

The CUAHSI Community Hydrologic Information System

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CUAHSI

HIS

Sharing hydrologic data

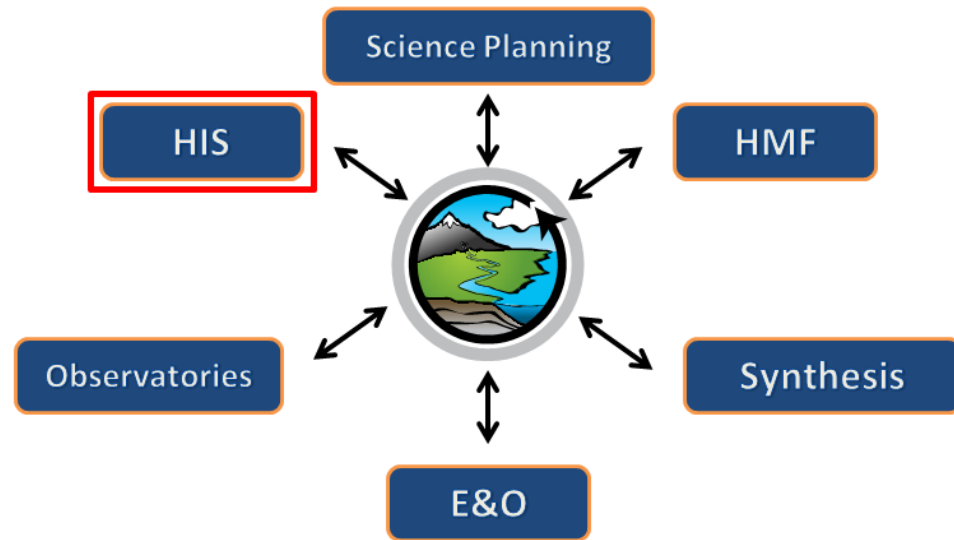
<http://his.cuahsi.org/>



Support
EAR 0622374

What is CUAHSI?

Consortium of Universities for the Advancement of Hydrologic Science, Inc.

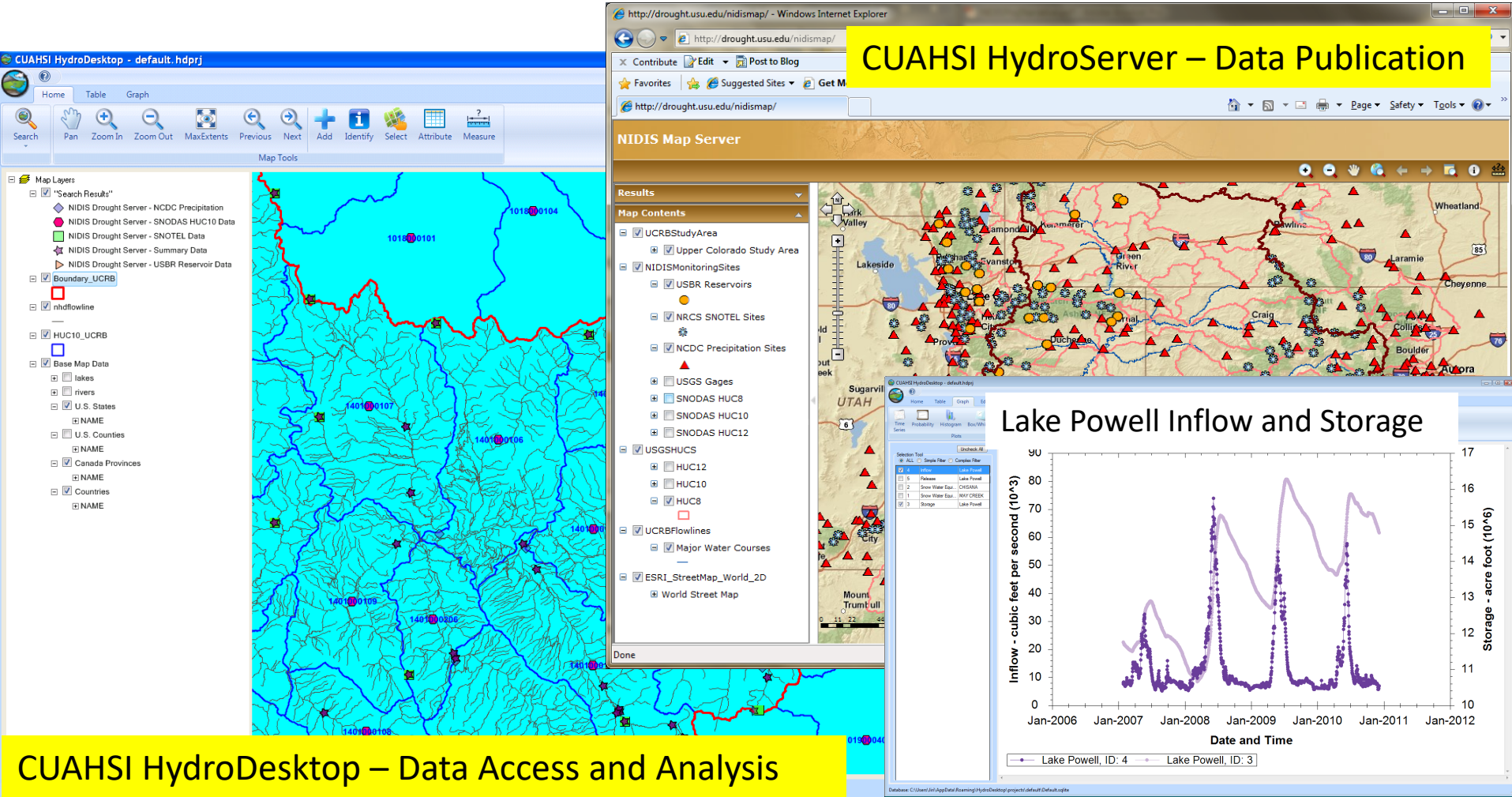


- 110 US University members
- 6 affiliate members
- 12 International affiliate members
(as of March 2009)

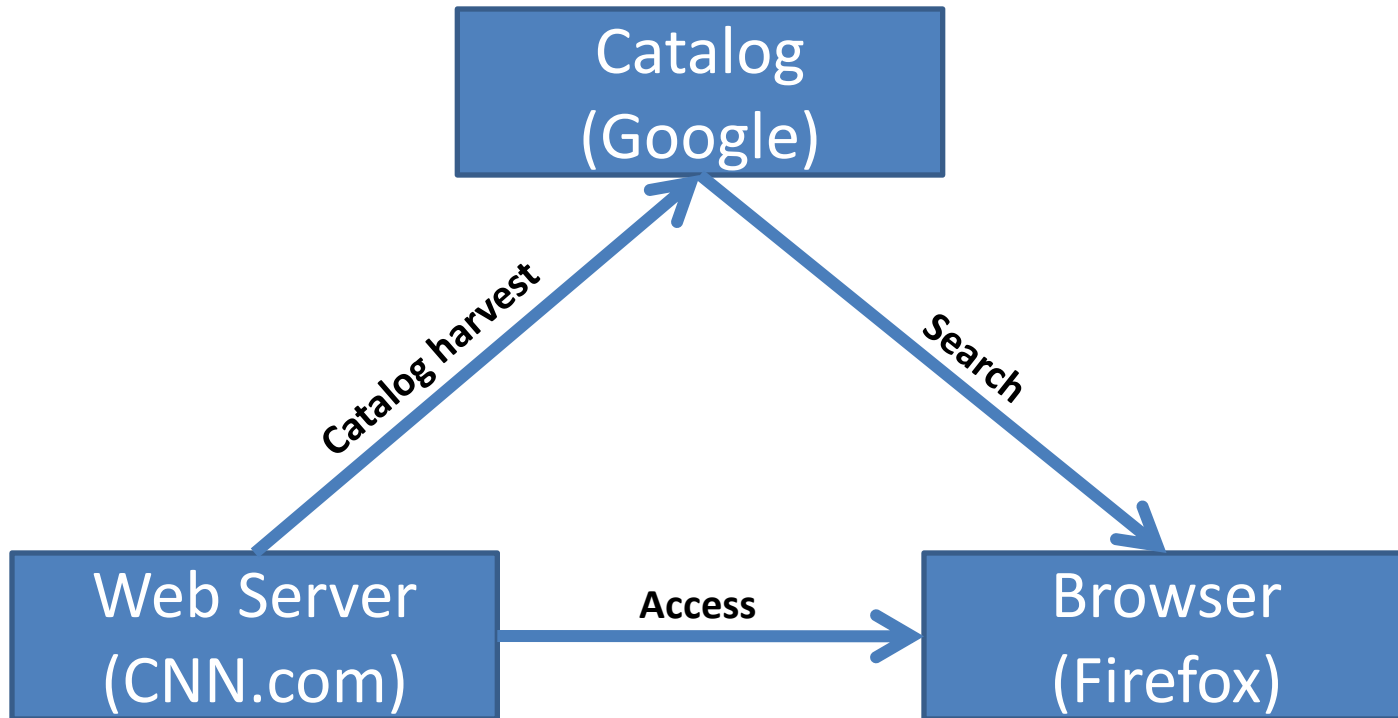
Infrastructure and services for the advancement of hydrologic science and education in the U.S.

CUAHSI HIS

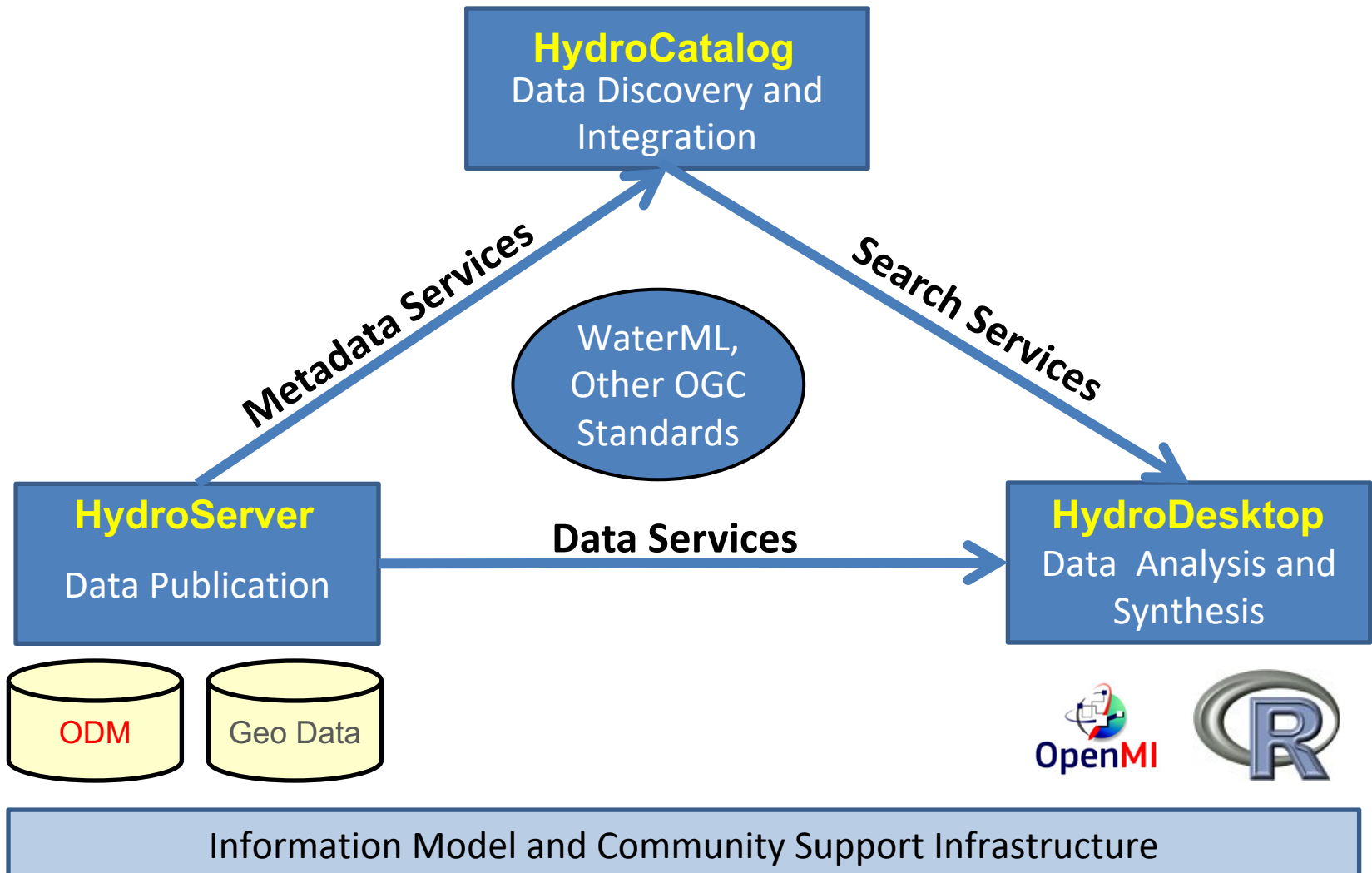
The CUAHSI Hydrologic Information System (HIS) is an internet based system to support the sharing of hydrologic data. It is comprised of hydrologic databases and servers connected through web services as well as software for data publication, discovery and access.



Web Paradigm



CUAHSI Hydrologic Information System Services-Oriented Architecture



Let's see some of it

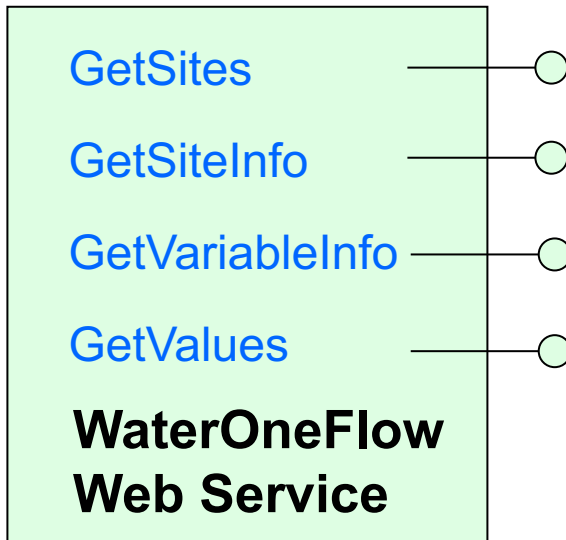
- <http://icewater.usu.edu/>
- <http://hydroserver.codeplex.com>
- <http://hydrodesktop.codeplex.com>

WaterML and WaterOneFlow

WaterML is an XML language for communicating water data

WaterOneFlow is a set of web services based on WaterML

- Set of **query** functions



- Returns data in **WaterML**

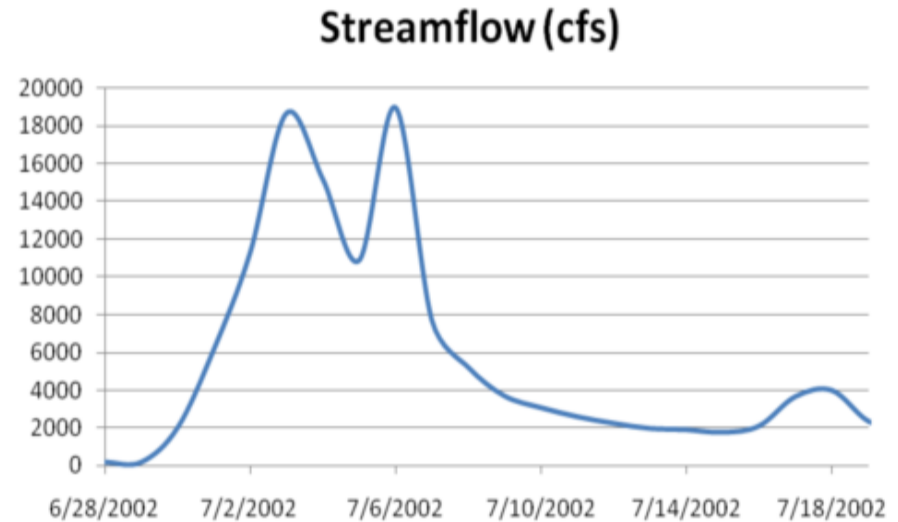
```
<timeSeries>
- <sourceInfo xsi:type="SiteInfoType">
  <siteName>Colorado Rv at Austin, TX</siteName>
  <siteCode network="NWIS" siteID="4619631">08158000</siteCode>
- <geoLocation>
  - <geogLocation xsi:type="LatLonPointType" srs="EPSG"
    <latitude>30.24465429</latitude>
    <longitude>-97.694448</longitude>
  </geogLocation>
  </geoLocation>
</sourceInfo>
- <variable>
  <variableCode vocabulary="NWIS" default="true" variableCode="08158000">08158000</variableCode>
  <variableName>Discharge, cubic feet per second</variableName>
  <units unitsAbbreviation="cfs" unitsCode="35">cubic feet per second</units>
</variable>
- <values count="2545">
  <value dateTime="2006-12-31T00:00:00">129</value>
  <value dateTime="2006-12-31T00:15:00">129</value>
  <value dateTime="2006-12-31T00:30:00">129</value>
  <value dateTime="2006-12-31T00:45:00">129</value>
  <value dateTime="2006-12-31T01:00:00">124</value>
  <value dateTime="2006-12-31T01:15:00">129</value>
  <value dateTime="2006-12-31T01:30:00">124</value>
  <value dateTime="2006-12-31T01:45:00">124</value>
  <value dateTime="2006-12-31T02:00:00">124</value>
```

WaterML as a Web Language

USGS Streamflow data in WaterML language

Discharge of the San Marcos River at Luling, TX
June 28 - July 18, 2002

```
<values count="21">  
  <value qualifiers="A" dateTime="2002-06-28T00:00:00">203</value>  
  <value qualifiers="A" dateTime="2002-06-29T00:00:00">195</value>  
  <value qualifiers="A" dateTime="2002-06-30T00:00:00">2010</value>  
  <value qualifiers="A" dateTime="2002-07-01T00:00:00">6170</value>  
  <value qualifiers="A" dateTime="2002-07-02T00:00:00">11300</value>  
  <value qualifiers="A" dateTime="2002-07-03T00:00:00">18700</value>  
  <value qualifiers="A" dateTime="2002-07-04T00:00:00">15200</value>  
  <value qualifiers="A" dateTime="2002-07-05T00:00:00">10900</value>  
  <value qualifiers="A" dateTime="2002-07-06T00:00:00">19000</value>  
  <value qualifiers="A" dateTime="2002-07-07T00:00:00">7720</value>  
  <value qualifiers="A" dateTime="2002-07-08T00:00:00">5230</value>  
  <value qualifiers="A" dateTime="2002-07-09T00:00:00">3710</value>  
  <value qualifiers="A" dateTime="2002-07-10T00:00:00">3090</value>  
  <value qualifiers="A" dateTime="2002-07-11T00:00:00">2610</value>  
  <value qualifiers="A" dateTime="2002-07-12T00:00:00">2260</value>  
  <value qualifiers="A" dateTime="2002-07-13T00:00:00">1990</value>  
  <value qualifiers="A" dateTime="2002-07-14T00:00:00">1920</value>  
  <value qualifiers="A" dateTime="2002-07-15T00:00:00">1780</value>  
  <value qualifiers="A" dateTime="2002-07-16T00:00:00">2120</value>  
  <value qualifiers="A" dateTime="2002-07-17T00:00:00">3680</value>  
  <value qualifiers="A" dateTime="2002-07-18T00:00:00">4010</value>  
  <qualifier qualifierCode="A" network="USGS" vocabulary="dv_rmk_cd">Approved for publication -- Processing and review completed.</qualifier>  
</values>
```



This is the WaterML GetValues response from NWIS Daily Values

"Welcome to the Hydrology Domain Working Group"

Work Plan

Evolving WaterML into an International Standard

Meetings

- [Atlanta OGC TC Meeting](#) - 17 September 2008
- [Valencia OGC TC Meeting](#) - 4 December 2008
- [Athens OGC TC Meeting](#) - 30 March 2009
- [Boston OGC TC Meeting](#) - 22 June 2009
- [Darmstadt OGC TC Meeting](#) - 29 September 2009
- [Mountain View OGC TC Meeting](#) - 8 December 2009
- [Ispra Hydrology DWG Workshop](#) - 15-18 March 2010 - [Agenda](#)
- [Silver Spring OGC TC Meeting](#) - 15 June 2010
- [Toulouse OGC TC Meeting](#) - 22 September 2010
- [Toulouse Hydrology DWG Workshop](#) - 21-22 September 2010 - [Agenda](#)
- [Sydney Hydrology DWG Meeting](#) - 1 December 2010

Meets every 3 months

Teleconferences most weeks

WaterML Version 2 standard
being proposed



Vote for adoption 3-6 months
later

Interoperability Experiments

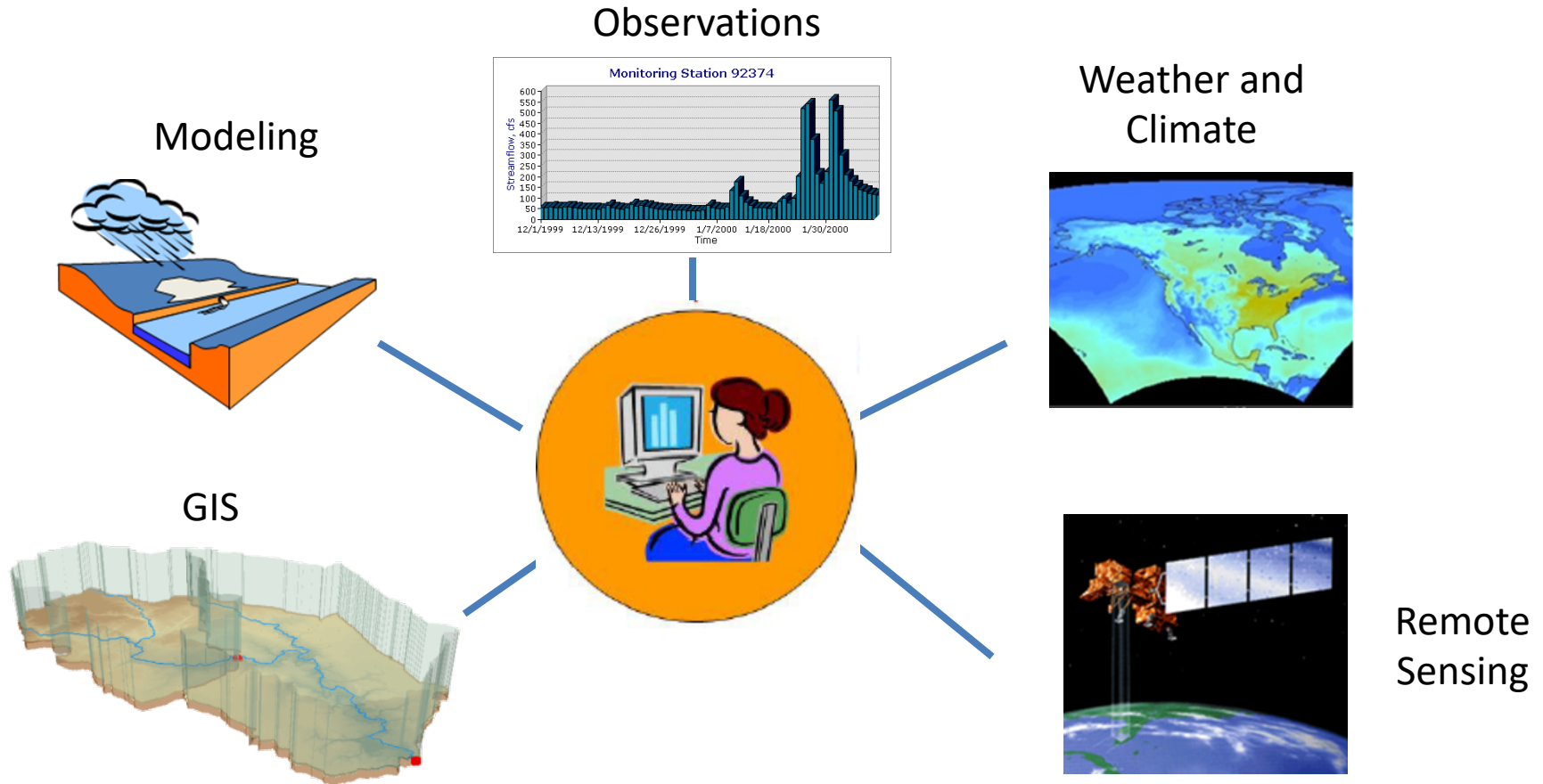
- [GroundwaterInteroperabilityExperiment](#)
- [SurfacewaterInteroperabilityExperiment](#)

To be open for public comment April to May 2011

<http://www.opengeospatial.org/projects/groups/waterml2.0swg>

HydroDesktop

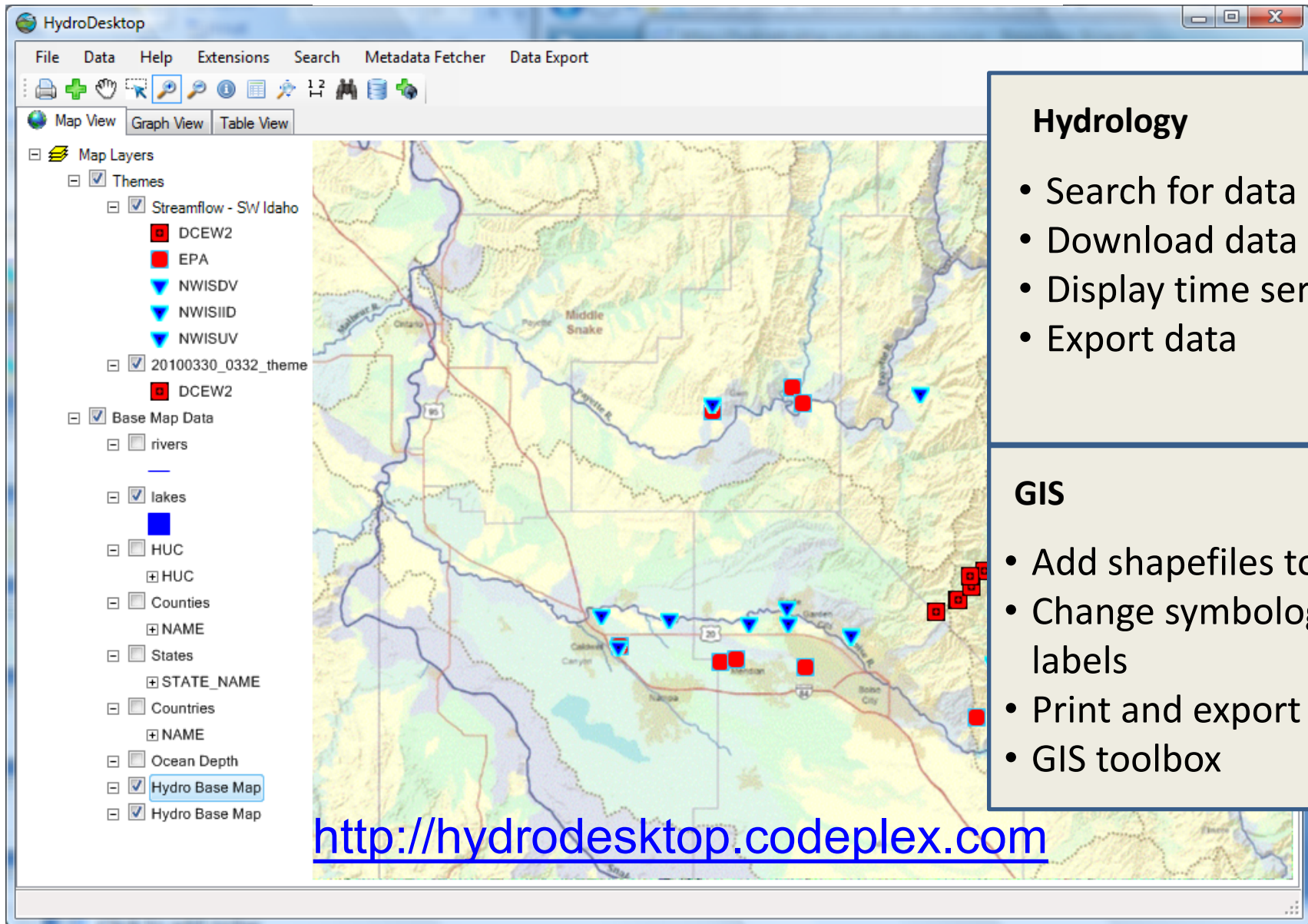
Desktop Hydrologic Information System





HydroDesktop

CUAHSI Open Source Hydrologic Data Tools



Hydrology

- Search for data
- Download data
- Display time series
- Export data

GIS

- Add shapefiles to map
- Change symbology and labels
- Print and export map
- GIS toolbox

<http://hydrodesktop.codeplex.com>



HydroDesktop

CUAHSI Open Source Hydrologic Data Tools

CodePlex
Open Source Community

Search all CodePlex projects

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Project Summary

HydroDesktop is a free and open source desktop application for the CUAHSI HIS WaterOneFlow web services data integration with other analysis and modeling tools.

Building the HydroDesktop Team

This is an open project that is actively seeking developers. If you are interested in working with us on the project, please introduce yourself using the [Discussions](#) tab. Also, you may want to start by reading the HydroDesktop [Functional Specifications](#). Finally you may want to take a quick look at the [Presentations and Publications](#) that introduce and describe the project. We look forward to meeting you and working with you on this project!

- » Go to the Discussions Page <http://hydrodesktop.codeplex.com/Thread/List.aspx> to introduce yourself
- » Look at the [Database Structure](#) for HydroDesktop

- 12800 total downloads
- 2000 code commits
- 25 registered developers

★ [Mark as a favorite project](#)

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CURRENT	1.1 Beta 294
DATE	Fri Oct 22 2010 at 1:00 AM
STATUS	Beta ?
RATING	No Ratings 241 downloads
MORE	View all downloads

Activity

Page Views	1
Visits	
Downloads	
Application Runs	

[View Detailed Stats](#)

HydroModeler

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

The screenshot shows the CUAHSI HydroDesktop interface with the HydroModeler tab active. The interface includes a menu bar (Home, Table, Graph, Edit, HydroModeler), a toolbar with icons for Open, Save, Save As..., Add Component, Add Trigger, Add Connection Composition, Run, and Clear Composition. A file browser on the left shows a directory structure with folders like .svn, bin, data, models, and a file named PET_sample_model. The main workspace displays a workflow diagram with the following components and connections:

- Solar Radiation (yellow box) connects to ET: Penman-Monteith (yellow box) via a downward arrow.
- ET: Penman-Monteith (yellow box) connects to DbWriter (yellow box) via a rightward arrow.
- ET: Penman-Monteith (yellow box) connects to Oatc.OpenMI.Gui.Trigger (blue box) via a downward arrow.

A text box in the bottom right of the workspace states: "Allows for the linking of data and models as 'plug-and-play' components".

Longitude: 5°58'23"W, Latitude: 88°58'27"N

In development at the University of South Carolina by Jon Goodall, Tony Castronova, Mehmet Ercan, Mostafa Elag, and Shirani Fuller



Integration with "R" Statistics Package

The screenshot displays the R GUI interface with several windows open:

- R Console:** Shows R code for generating a 3D surface plot:

```
rgl.sr> ylen <- ylim[2] - ylim[1] + 1
rgl.sr> colorlut <- terrain.colors(ylen)
rgl.sr> col <- colorlut[y - ylim[1] + 1]
rgl.sr> rgl.clear()
rgl.sr> rgl.surface(x, z, y, color = col)
```
- R Data Editor:** Displays a data table with columns 'height' and 'weight':

height	weight
58	115
59	117
60	120
61	123
62	126
63	129
64	132
65	135
66	139
67	142
68	146
69	150
70	154
71	159
72	164
- R Workspace Browser:** Lists objects in the workspace:

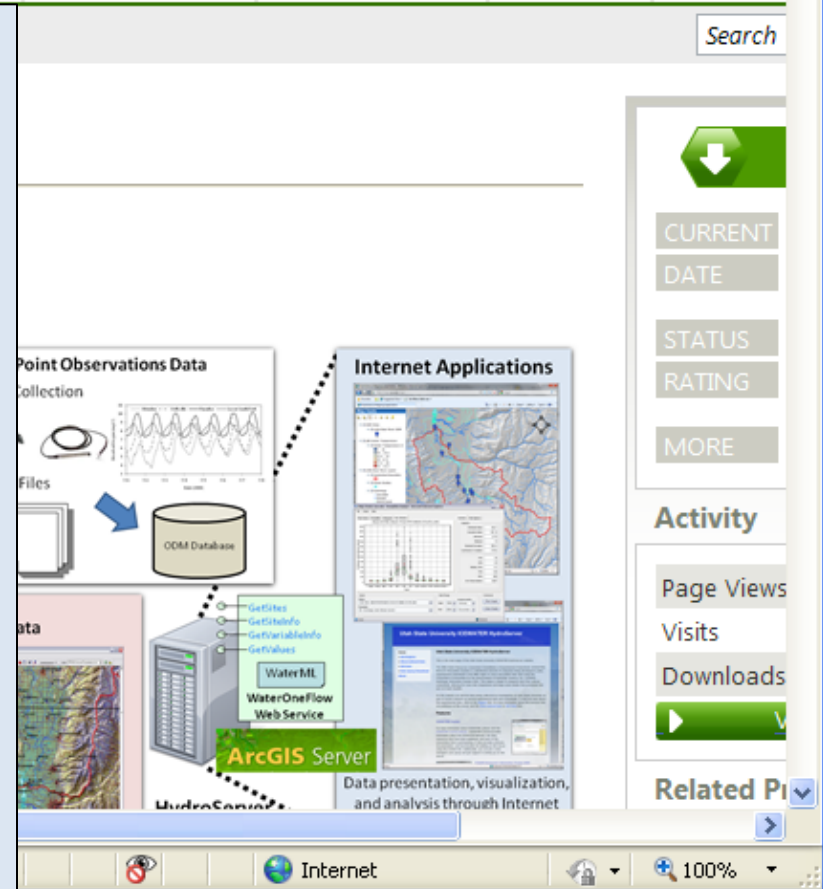
Object	Type	Structure
dati	data.frame	dim: 20 4
g	factor	levels: 10
l	numeric	length: 12
n	numeric	length: 1
opar	list	length: 2
pie.sales	numeric	length: 6
pin	numeric	length: 2
scale	numeric	length: 1
usr	numeric	length: 4
women	data.frame	dim: 15 2
height	numeric	length: 15
weight	numeric	length: 15
x	numeric	length: 87
- R Package Manager:** Shows installed and available packages:

status	Package	Description
<input checked="" type="checkbox"/> loaded	graphics	The R Graphics Package
<input type="checkbox"/> not loaded	grid	The Grid Graphics Package
<input type="checkbox"/> not loaded	lattice	Lattice Graphics
<input checked="" type="checkbox"/> loaded	methods	Formal Methods and Classes
<input type="checkbox"/> not loaded	mgcv	CAMs with GCV smoothness estimation
- RGL device 1 (active):** Displays a 3D surface plot of a landscape, showing a mountain range with a color gradient from green to yellow.



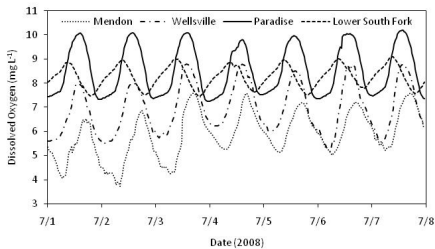
<http://hydroserver.codeplex.com>

- A platform for publishing space-time hydrologic datasets that:
 - Autonomous with local control of data
 - Part of a distributed system that makes data universally available
- Basis for Experimental Watershed or Observatory data management system
- Standards based approach to data publication
 - Accepted and emerging standards for data storage and transfer (OGC, WaterML)
- Built on established software
 - MS SQL Server, ArcGIS server
- Open Source Community Code Repository
 - Sustainability

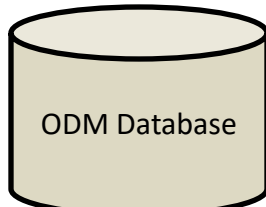
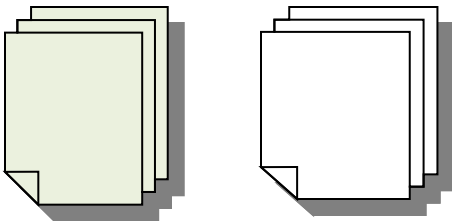


Point Observations Data

Ongoing Data Collection



Historical Data Files

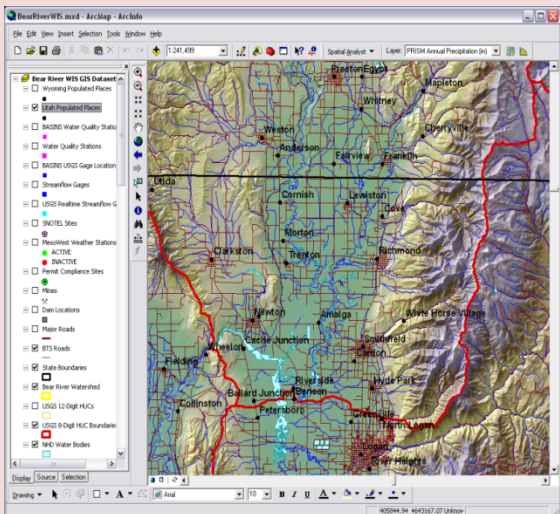


Internet Applications

The screenshot shows a web browser displaying a GIS application. The map shows the Bear River watershed with various data layers. A data analysis window is open, showing a time series plot for 'BEAR RIVER NEAR UTAH-WYOMING STATE LINE' with a summary table.

Statistic	Value
Arithmetic Mean	190.7
Geometric Mean	89.14
Minimum	13
Maximum	2170
Standard Deviation	306.4
Coefficient of Variation	170%

GIS Data



GetSites
GetSiteInfo
GetVariableInfo
GetValues

WaterML
WaterOneFlow
Web Service

ArcGIS Server

HydroServer

Data presentation, visualization, and analysis through Internet enabled applications

Utah State University ICEWATER HydroServer

Home
• HRS Regions
• Observational Data
• GIS Data
• Data Query/Download
• About

The main page of the Utah State University ICEWATER HydroServer website. It provides information about the network information system and the data resources available.

Observation Data Model for hydrologic and environmental measurements

The way that data is organized can enhance or inhibit the analysis that can be done



Streamflow



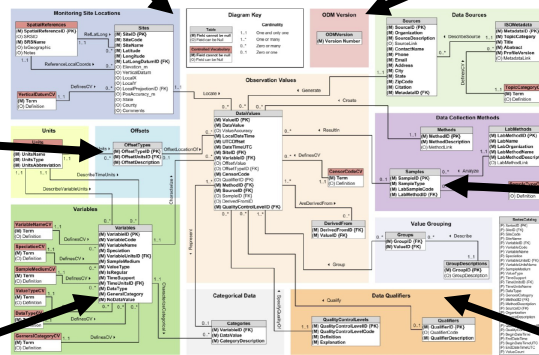
Groundwater levels



Precipitation & Climate



Soil moisture data



Water Quality

Flux tower data



Why an Observations Data Model

- Provides a common persistence model for observations data
- Syntactic heterogeneity (File types and formats)
- Semantic heterogeneity
 - Language for observation attributes (structural)
 - Language to encode observation attribute values (contextual)
- Publishing and sharing research data
- Metadata to facilitate unambiguous interpretation
- Enhance analysis capability

Scope

- Focus on Hydrologic Observations made at a point
- Exclude Remote sensing or grid data.
- Primarily store raw observations and simple derived information to get data into its most usable form.
- Limit inclusion of extensively synthesized information and model outputs at this stage.

What are the basic attributes to be associated with each single data value and how can these best be organized?

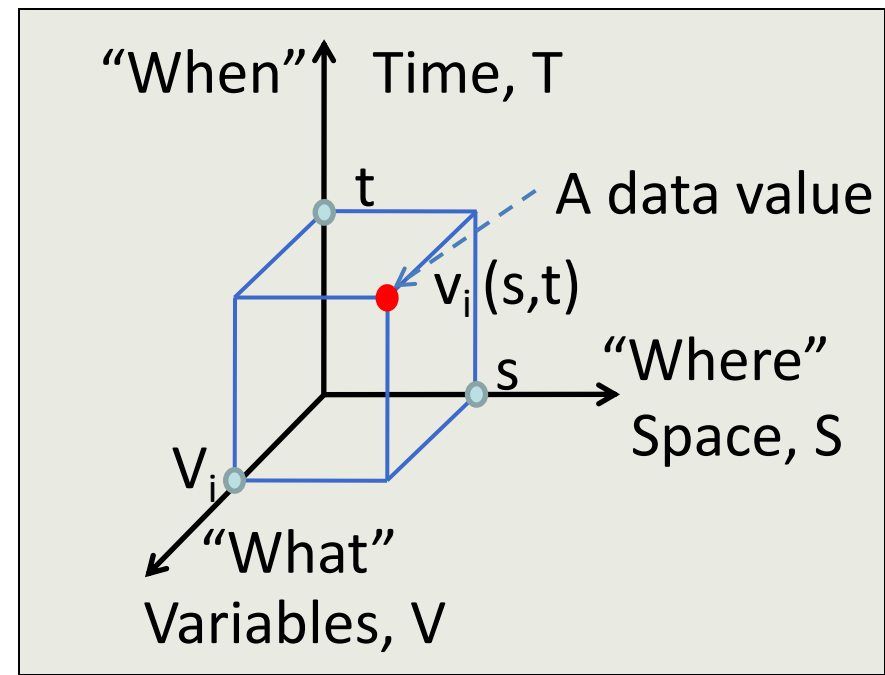
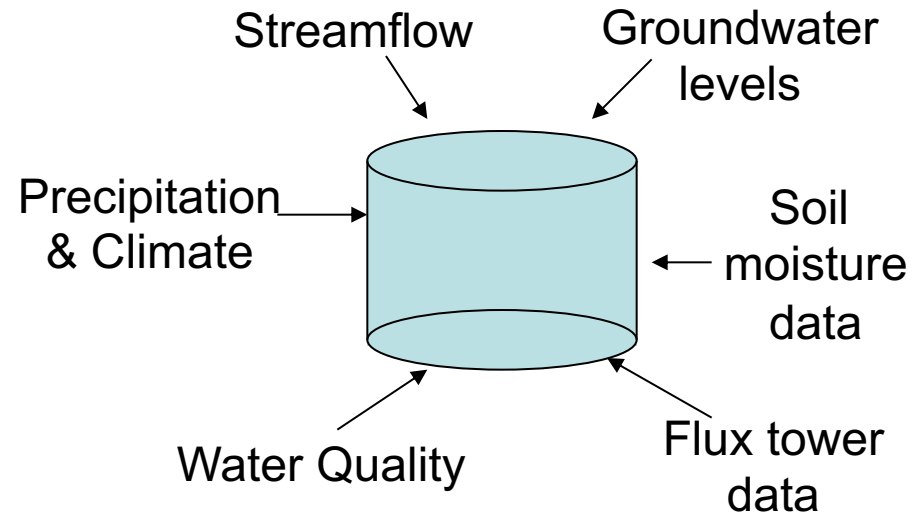
Value
Date/Time
Variable
Location
Units
Interval (support)
Accuracy

Offset
Offset Type/ Reference Point
Source/Organization
Censoring
Data Qualifying Comments

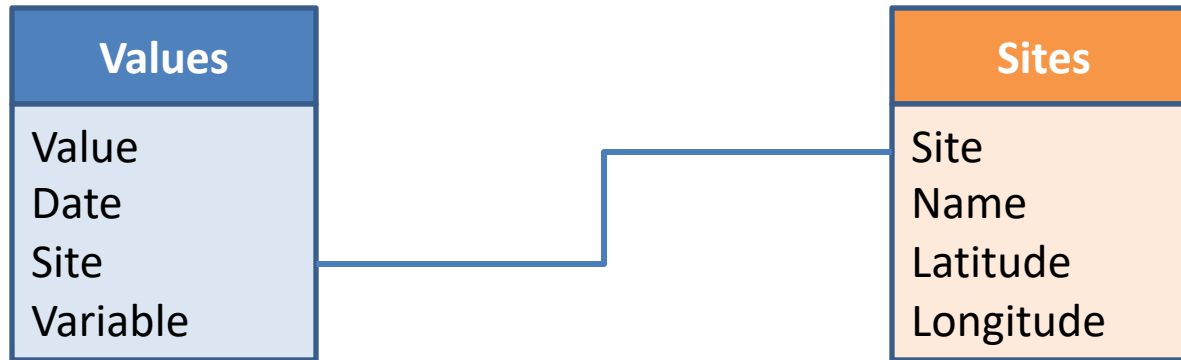
Method
Quality Control Level
Sample Medium
Value Type
Data Type

CUAHSI Observations Data Model

- A **relational database** at the single observation level (atomic model)
- Stores **observation data** made at points
- Metadata for **unambiguous interpretation**
- Traceable heritage from **raw** measurements to **usable** information
- **Standard format** for data sharing
- **Cross dimension** retrieval and analysis



Data Storage – Relational Database

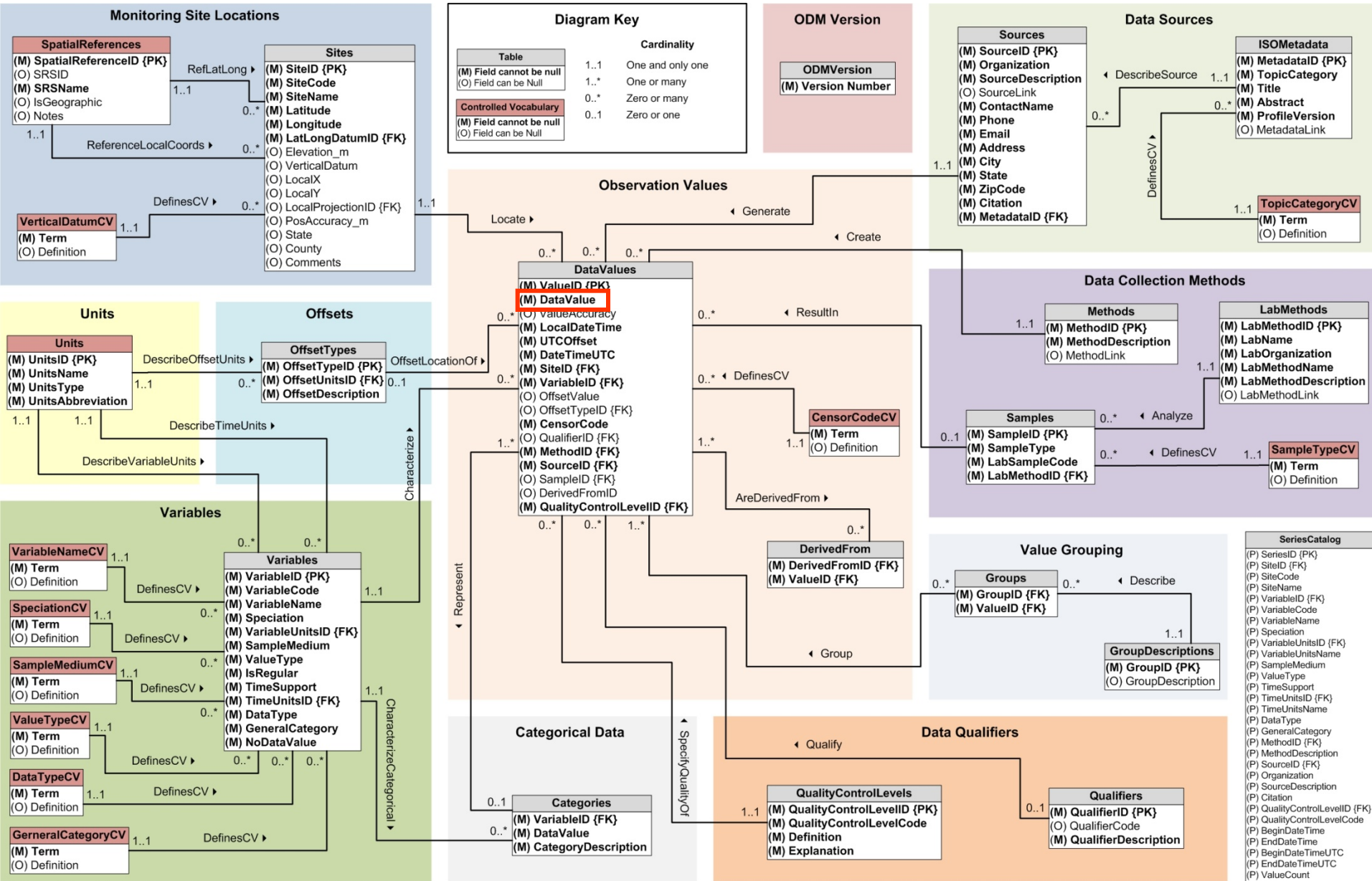


Value	Date	Site	Variable
4.5	3/3/2007	1	Streamflow
4.2	3/4/2007	1	Streamflow
33	3/3/2007	2	Temperature
34	3/4/2007	2	Temperature

Site	Name	Latitude	Longitude
1	Cane Creek	41.1	-103.2
2	Town Lake	40.3	-103.3

Why Use a RDBMS

- Mature and stable technology
- Structured Query Language (SQL)
- Sharing of data among multiple applications
 - Data integrity and security
 - Access by multiple users at the same time
 - Tools for backup and recovery
- Reduced application development time



Discharge, Stage, Concentration and Daily Average Example

DataValues : Table

ValueID	DataValue	ValueAccuracy	LocalDateTime	VariableID	MethodID	SourceID
201	4.49		09/04/2003 14:00:00.000	4	4	2
193	722	22.89831642	05/01/2006 0:00:00.000	3	3	1
97	748		05/01/2006 0:00:00.000	2	2	1
1	4.18		05/01/2006 0:00:00.000	1	1	1
98	748		05/01/2006 0:15:00.000	2	2	1
2	4.18		05/01/2006 0:15:00.000	1	1	1

Record: 1 of 415

Variables : Table

VariableID	VariableCode	VariableName	VariableUnitsID	SampleMedium	ValueType	IsRegular	TimeSupport	TimeUnitsID	Data Type
1	NWIS:00065	Gage height	1	Water	Field Observation	<input checked="" type="checkbox"/>	15		Continuous
2	NWIS:00060	Discharge	2	Water	Derived Value	<input checked="" type="checkbox"/>	15		Continuous
3	NWIS:00060	Discharge, daily average	2	Water	Derived Value	<input checked="" type="checkbox"/>	24		Average
4	NWIS:00300	Dissolved oxygen concentration	3	Water	Field Observation	<input type="checkbox"/>	0		Instantaneous

Record: 5 of 7

Units : Table

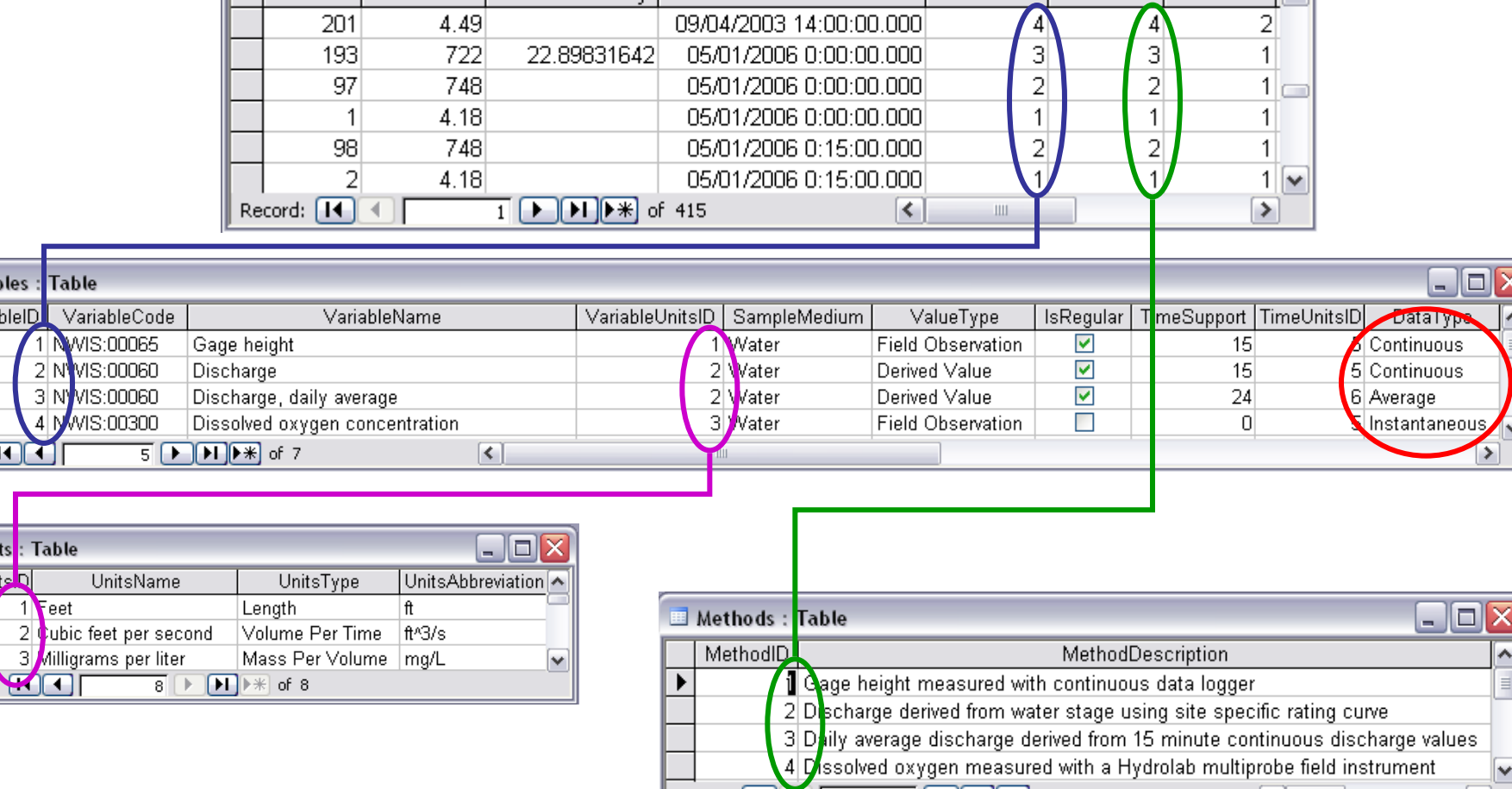
UnitsID	UnitsName	UnitsType	UnitsAbbreviation
1	Feet	Length	ft
2	Cubic feet per second	Volume Per Time	ft ³ /s
3	Milligrams per liter	Mass Per Volume	mg/L

Record: 8 of 8

Methods : Table

MethodID	MethodDescription
1	Gage height measured with continuous data logger
2	Discharge derived from water stage using site specific rating curve
3	Daily average discharge derived from 15 minute continuous discharge values
4	Dissolved oxygen measured with a Hydrolab multiprobe field instrument

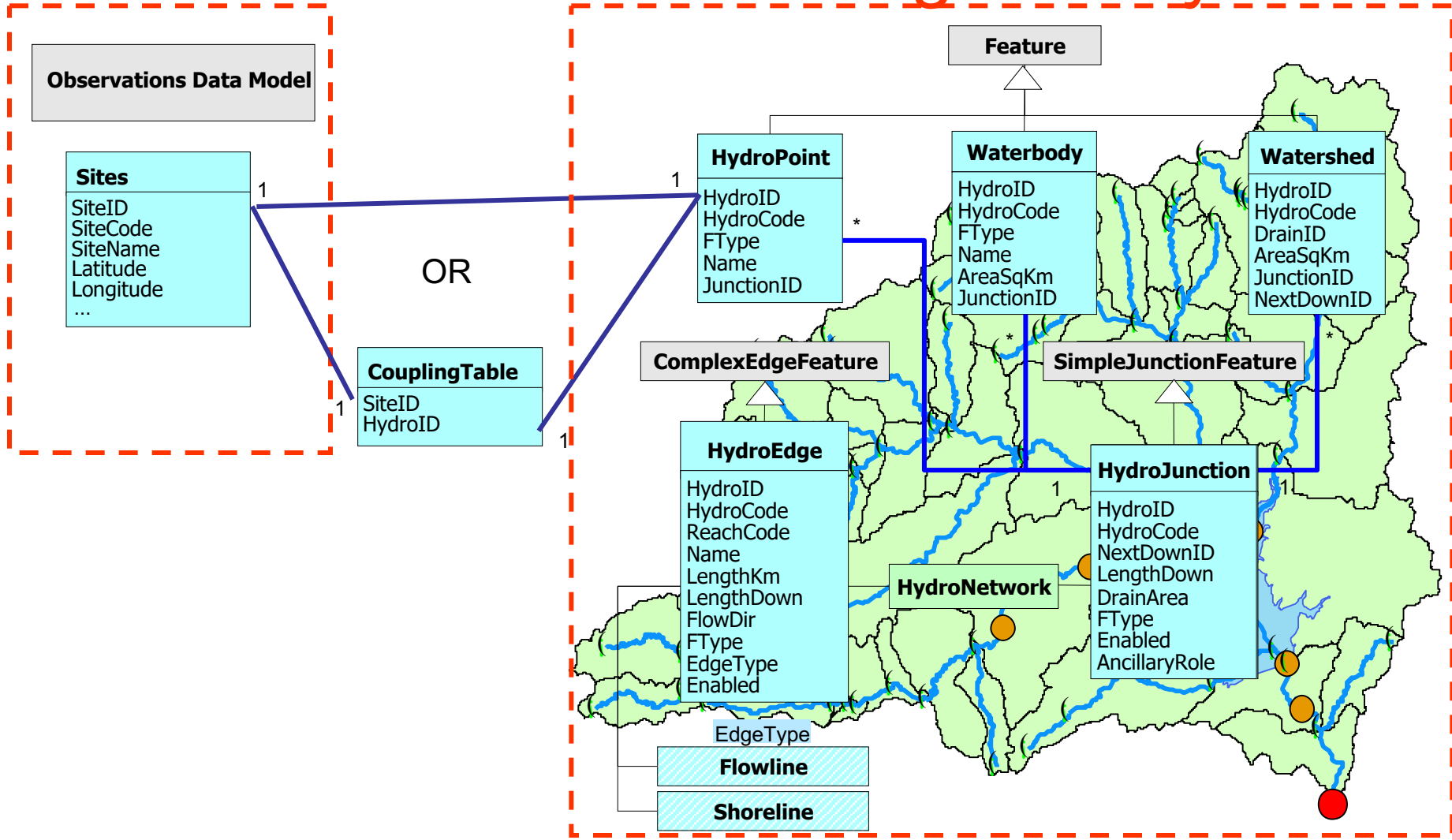
Record: 1 of 6



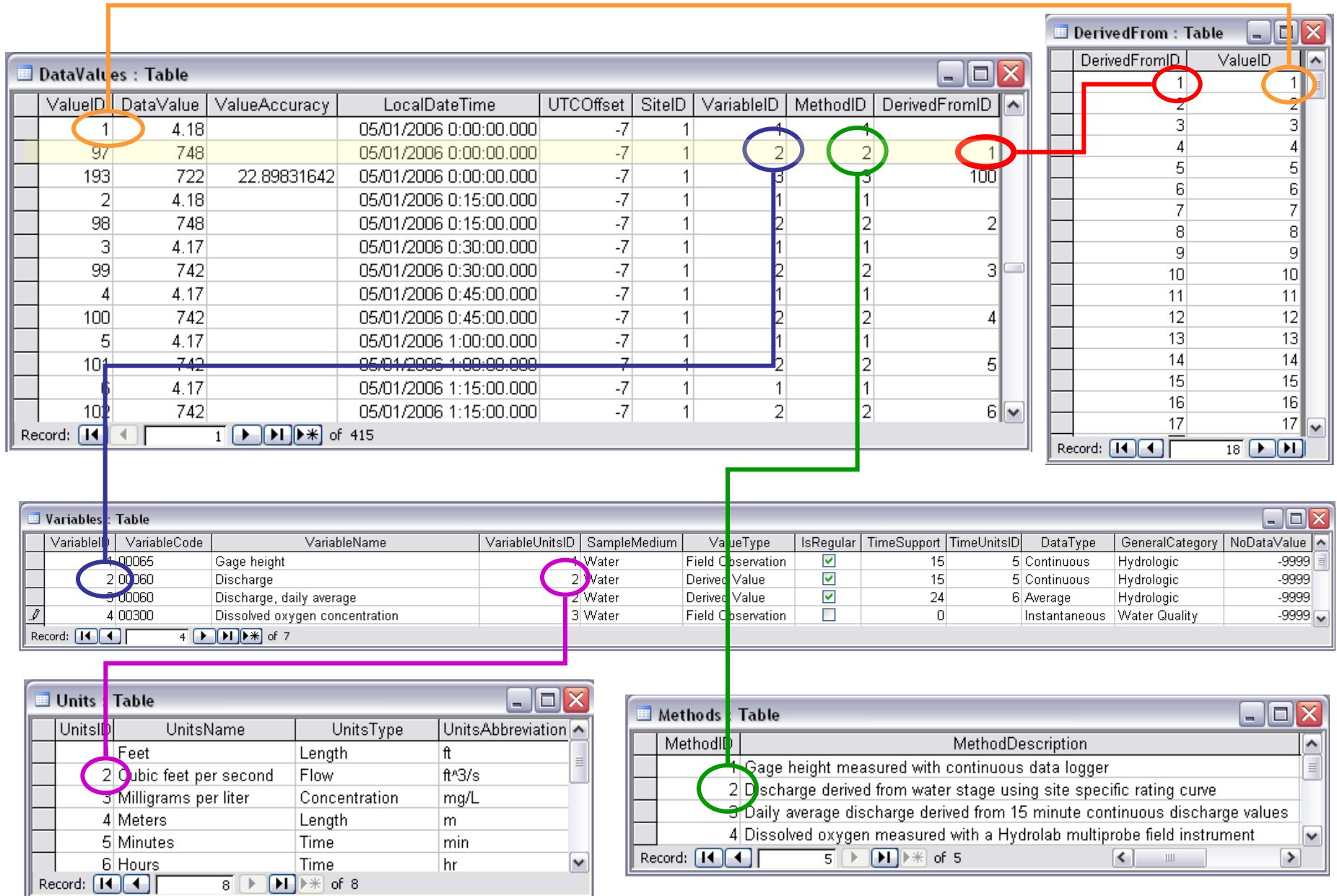
Independent of, but can be coupled to Geographic Representation

ODM

e.g. Arc Hydro

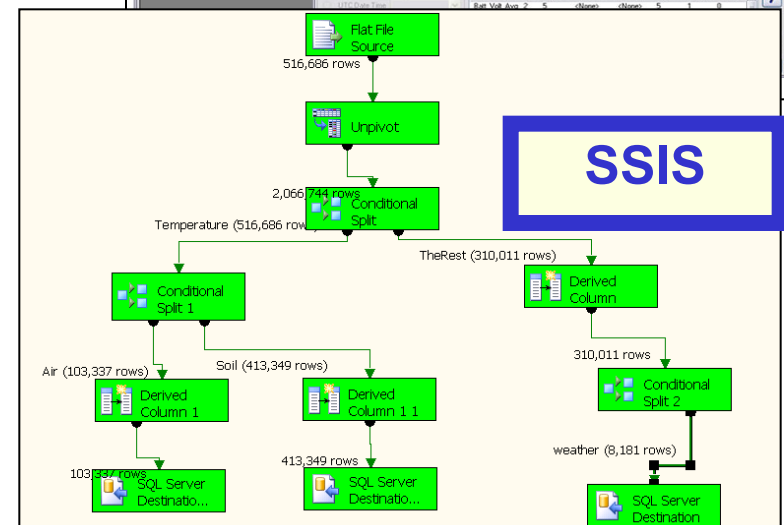
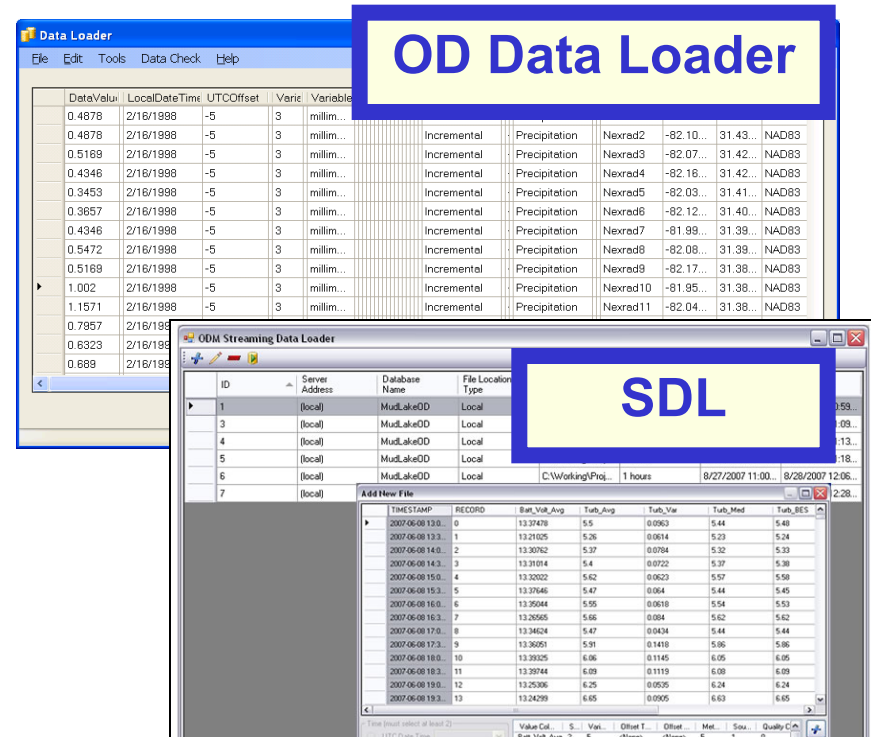


Stage and Streamflow Example



Loading data into ODM

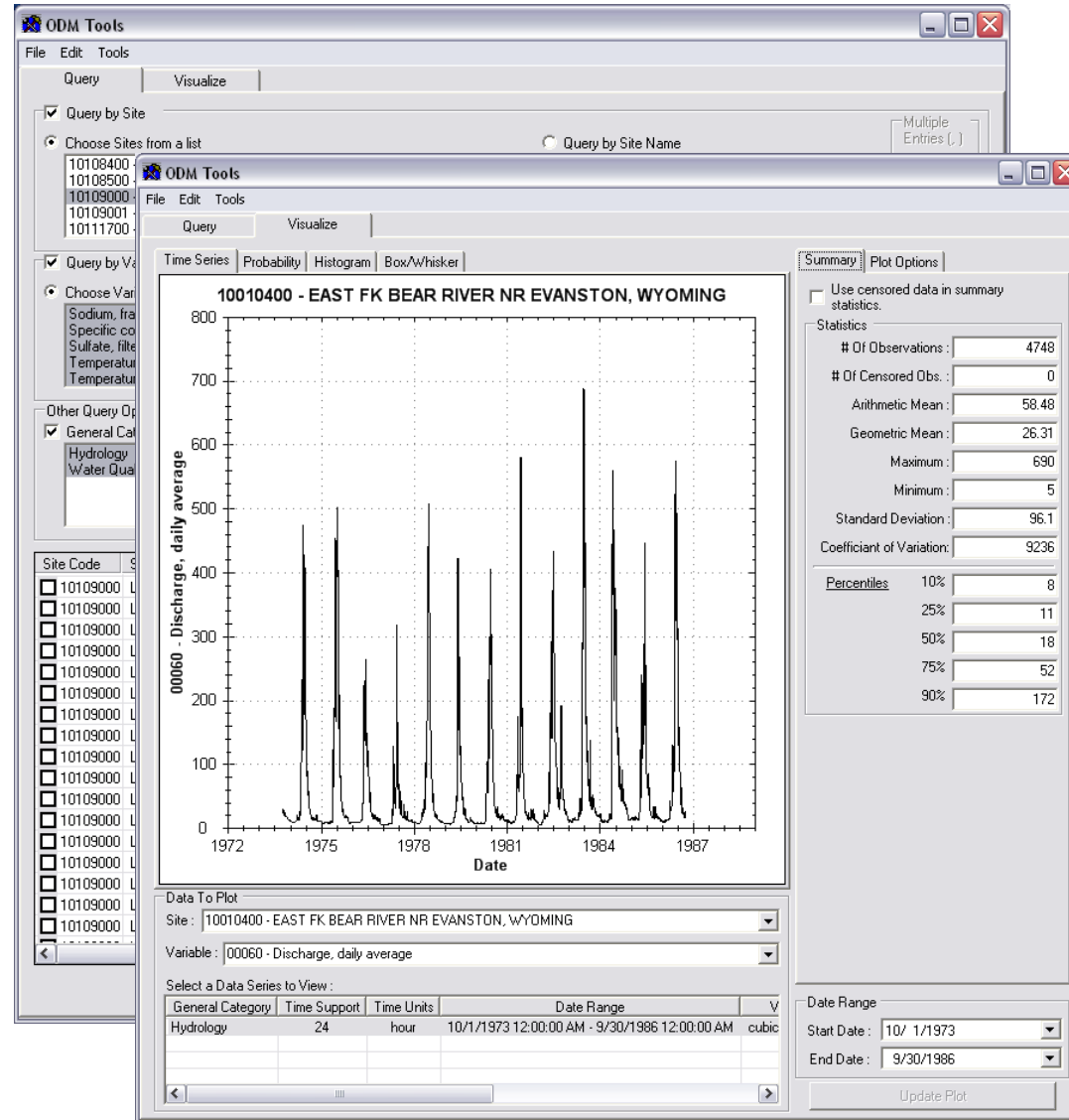
- Interactive OD Data Loader (OD Loader)
 - Loads data from spreadsheets and comma separated tables in simple format
- Scheduled Data Loader (SDL)
 - Loads data from datalogger files on a prescribed schedule.
 - Interactive configuration
- SQL Server Integration Services (SSIS)
 - Microsoft application accompanying SQL Server useful for programming complex loading or data management functions



Managing Data Within ODM

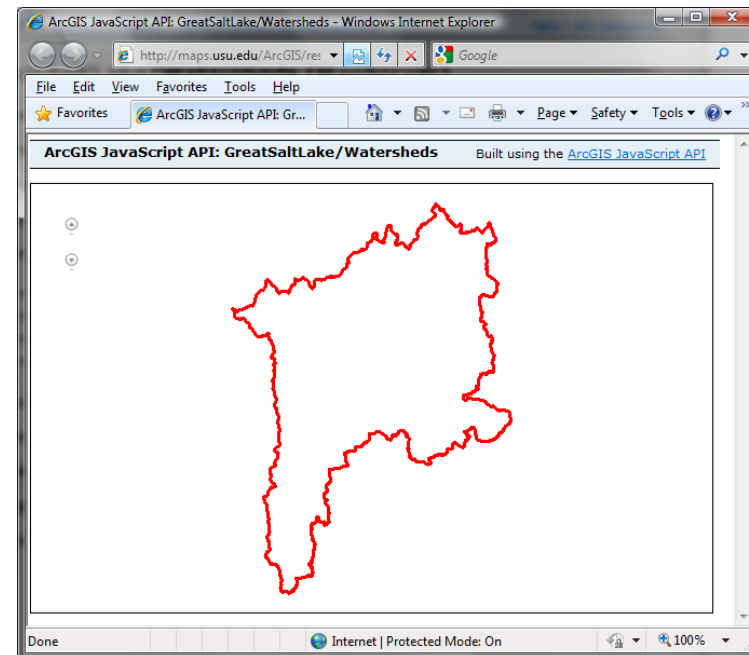
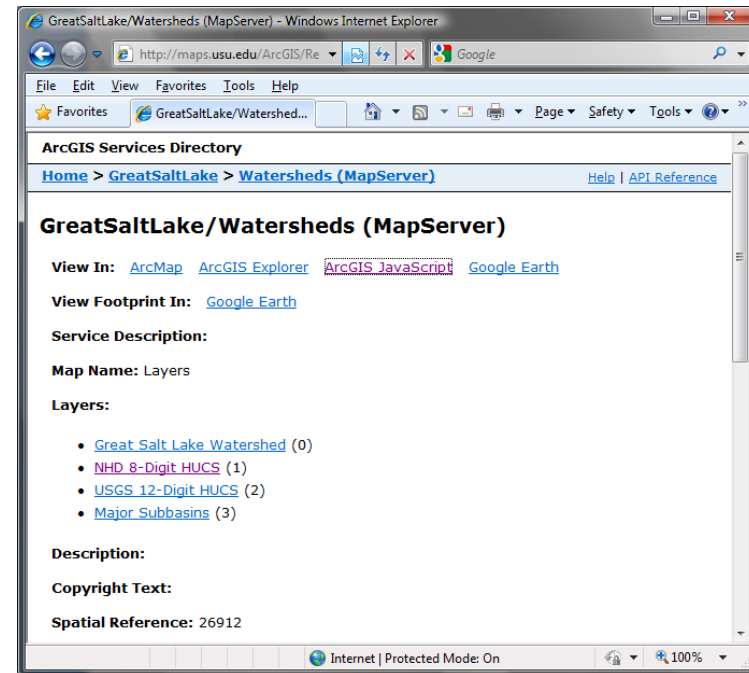
ODM Tools

- **Query and export**
 - export data series and metadata
- **Visualize** – plot and summarize data series
- **Edit** – delete, modify, adjust, interpolate, average, etc.



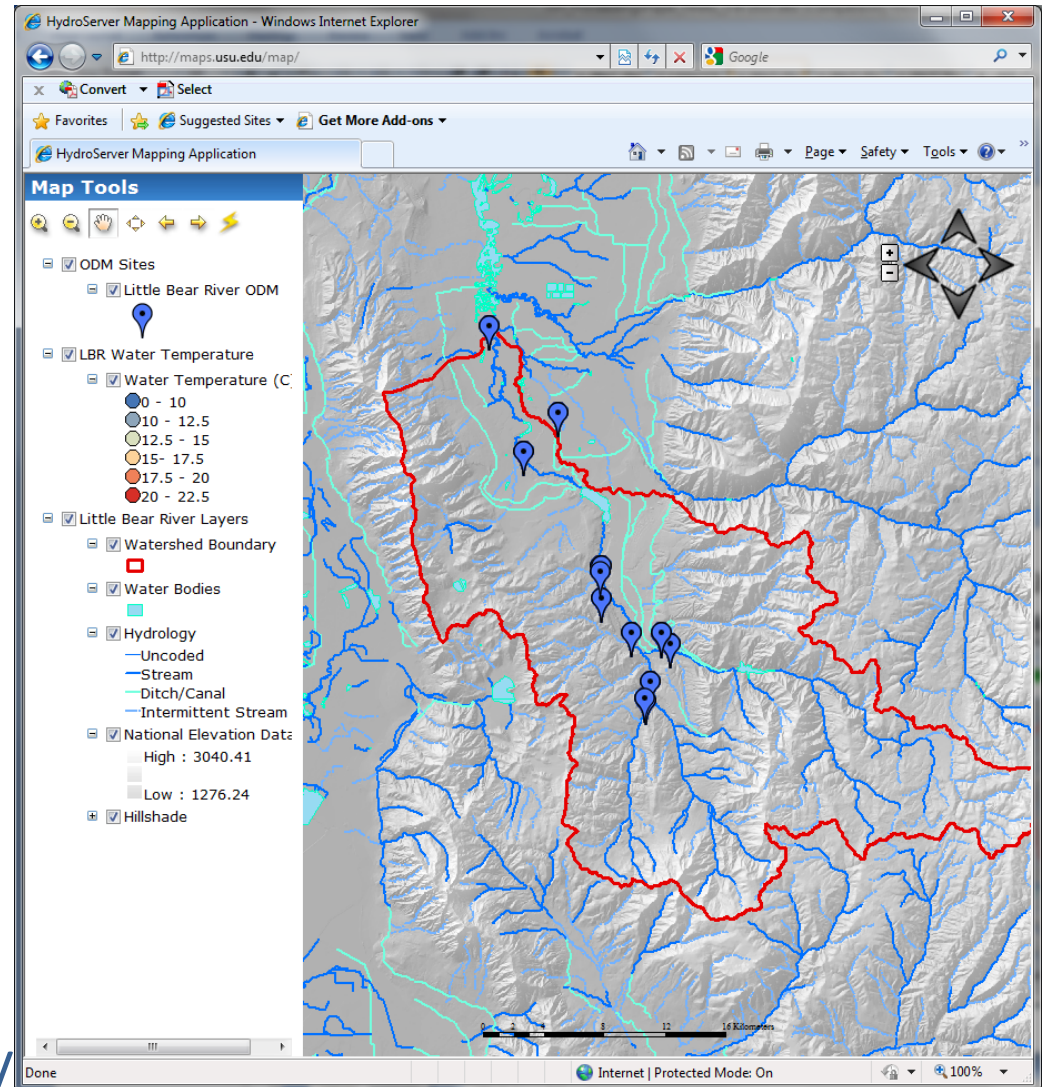
Publication of Spatial (GIS) Datasets

- Publishing spatial datasets using ArcGIS Server
 - Using OGC standards that can be consumed by a number of GIS clients
 - WMS, WFS, WCS



Data Presentation Via a Map Interface

- Internet Map Server built using ArcGIS
- Web browser client
- Combine spatial data and observational data
- Launch data visualization tools
- Based on a “Region”

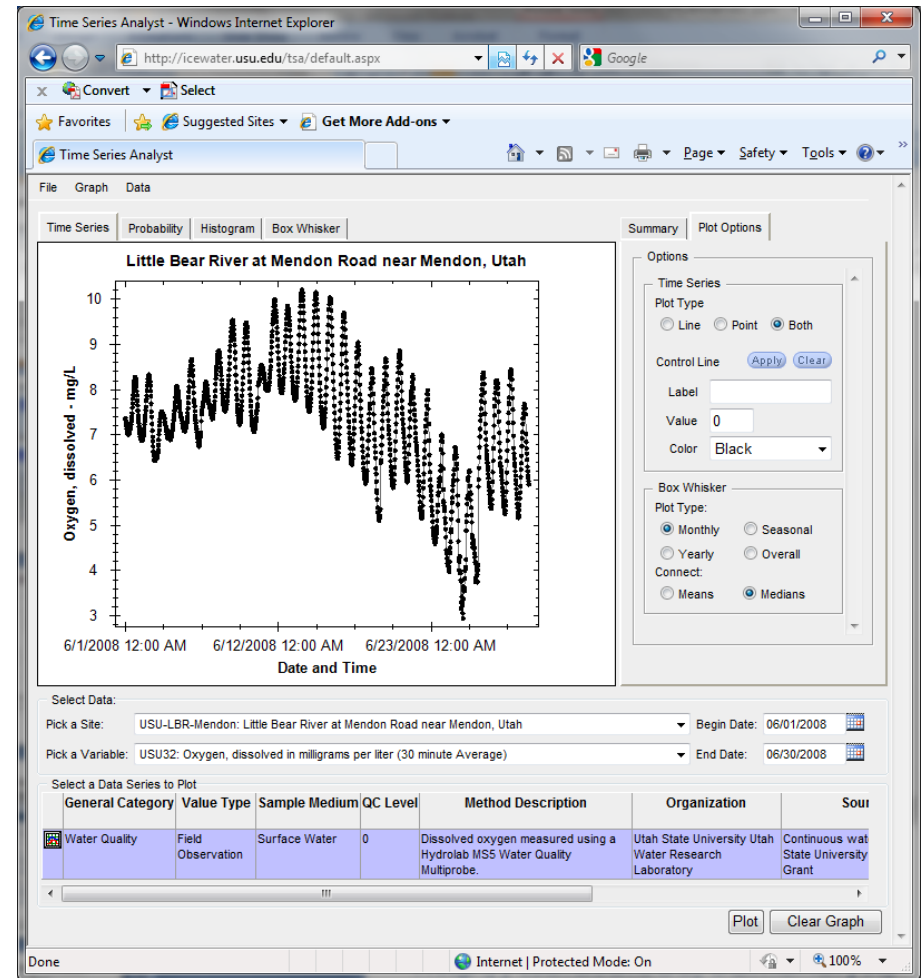


<http://icewater.usu.edu/map/>

Data Preview, Visualization, and Analysis

Time Series Analyst

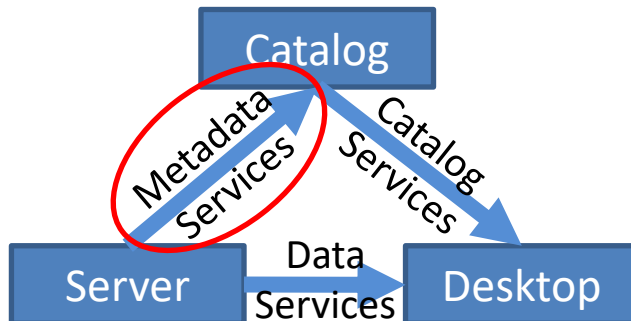
- Web Browser Client
- Multiple ODM Database Support
- Variety of plot types
- Descriptive statistics
- Linked to the map application
- Data preview and download



<http://icewater.usu.edu/tsa/>

HydroServer Capabilities Web Service

- Publish capabilities of each HydroServer
 - Listing of published observational data services
 - Listing of published spatial data services
- Supports automatic cataloging of available services at HIS Central
- **Makes HydroServers self describing**



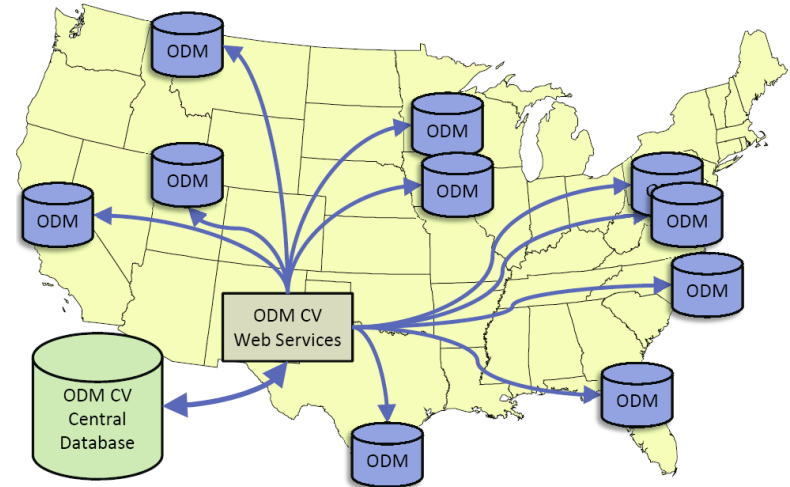
The screenshot shows a Windows Internet Explorer browser window displaying the 'HISNodeCapabilities Web Service' page. The address bar shows the URL 'http://icewater.usu.edu/HISNodeCapabilities'. The page title is 'HISNodeCapabilities'. The main content area lists supported operations with a brief description for each:

- GetMapServiceInfo**: Given the ID for a spatial data service, this method returns a string (formatted as XML) with all of the metadata for that spatial data service.
- GetMapServices**: This method returns a string (formatted as XML) with all of the metadata for published spatial data services.
- GetRegionInfo**: This method returns a string (formatted as XML) with all of the metadata for that region.
- GetRegionMapServices**: Given the ID for a study region, this method returns a string (formatted as XML) with a list of all of the spatial data services associated with that region.
- GetRegionWaterOneFlowServices**: Given the ID for a study region, this method returns a string (formatted as XML) with a list of all of the WaterOneFlow data services associated with that region.
- GetRegions**: This method returns a string (formatted as XML) with a list of all of the study regions for which data have been published.
- GetWaterOneFlowServiceInfo**: Given the ID for a WaterOneFlow data service, this method returns a string (formatted as XML) with all of the metadata for that WaterOneFlow data service.
- GetWaterOneFlowServices**: This method returns a string (formatted as XML) with all of the metadata for published WaterOneFlow data services.

The browser window also shows the standard menu bar (File, Edit, View, Favorites, Tools, Help) and the status bar at the bottom indicating 'Done' and 'Internet | Protected Mode: On'.

Overcoming Semantic Heterogeneity

- ODM Controlled Vocabulary System
 - ODM CV central database
 - Online submission and editing of CV terms
 - Web services for broadcasting CVs



ODM VariableNameCV

Variable Name	
Investigator 1:	“Temperature, water”
Investigator 2:	“Water Temperature”
Investigator 3:	“Temperature”
Investigator 4:	“Temp.”

Term
...
Sunshine duration
Temperature
Turbidity
...

Dynamic controlled vocabulary moderation system

ODM Data Manager



ODM Website

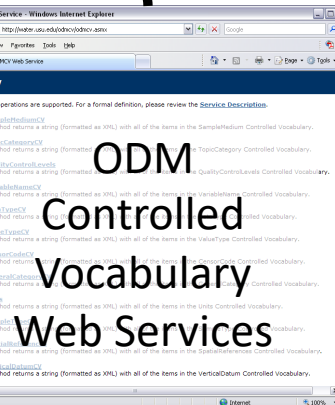


ODM Controlled Vocabulary Moderator

ODM Tools

Term	Definition	Term	Definition
Average	The values represent the average over a time interval, such as daily mean discharge or daily mean temperature.	Average	The values represent the average over a time interval, such as daily mean discharge or daily mean temperature.
Best Easy Systematic Estimator	Best Easy Systematic Estimator $BES = (Q1 + 2Q2 + 4Q3) / 4$. Q1, Q2, and Q3 are first, second, and third quartiles. See Wilcoxon, F., and Engel, C.	Best Easy Systematic Estimator	Best Easy Systematic Estimator $BES = (Q1 + 2Q2 + 4Q3) / 4$. Q1, Q2, and Q3 are first, second, and third quartiles. See Wilcoxon, F., and Engel, C.
Categorical	The values are categorical rather than continuous valued quantities. Mapping from Value values to categories is through the CategoryDivisions table.	Categorical	The values are categorical rather than continuous valued quantities. Mapping from Value values to categories is through the CategoryDivisions table.
Constant Over Interval	The values are quantities that can be interpreted as constant over the time interval from the previous measurement.	Constant Over Interval	The values are quantities that can be interpreted as constant over the time interval from the previous measurement.
Continuous	A quantity specified at a particular instant in time measured with sufficient frequency (small spacing) to be interpreted as a continuous record of the phenomenon.	Continuous	A quantity specified at a particular instant in time measured with sufficient frequency (small spacing) to be interpreted as a continuous record of the phenomenon.
Cumulative	The values represent the cumulative value of a variable measured or calculated up to a given instant of time, such as cumulative volume of flow or cumulative precipitation.	Cumulative	The values represent the cumulative value of a variable measured or calculated up to a given instant of time, such as cumulative volume of flow or cumulative precipitation.
Incremental	The values represent the incremental value of a variable over a time interval, such as the incremental volume of flow or incremental precipitation.	Incremental	The values represent the incremental value of a variable over a time interval, such as the incremental volume of flow or incremental precipitation.

XML



ODM Controlled Vocabulary Web Services

Master ODM Controlled Vocabulary

Local ODM Database

Local Server

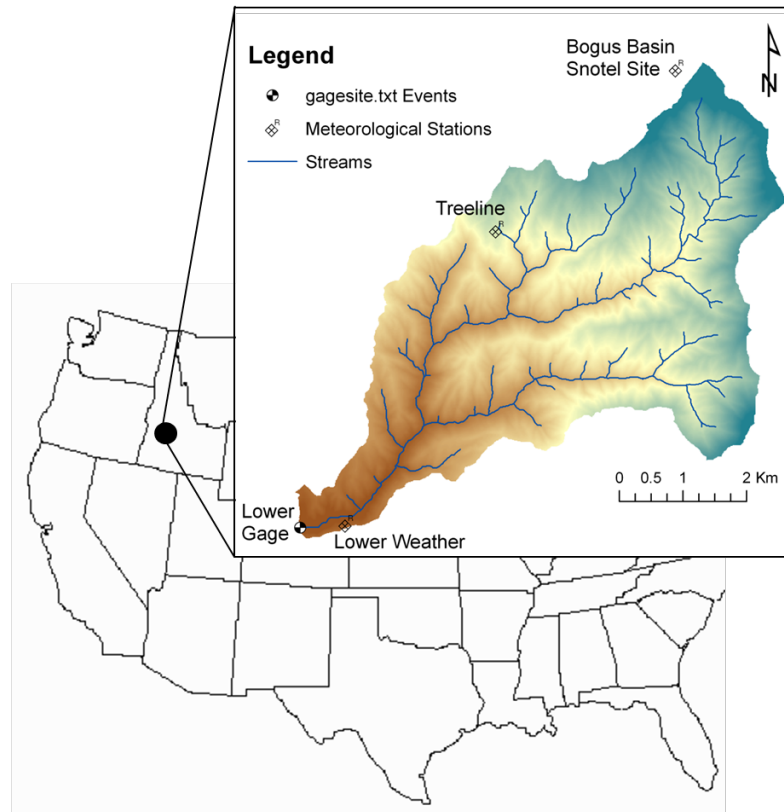
<http://his.cuahsi.org/mastercvreg.html>

From Jeff Horsburgh

37 Water Data Services on HIS Central from 12 Universities

- University of Maryland, Baltimore County
- Montana State University
- University of Texas at Austin
- University of Iowa
- Utah State University
- University of Florida
- University of New Mexico
- University of Idaho
- Boise State University
- University of Texas at Arlington
- University of California, San Diego
- Idaho State University

Dry Creek Experimental Watershed (DCEW) (28 km² semi-arid steep topography, Boise Front)

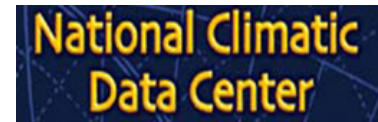


68 Sites
24 Variables
4,700,000+ values

Published by Jim
McNamara, Boise
State University

Water Agencies and Industry

- **USGS, NCDC, Corps of Engineers** publishing data using HIS WaterML
- **OGC Hydrology Domain Working Group** evaluating WaterML as OGC standard
- **ESRI** using CUAHSI model in ArcGIS.com GIS data collaboration portal
- **Kisters** WISKI support for WaterML data publication
- **Australian Water Resources Information System** Water Accounting System has adopted aspects of HIS
- **NWS West Gulf River Forecast Center** Multi-sensor Precipitation Estimate published from ODM using WaterML



Federal Agency Water Data Services at HISCentral (10/2010)

Network Name	Site Count	Value Count	Earliest Observation	Notes
NWISDV	31,800	304,000,000	01/01/1861	WaterML-compliant GetValues service from NWIS, catalog ingested
EPA	236,000	78,000,000	01/11/1900	SOAP wrapper over WQX services, catalog ingested
NWISUV	11,800	84,500,000	60 DAYS	WaterML-compliant GetValues Service, catalog ingested
NCDC ISH	11,600	3,000,000*	1/1/2005	WaterML-compliant GetValues service from NCDC
NCDC ISD	24,800	18,200,000	1/1/1892	WaterML-compliant GetValues service from NCDC
NWISIID	376,000	86500,000	9/1/1867	SOAP wrapper over NWIS web site, catalog ingested
NWISGW	834,000	8,490,000	1/1/1800	SOAP wrapper over NWIS web site, catalog ingested
RIVERGAGES	1,300	264,000,000	1/1/2000	WaterML compliant REST services from Army Corps of Engineers

* Estimated

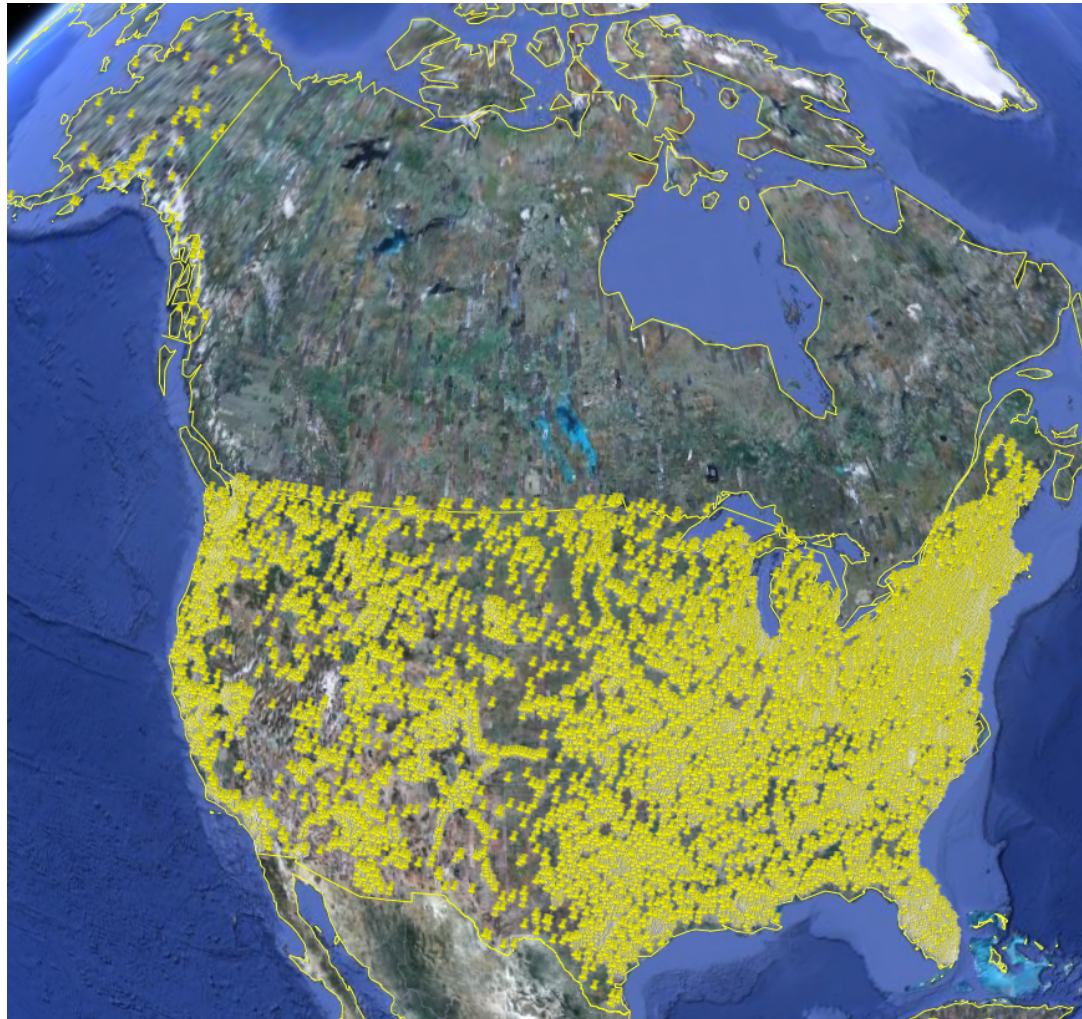
USGS Unit Values Data



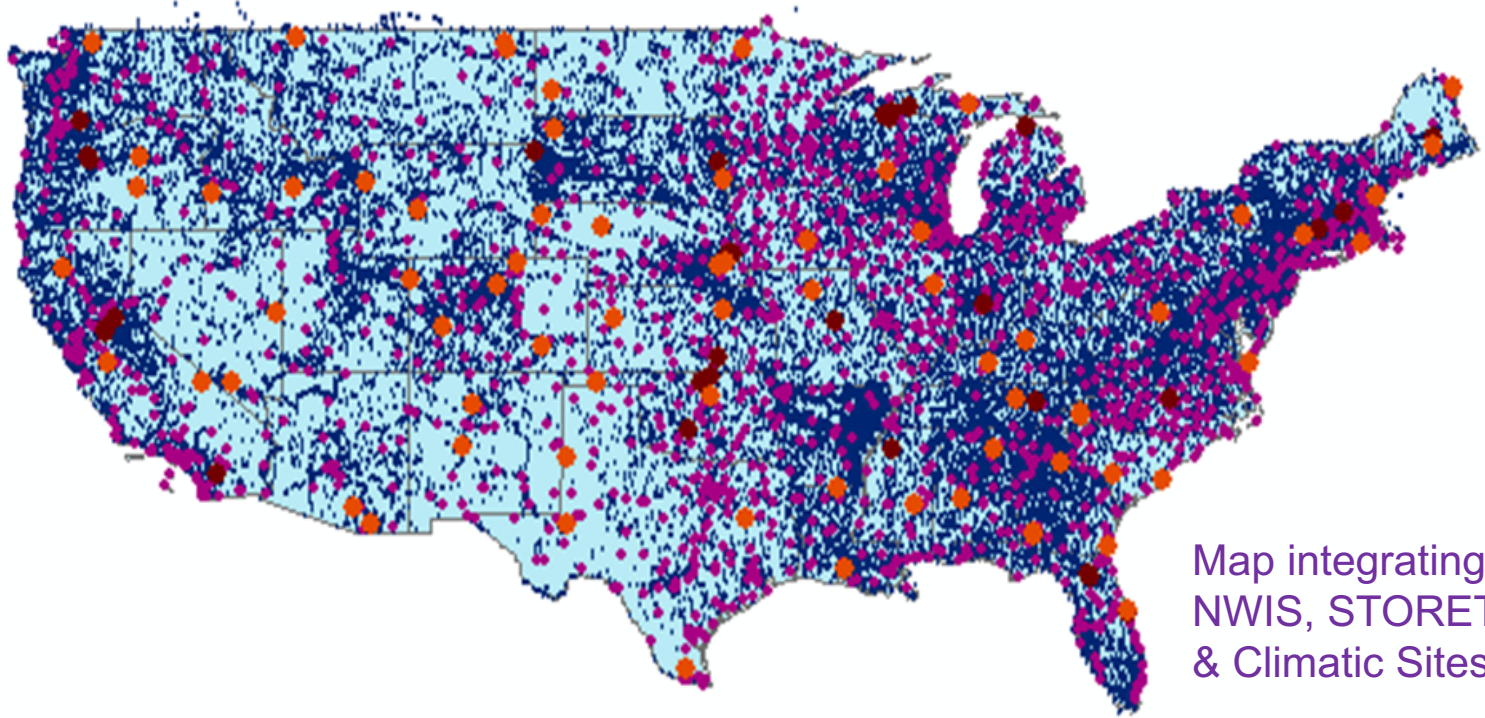
Real time streamflow
data over the last 60
days

11188 sites, nationally
for the US

Published by **USGS**
National Water
Information System



HISCentral Content (11/2010)



Map integrating
NWIS, STORET,
& Climatic Sites

58 public services

18,000+ variables

1.96+ million sites

23.3 million series

Referencing 5.1 billion data values

*Available via HISCentral
discovery services*

Available via GetValues requests

Summary

- **Data Storage** in an *Observations Data Model* (ODM) and publication through **HydroServer**
- **Data Access** through internet-based *Water Data Services* using a consistent data language, called WaterML from **HydroDesktop**
- **Data Discovery** through a *National Water Metadata Catalog* and thematic keyword search system at **HIS Central**
- **Integrated Modeling and Analysis** within **HydroDesktop**

The combination of these capabilities creates a common window on water observations data for the United States unlike any that has existed before.



- Learn about the CUAHSI-HIS System
- Share your work with information systems and large scale datasets
- Share your use of hydrologic data for teaching
- Interact with other users
- Share your work linking data and modeling
- Show science enabled by HIS
- Hands-on workshops
- Contribute to the future of HIS

For information on presenting or attending see:

<http://his.cuahsi.org/conference2011>

Contact: David.Tarboton@usu.edu

Thanks! HIS Project Team and Sponsors

- [University of Texas at Austin](#) – David Maidment, Tim Whiteaker, James Seppi, Fernando Salas, Jingqi Dong, Harish Sangireddy
- [San Diego Supercomputer Center](#) – Ilya Zaslavsky, David Valentine, Tom Whitenack, Matt Rodriguez
- [Utah State University](#) – Jeff Horsburgh, Kim Schreuders, Stephanie Reeder, Edward Wai Tsui, Ravichand Vegiraju, Ketan Patil
- [University of South Carolina](#) – Jon Goodall, Anthony Castronova
- [Idaho State University](#) – Dan Ames, Ted Dunsford, Jiří Kadlec, Yang Cao, Dinesh Grover
- [Drexel University/CUNY](#) – Michael Piasecki
- [WATERS Network](#) – Testbed Data Managers
- [CUAHSI Program Office](#) – Rick Hooper, Yoori Choi, Conrad Matiuk
- [ESRI](#) – Dean Djokic, Zichuan Ye



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Sharing hydrologic data

<http://his.cuahsi.org/>



Support
EAR 0622374