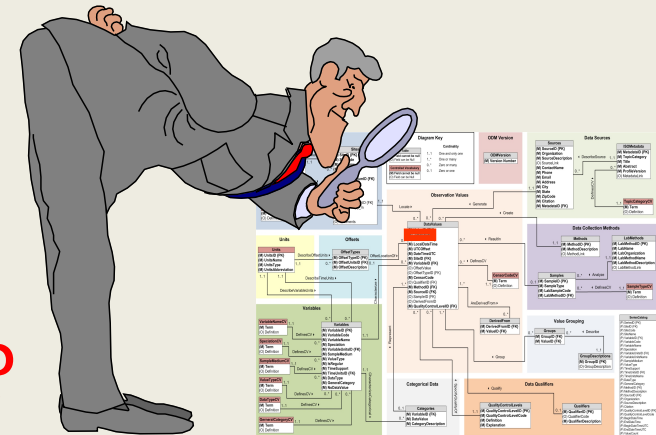
Interact with colleagues

## Summary

- Simple and easy to use
- Data and model sharing enabled by open standards based metadata
- Find, create, share, connect, interact, work together online
- Archive data collections accompanying research publications in easily accessible way
- Integration and synthesis across data collections

## To participate

- See <http://his.cuahsi.org>
- Join [his@sdsc.edu](mailto:his@sdsc.edu)
- Write [dtarb@usu.edu](mailto:dtarb@usu.edu)



# Questions ?

# HydroShare

