



# The CUAHSI Hydrologic Information System

Presented by Dr. Tim Whiteaker  
The University of Texas at Austin

21 October, 2010

# About the Speaker



*PhD 2004*



*Research Associate*



Watershed  
WaterML Rainfall  
BassGuitar  
WebServices  
Information  
Hydrologic  
WaterResources  
Programming  
Hydro WaterRights  
Runoff Photography Research  
Engineering Groundwater  
CUAHSI SurfaceWater  
Systems  
WaterOneFlow  
Geographic  
UniversityOfTexas  
ArcHydroAustin  
ArcObjects  
Environment

# What You Will Learn

- What is the CUAHSI **Hydrologic Information System** (HIS)
  - History
  - Why people use it
- How to **access** data in HIS
- How to **publish** your data with HIS

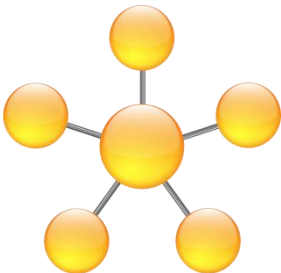
# Outline



- The HIS Story



- HIS components

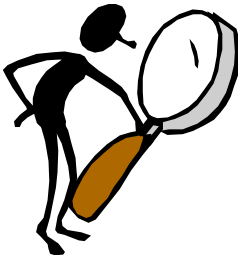


- Putting the pieces together

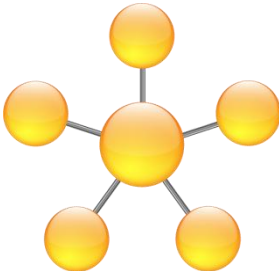
# Outline



- *The HIS Story*



- HIS components



- Putting the pieces together

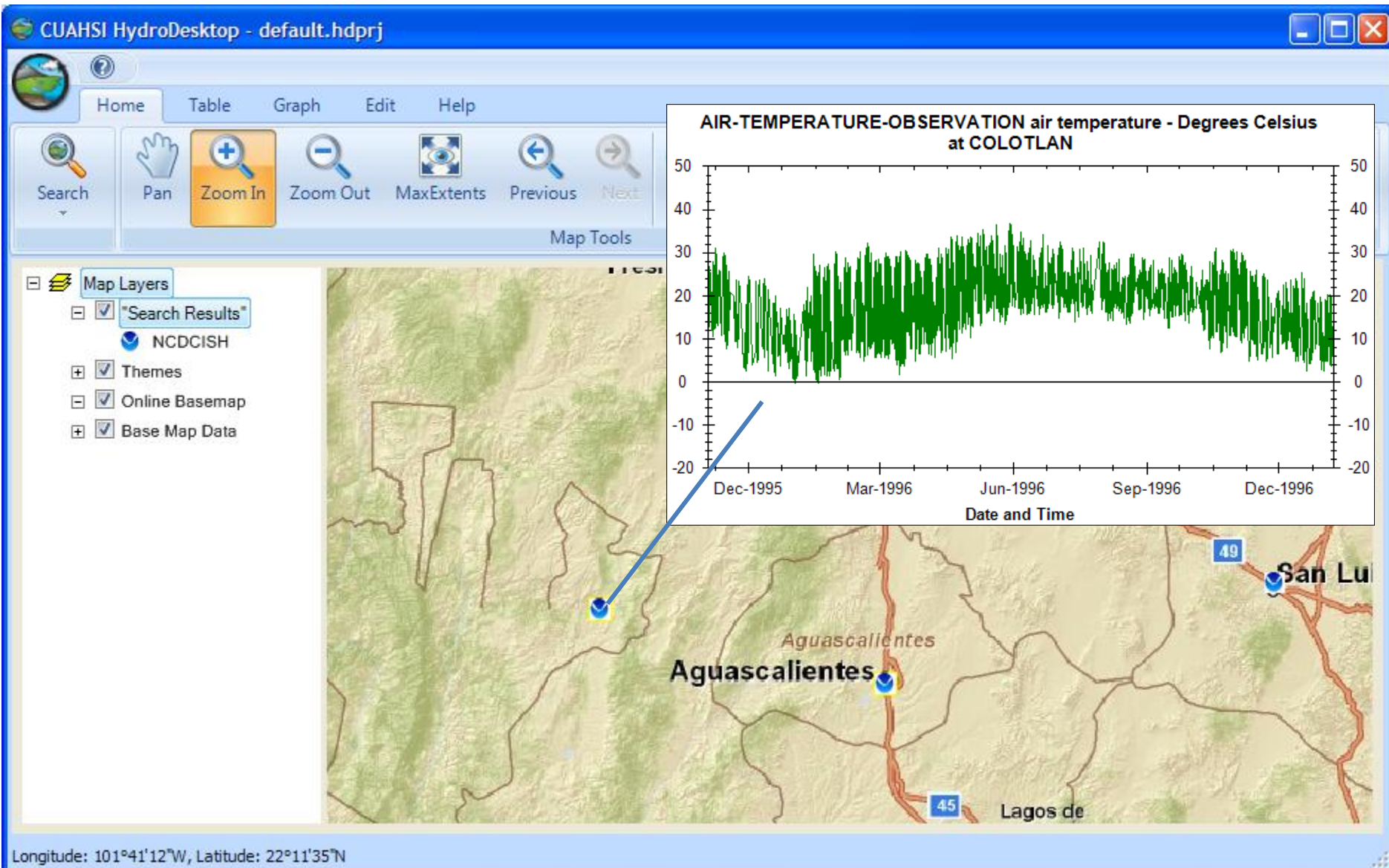
# HIS Connects People with Data

- The CUAHSI\* Hydrologic Information System (HIS) provides web services, tools, standards and procedures that enhance access to more and better data for hydrologic analysis.

[his.cuahsi.org](http://his.cuahsi.org)

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

# Temperature Near Aguascalientes

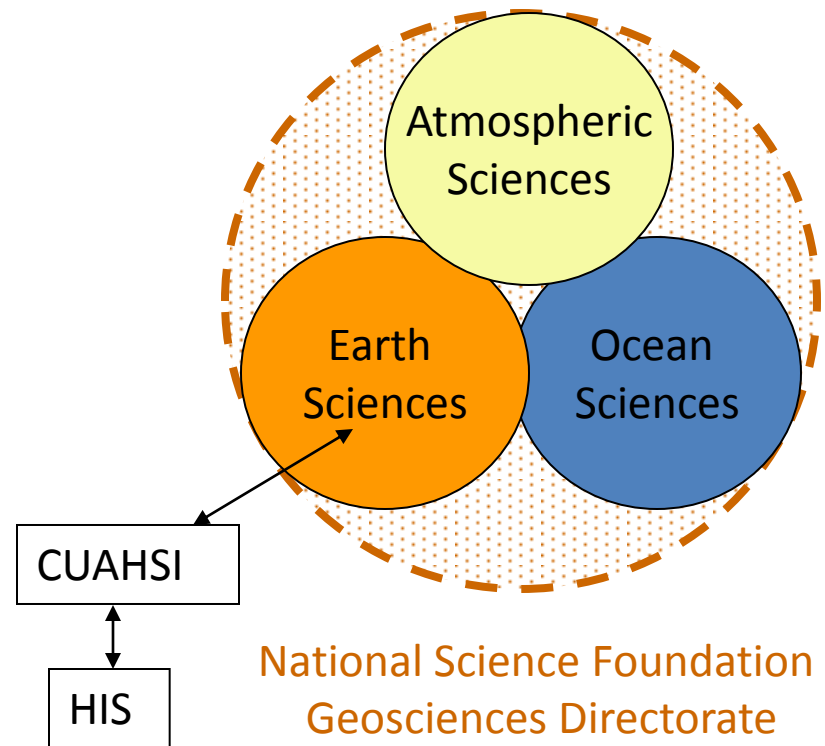


# What is CUAHSI

Consortium of Universities  
for the Advancement of Hydrologic Science, Inc

- Formed in **2001**
- Develops **infrastructure and services to advance hydrologic science** in US universities

[www.cuahsi.org](http://www.cuahsi.org)

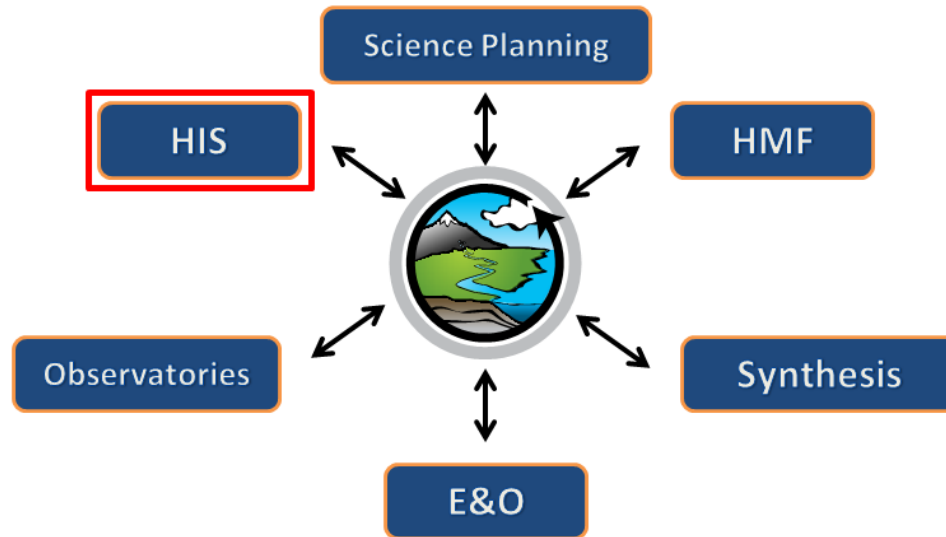


# CUAHSI Member Institutions



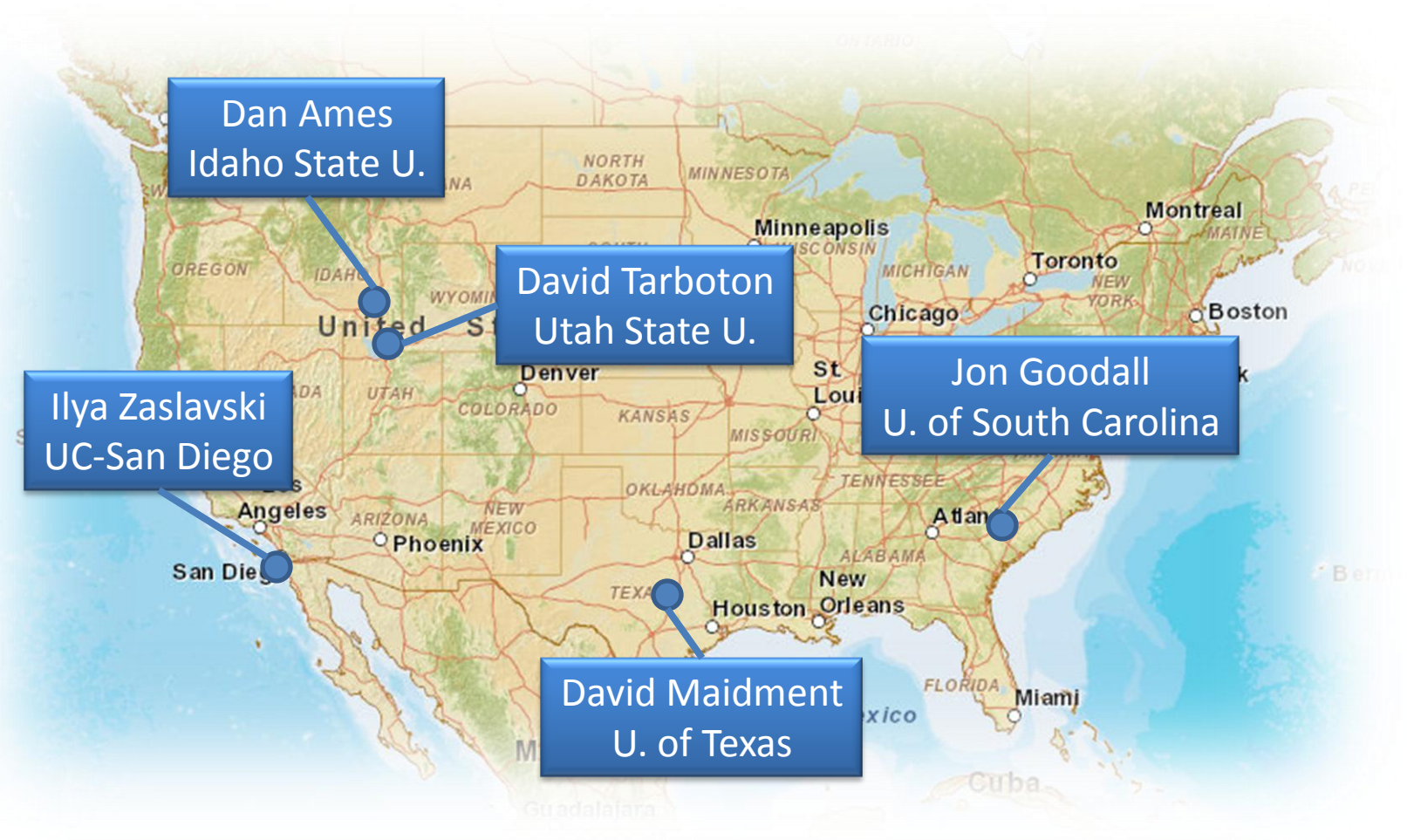
112 North American universities, and 16 international affiliates

# CUAHSI Hydrologic Information Systems Project

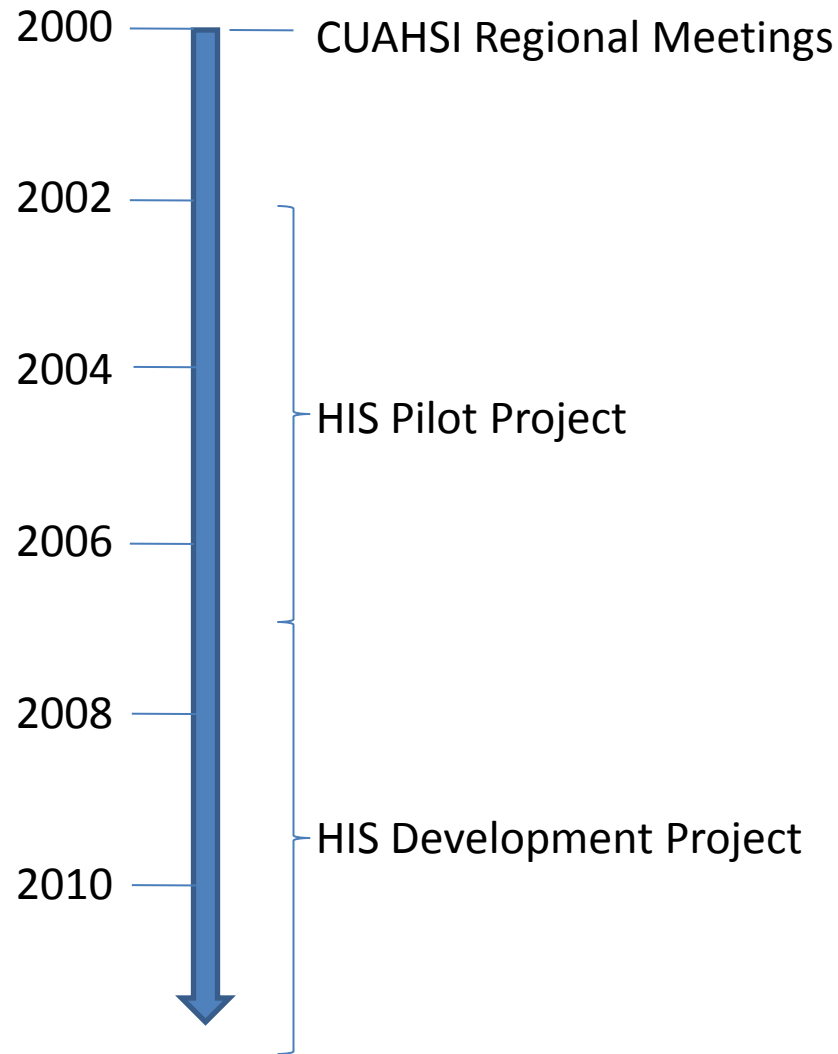


David R. Maidment  
The University of Texas at Austin  
(HIS Project Leader)

# HIS Team Principle Investigators



# CUAHSI HIS Development





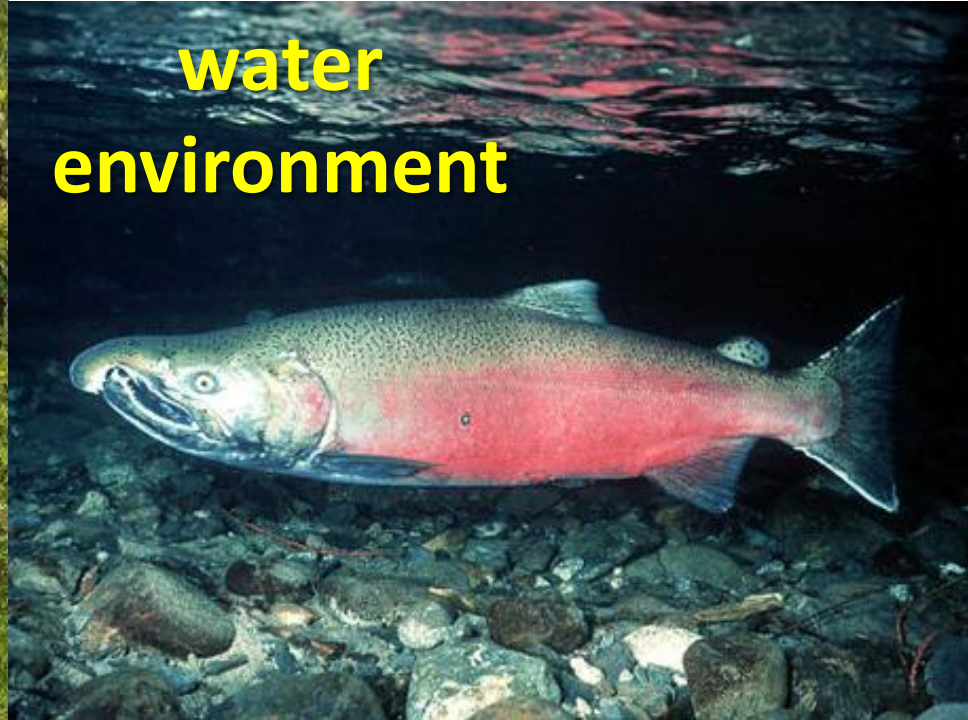
**too much  
water**



**too little  
water**

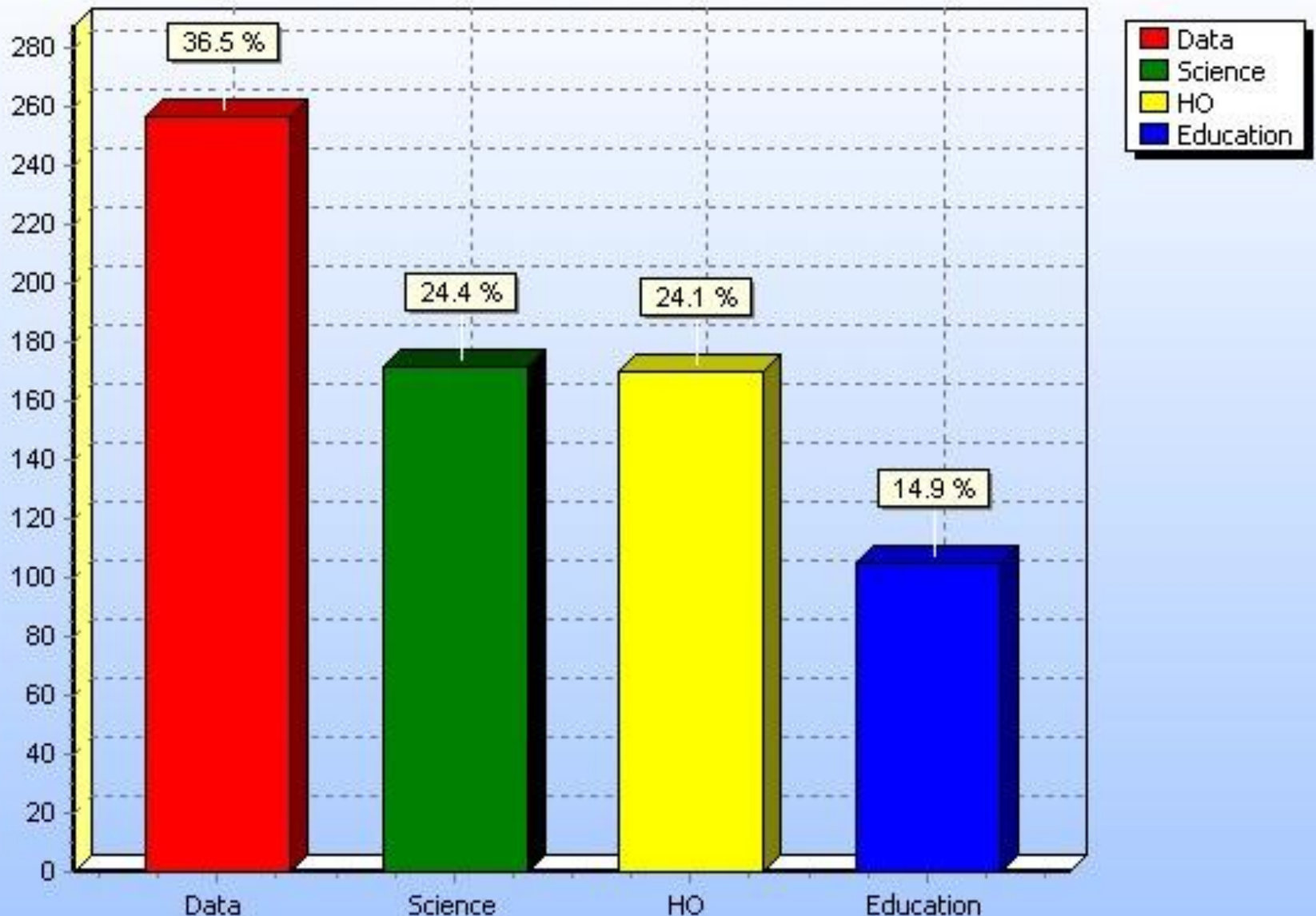


**dirty  
water**



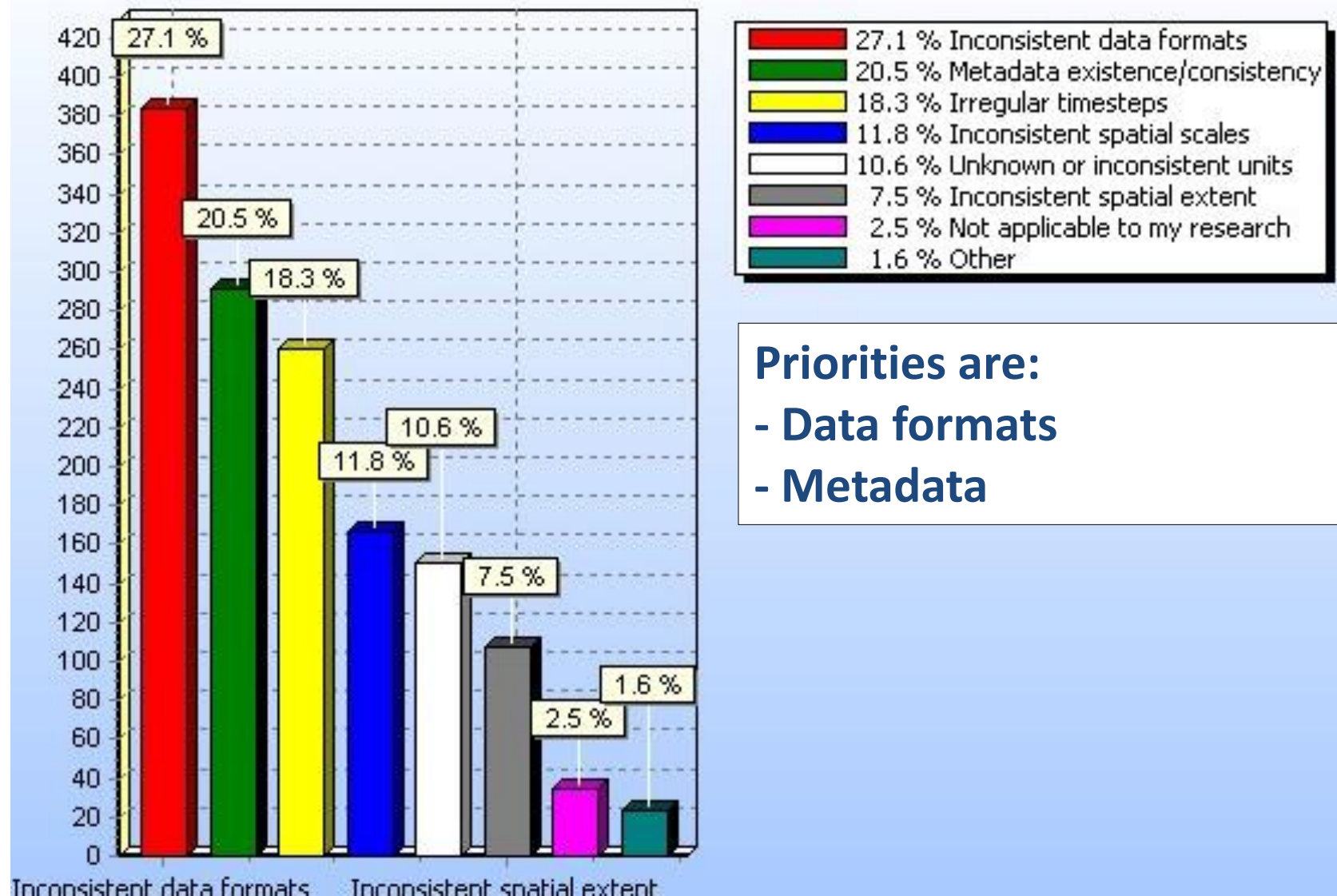
**water  
environment**

Please rank these four HIS service categories for helping you.



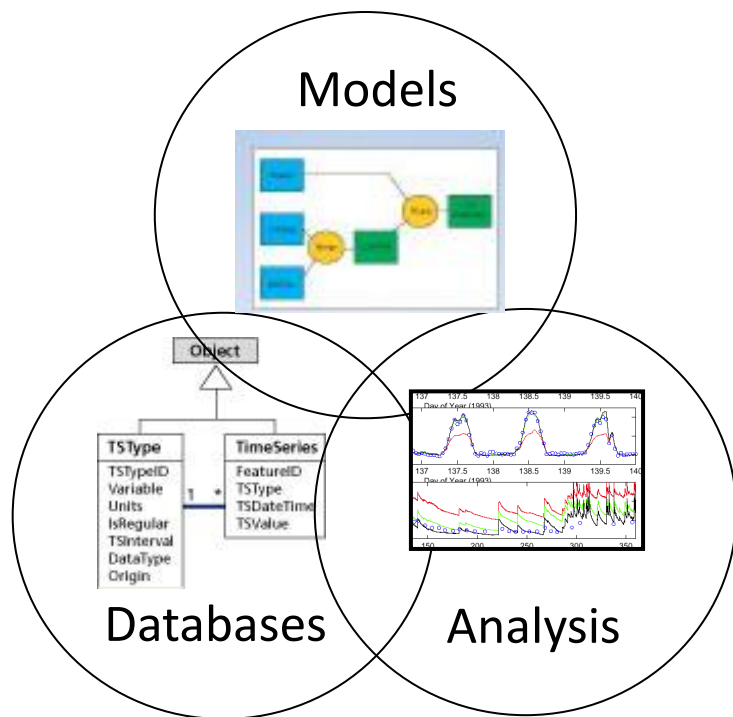
**Conclusion: Data services are the highest priority**

Which of the following data analysis difficulties are most important for HIS to address?



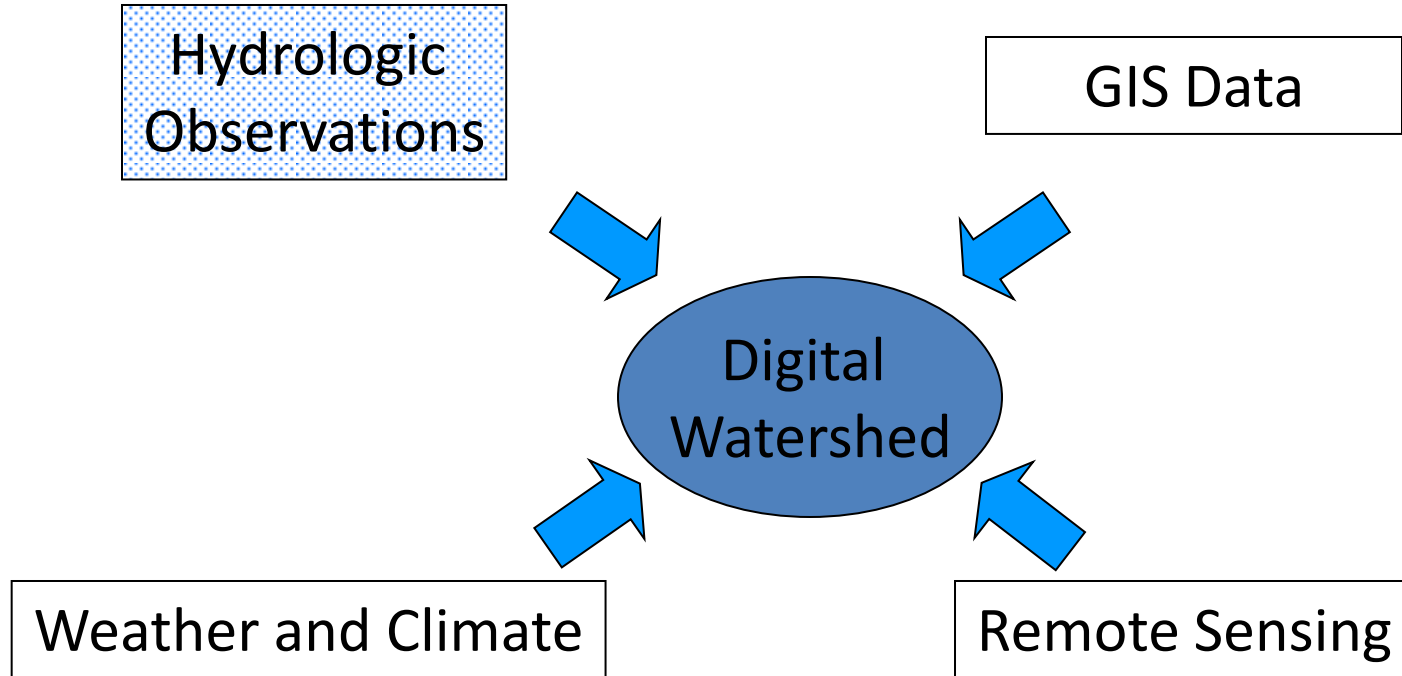
# CUAHSI Hydrologic Information System

Goal: Enhance hydrologic science by facilitating user access to more and better data for testing hypotheses and analyzing processes



- Advancement of **water science** is critically dependent on integration of **water information**
- It is as important to represent **hydrologic environments** precisely with data as it is to represent **hydrologic processes** with equations

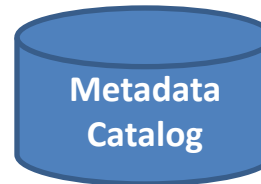
# Data Integration



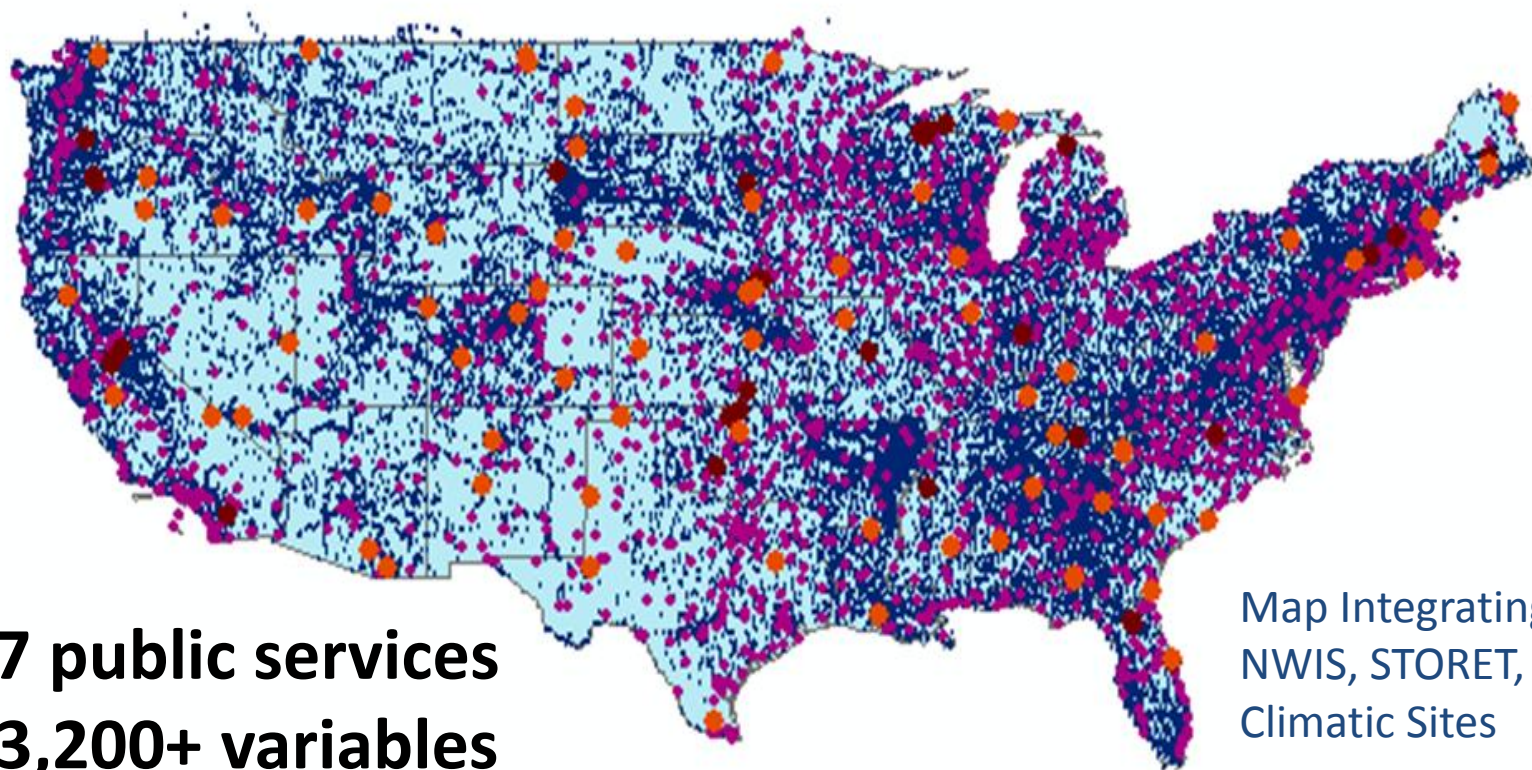
*Currently, the focus is on data from monitoring sites at point locations.*

# The Result

- WaterML language for describing water data
- National catalog of water data sources
- Free software for data access



# CUAHSI Water Data Services, April 2010



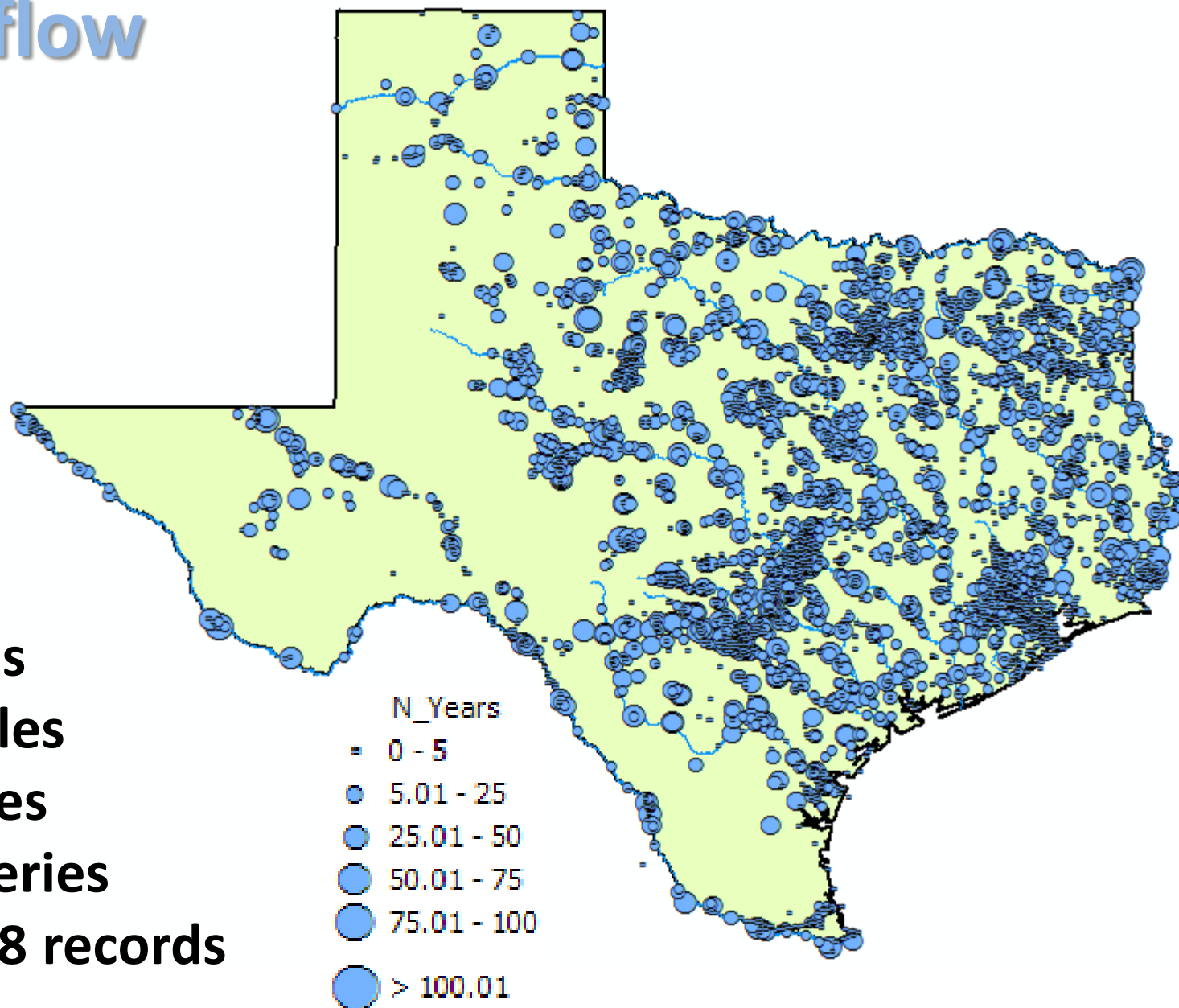
Map Integrating  
NWIS, STORET, &  
Climatic Sites

**47 public services**  
**13,200+ variables**  
**1.8 million sites**  
**22.9 million series**  
**4.7 billion data values**

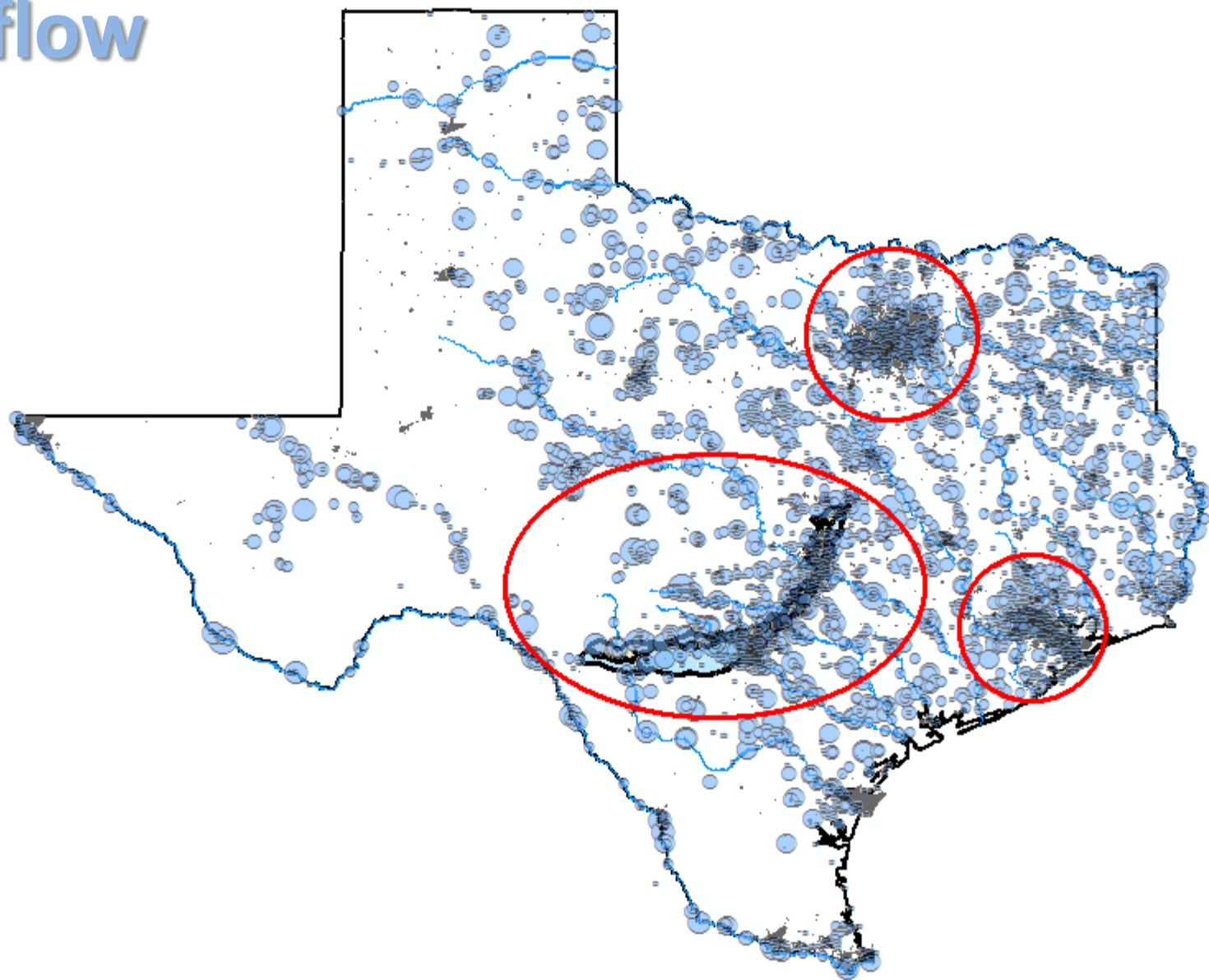
*The largest water data  
catalog in the world*

# Streamflow

**2 services**  
**7 variables**  
**4,363 sites**  
**11,484 series**  
**9,493,968 records**

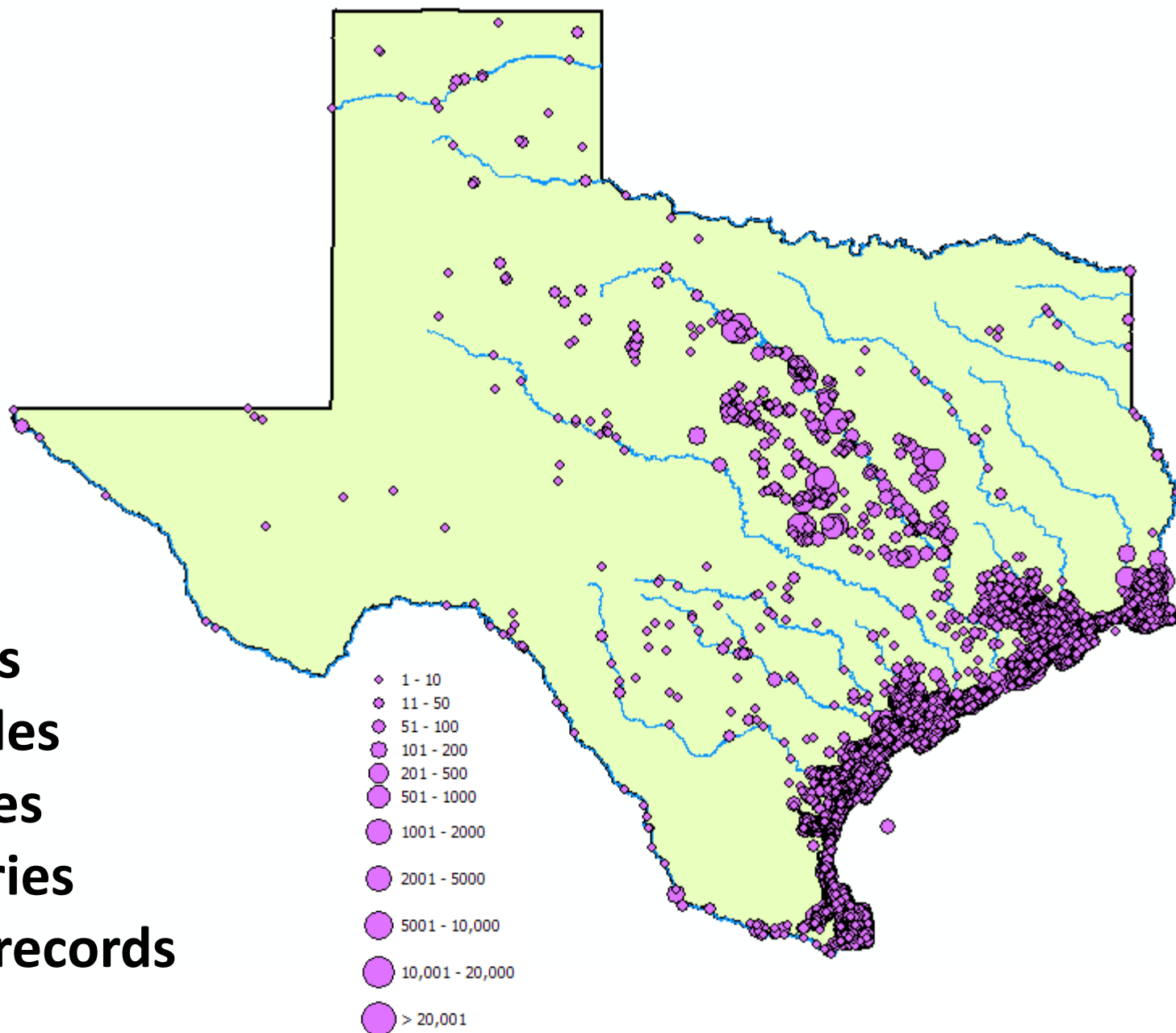


# Streamflow

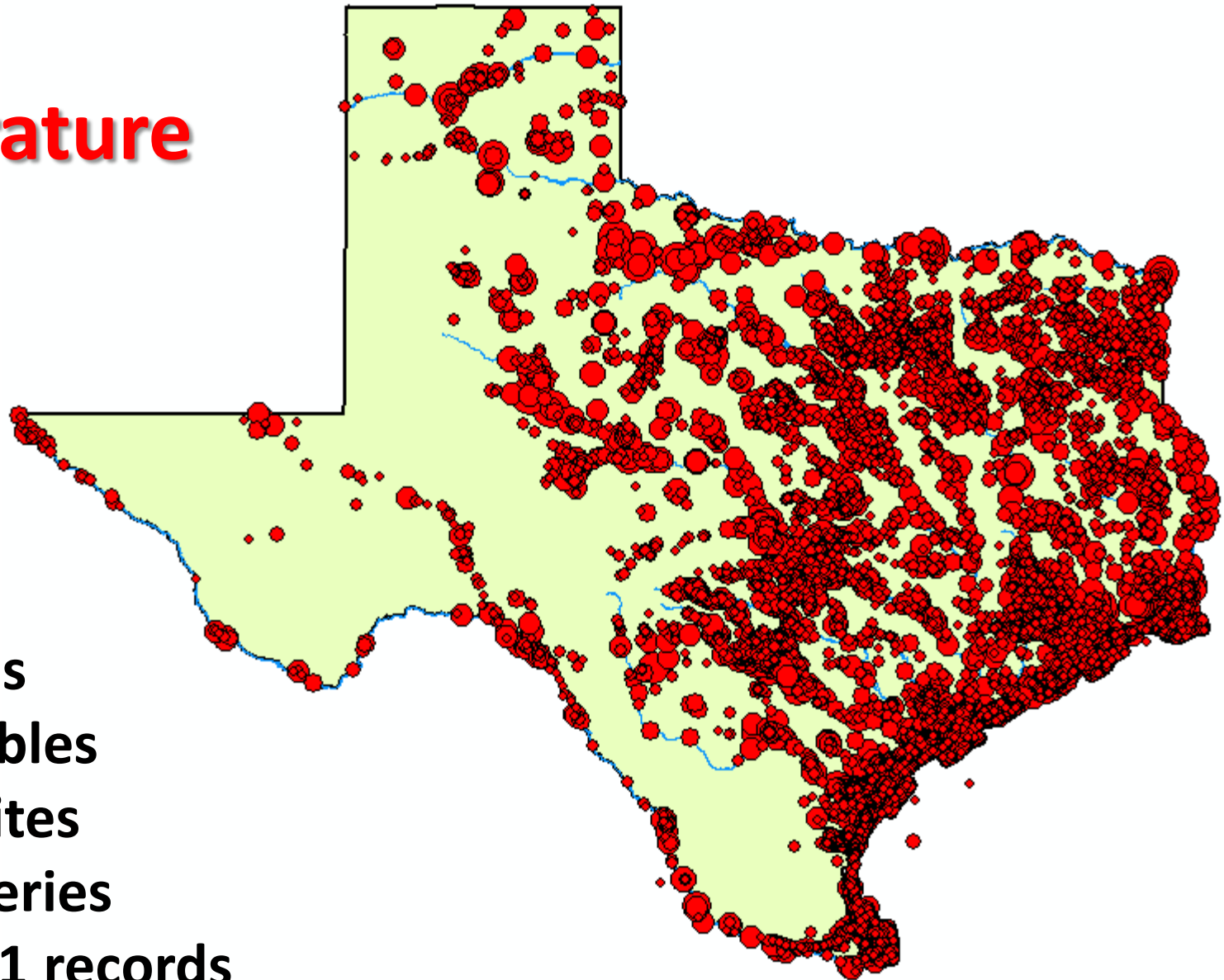


# Salinity

**5 services**  
**7 variables**  
**6,613 sites**  
**7,912 series**  
**346,813 records**

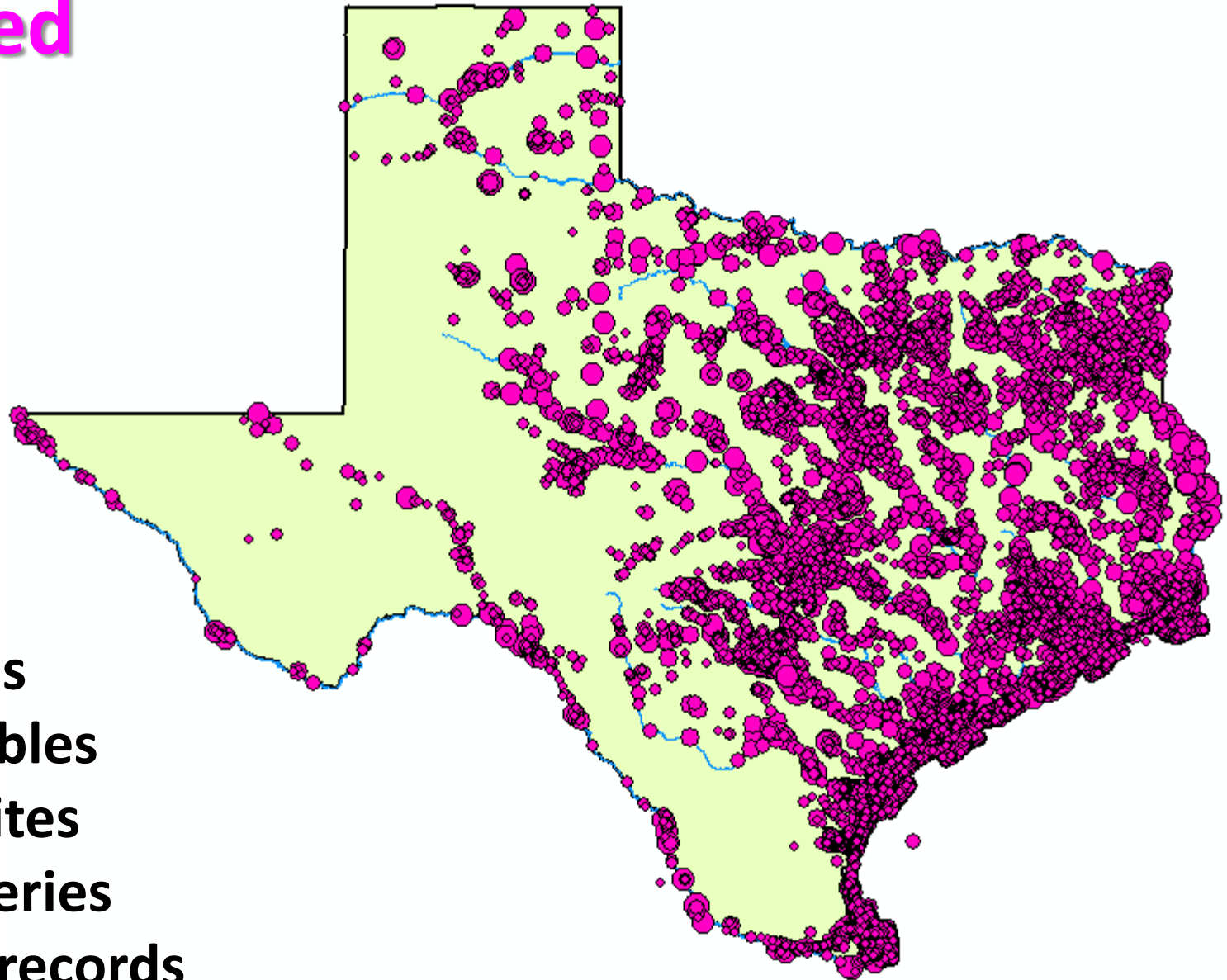


# Water Temperature



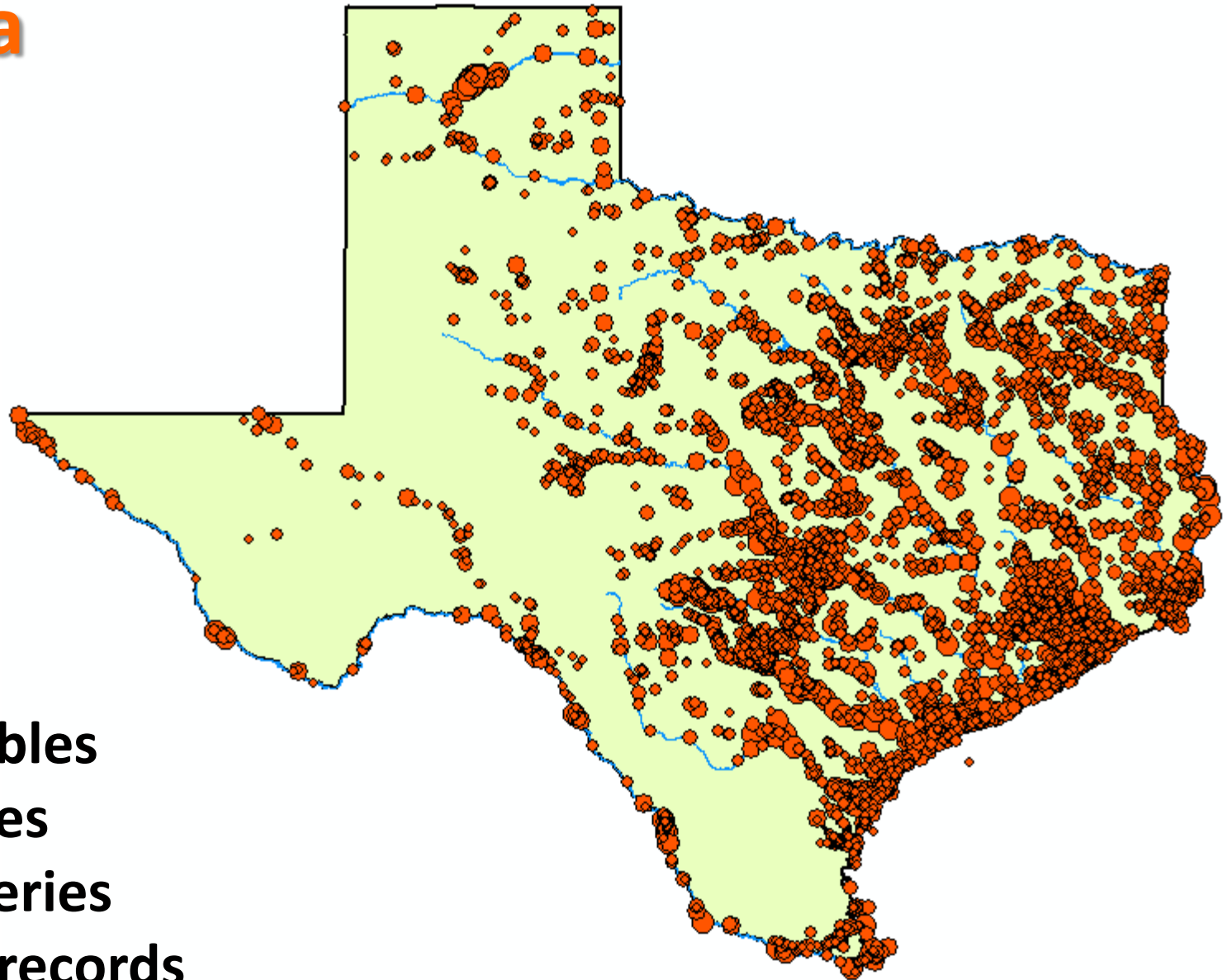
**6 services**  
**11 variables**  
**11,158 sites**  
**22,953 series**  
**1,546,841 records**

# Dissolved Oxygen



**5 services**  
**18 variables**  
**10,823 sites**  
**21,655 series**  
**930,571 records**

# Bacteria



**1 service**

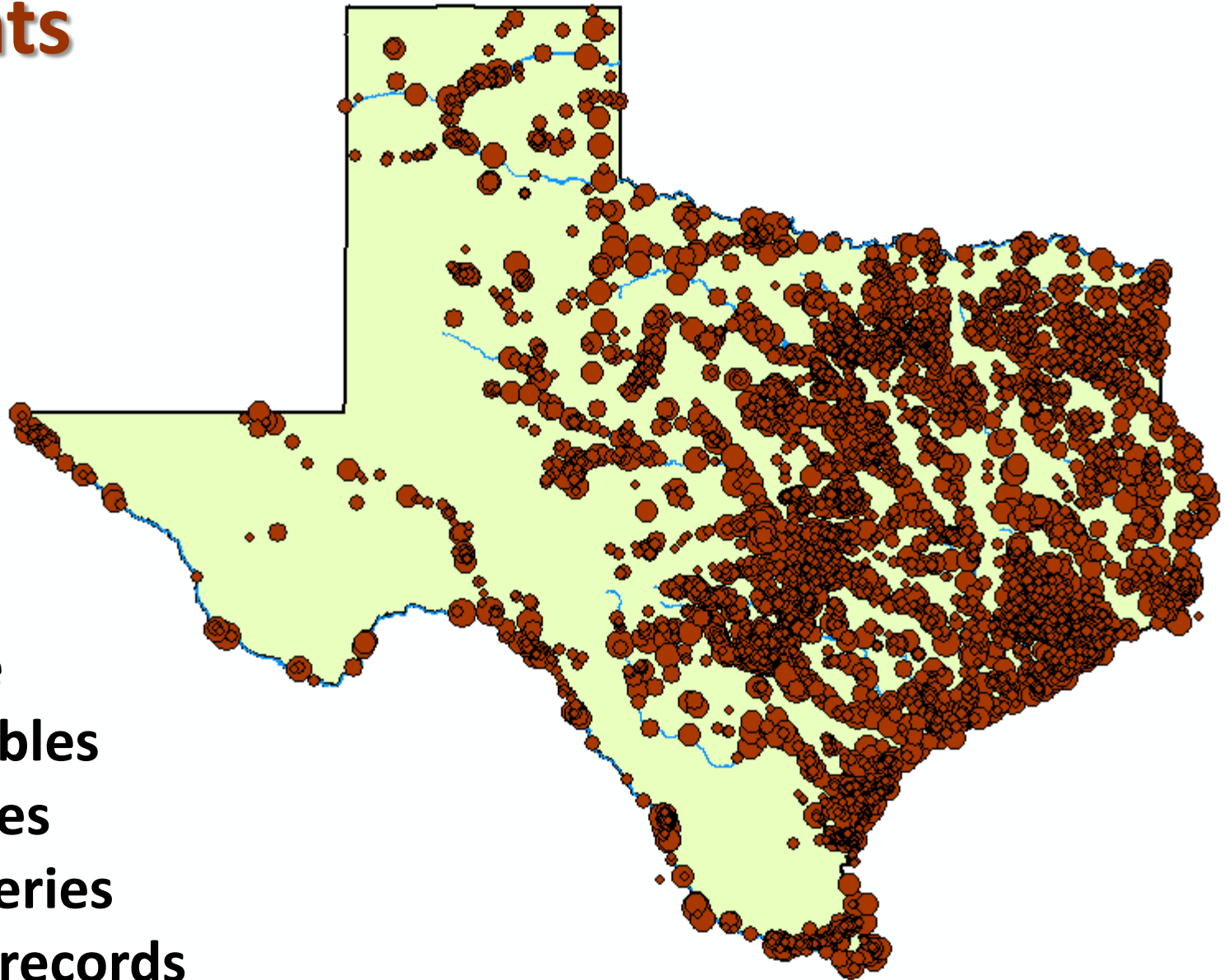
**21 variables**

**4,801 sites**

**15,483 series**

**297,849 records**

# Nutrients



**1 service**

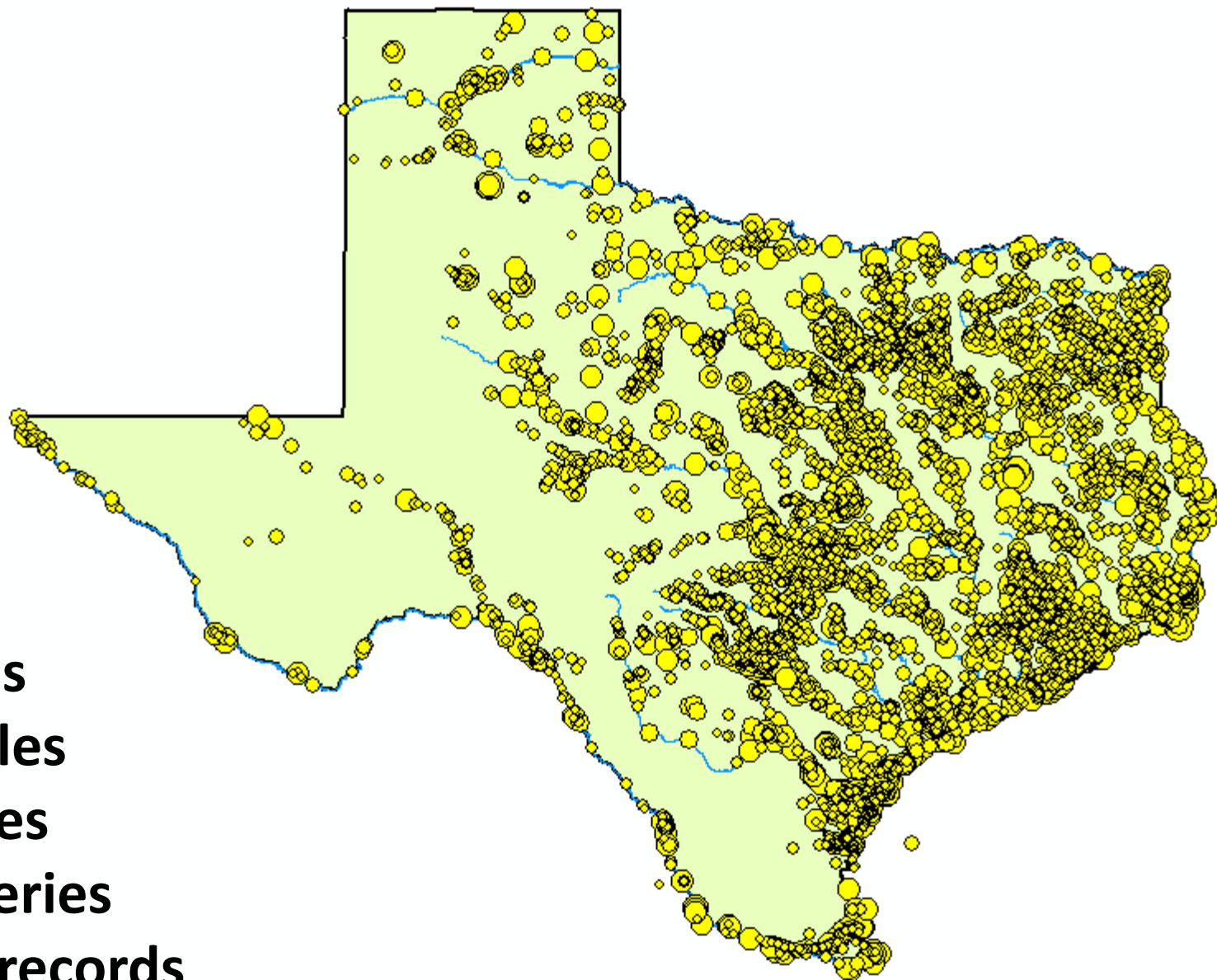
**25 variables**

**5,635 sites**

**52,396 series**

**856,194 records**

pH



**3 services**

**7 variables**

**6,228 sites**

**16,576 series**

**785,650 records**

# For more on the HIS Story

[his.cuahsi.org](http://his.cuahsi.org)

**CUAHSI HIS**  
Sharing hydrologic data

CUAHSI's Hydrologic Information System (CUAHSI-HIS) provides web services, tools, standards and procedures that enhance access to more and better data for hydrologic analysis.

Home | How To | Components | Community | Publications | About Us | Contact Us

Google Custom Search Search HIS

*The CUAHSI Hydrologic Information System (HIS) is an internet-based system for sharing hydrologic data. It is comprised of databases and servers, connected through web services, to client applications, allowing for the publication, discovery and access of data.*

**Key Components of CUAHSI-HIS:**

```
graph TD
    HS[HydroServer  
Data Publication] -- "Metadata Services  
Service Registration  
and Catalog Harvesting" --> HC[HIS Central  
Data Discovery]
    HC -- "Search Services  
Geographic, Semantic, Time  
and Network Search" --> HD[HydroDesktop  
and other clients  
Data Access]
    HS -- "Data Services  
Water and Spatial Data" --> HD
```

**Quick Links**

- HydroDesktop
- HydroExcel
- HydroGet
- FetchWaterML
- WaterML Web Services
- ODM Database
- HydroServer
- Master Controlled Vocabulary
- HydroTagger
- HIS Central

**What's New**

**Hydrologic Data Needs Survey**  
Help us help you, by filling out our Hydrologic Data Publication, Discovery, Access and Analysis Needs Survey. This survey follows on to those conducted in 2004 and 2006. Results of these surveys have had a significant influence on the direction of this project.

**Hope to see you at the Water Data Service Workshop, July 21-22, 2010**  
This workshop is an introduction to the CUAHSI HIS web service approach to sharing and accessing hydrologic data, including the key tools and technologies: HydroServer (store and publish), HIS Central (catalog and search), and HydroDesktop (access and analyze). The workshop follows the CUAHSI Biennial Colloquium in Boulder, CO.

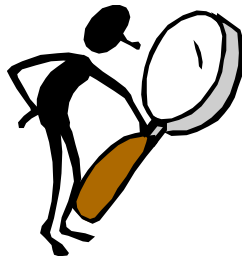
**HIS at the AWRA Spring Specialty Conference: GIS & Water Resources VI**  
The keynote by ESRI's Jack Dangermond described how ESRI is integrating HIS technology into their new products. There was also a number of other HIS related presentations, and we had demos and more at the CUAHSI booth at the conference on, March 29-31, 2008, and the workshops that followed it on April 1-2, in Orlando, FL.

Done

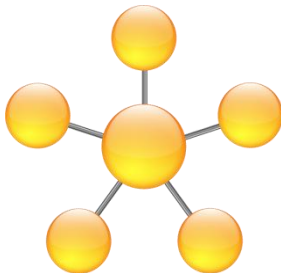
# Outline



- The HIS Story

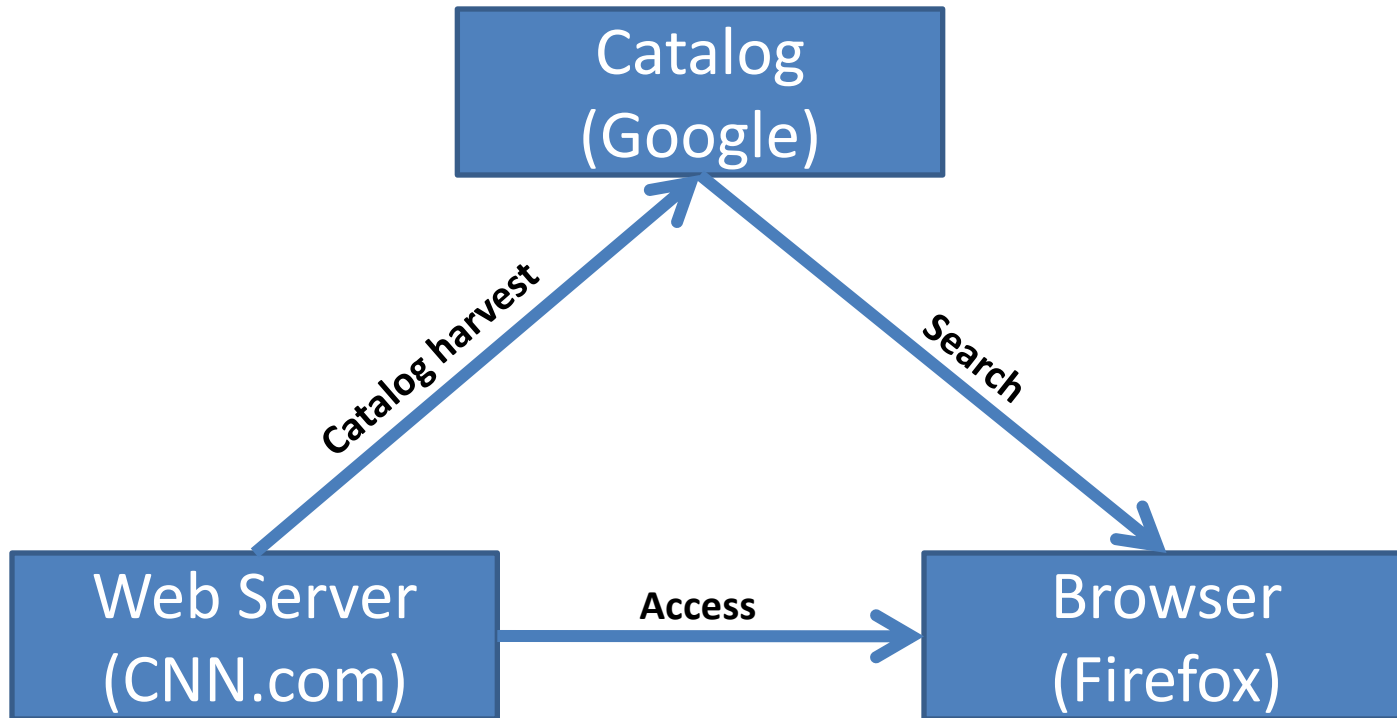


- ***HIS components***

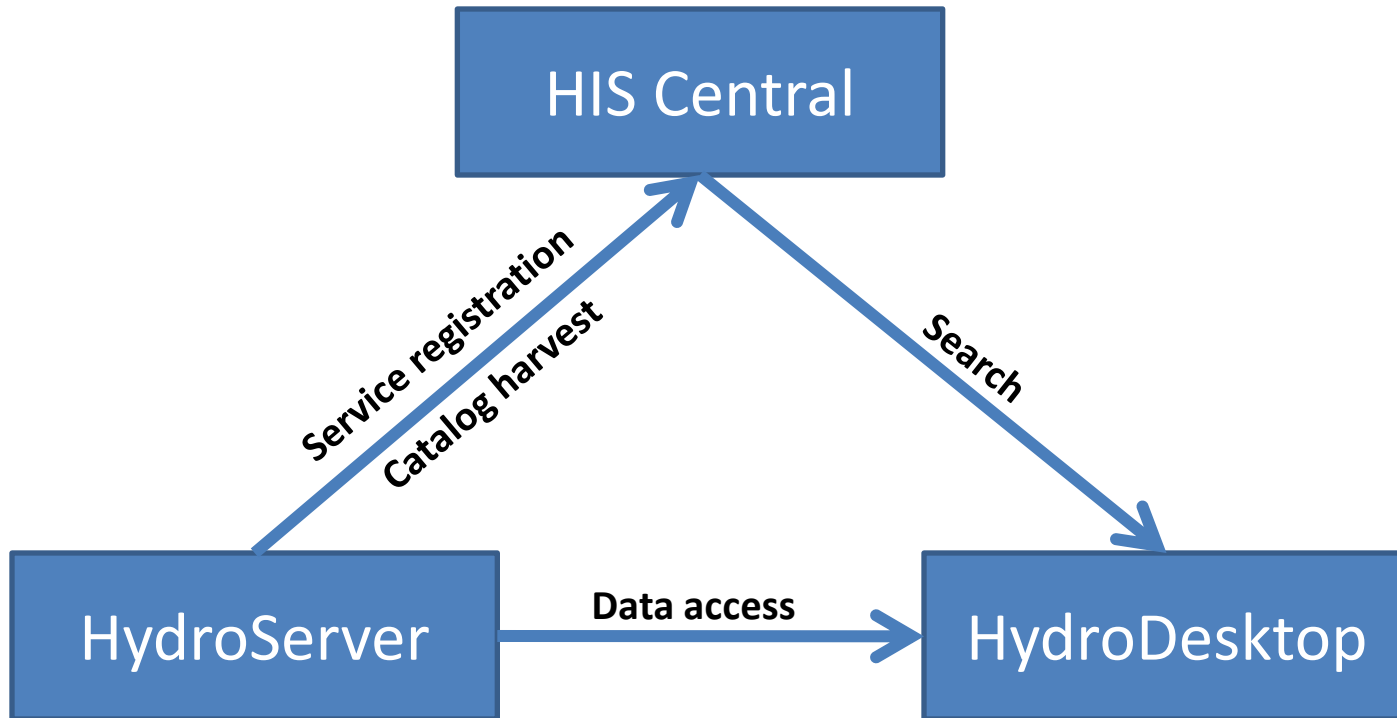


- Putting the pieces together

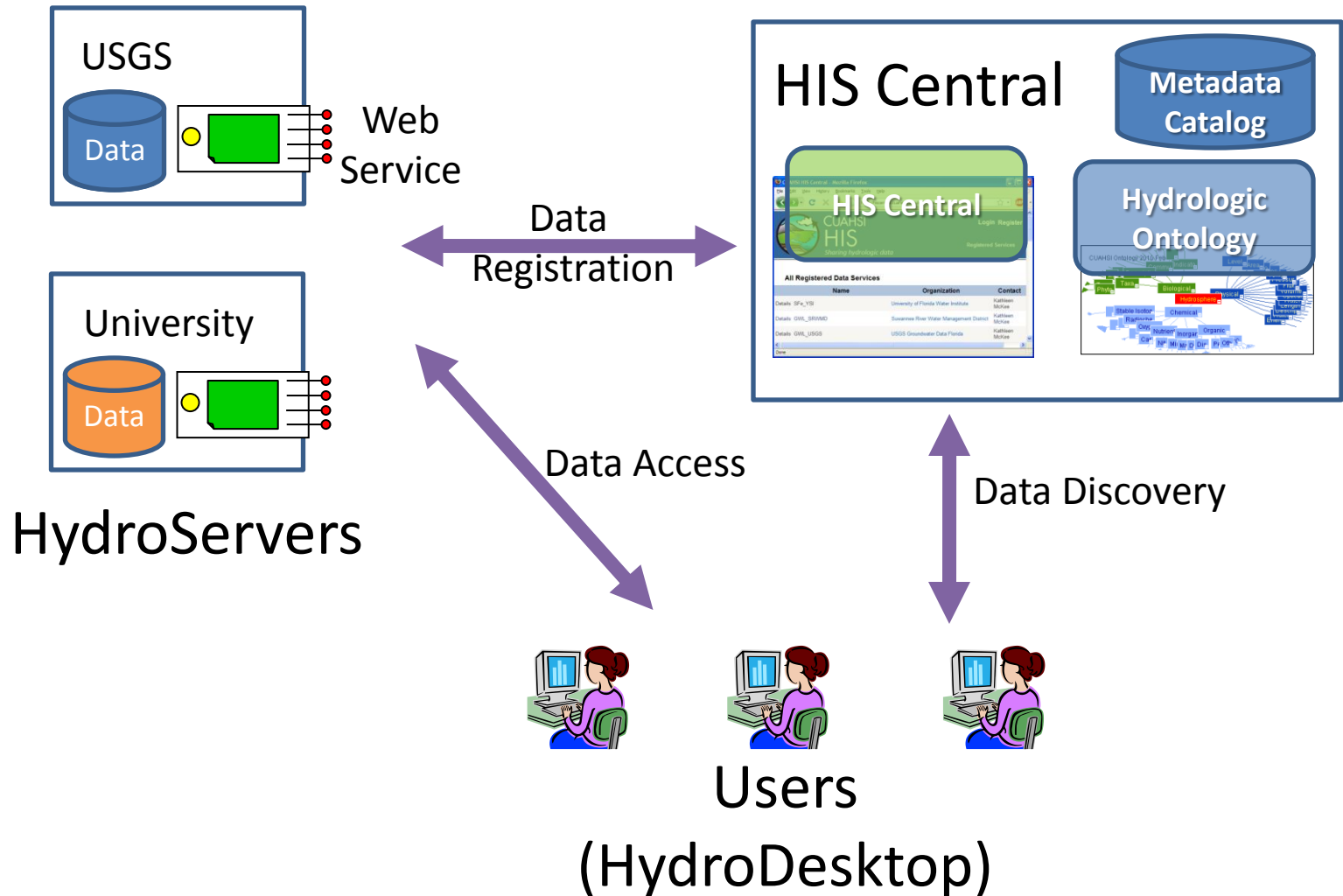
# Web Paradigm



# Services-Oriented Architecture for Water Data



# HIS System Overview



# Water Data

Water quantity  
and quality



Soil water



Rainfall & Snow



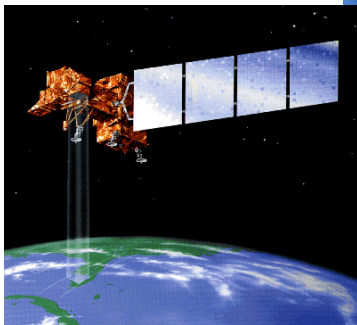
Meteorology



Modeling



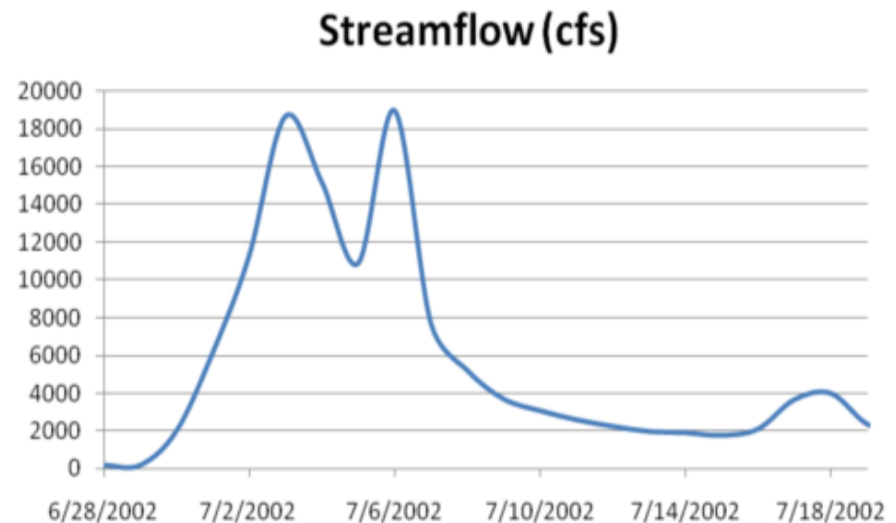
Remote sensing



# Point Observations Time Series

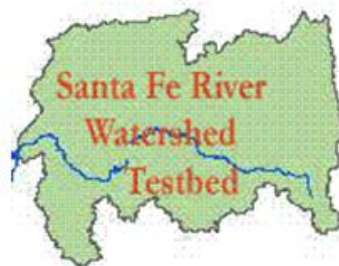
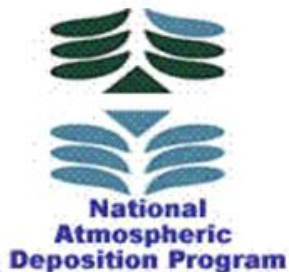


A **point** location in **space**



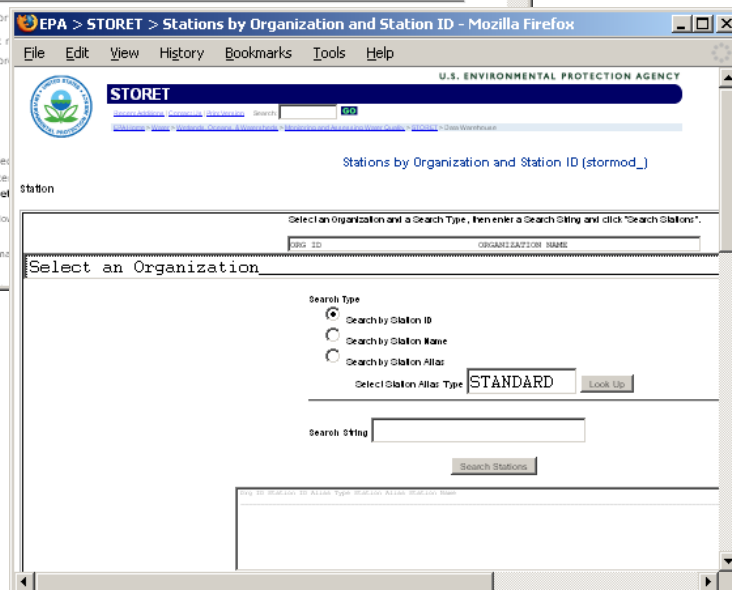

A **series** of values in **time**

# Sources of Observations Data

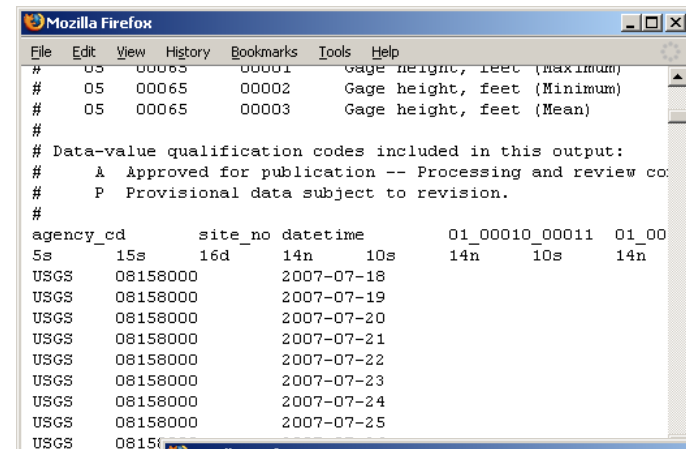


# Getting Water Data (the old way)

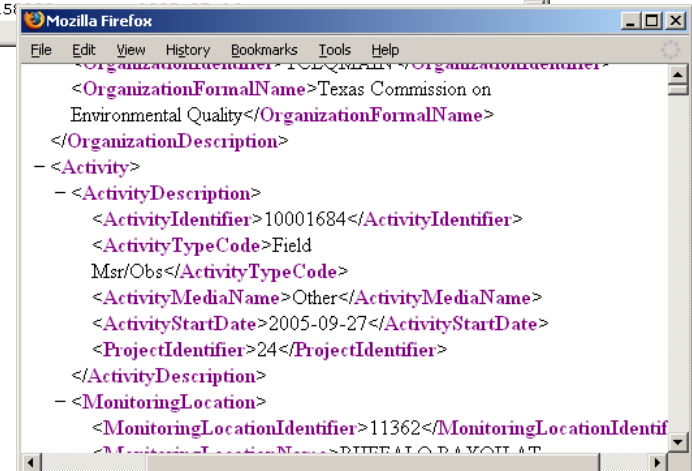
## Different Query Pages



## Different Query Responses



agency_cd	site_no	datetime	gage height, feet (Maximum)	gage height, feet (Minimum)	gage height, feet (Mean)
USGS	08158000	2007-07-18	14n	10s	14n
USGS	08158000	2007-07-19			
USGS	08158000	2007-07-20			
USGS	08158000	2007-07-21			
USGS	08158000	2007-07-22			
USGS	08158000	2007-07-23			
USGS	08158000	2007-07-24			
USGS	08158000	2007-07-25			



```
<OrganizationFormalName>Texas Commission on  
Environmental Quality</OrganizationFormalName>  
</OrganizationDescription>  
- <Activity>  
- <ActivityDescription>  
  <ActivityIdentifier>10001684</ActivityIdentifier>  
  <ActivityTypeCode>Field  
  Msr/Obs</ActivityTypeCode>  
  <ActivityMediaName>Other</ActivityMediaName>  
  <ActivityStartDate>2005-09-27</ActivityStartDate>  
  <ProjectIdentifier>24</ProjectIdentifier>  
</ActivityDescription>  
- <MonitoringLocation>  
  <MonitoringLocationIdentifier>11362</MonitoringLocationIdentifier>  
  <MonitoringLocationName>BUTTE LA PRAIRIE AT
```

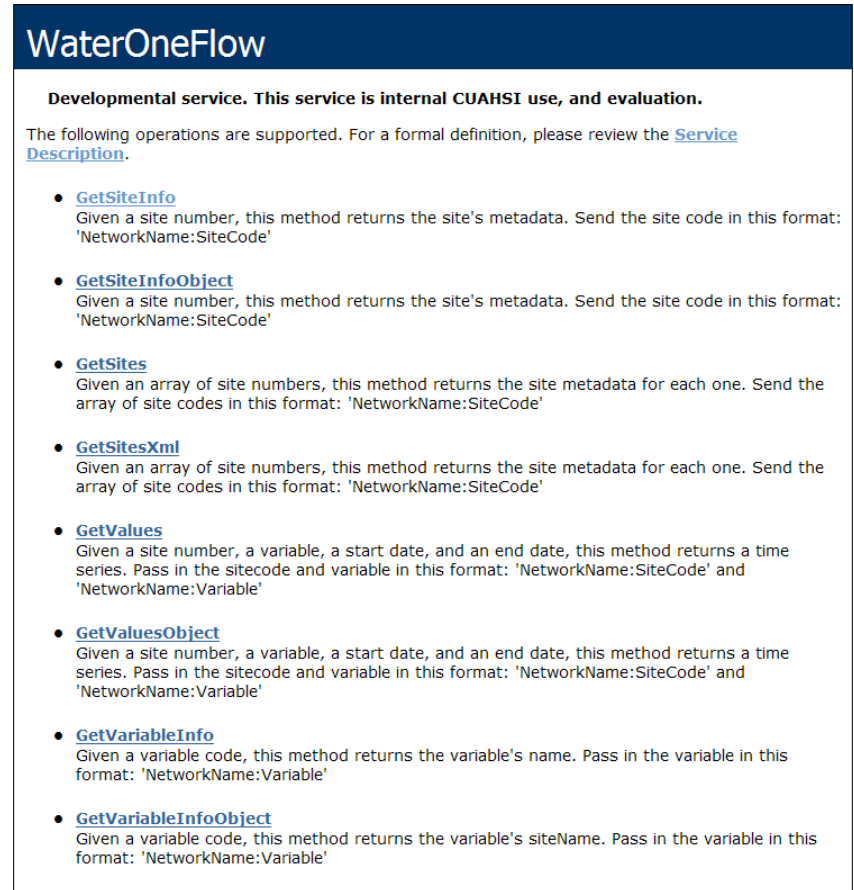
# Web Pages and Web Services

<http://www.safl.umn.edu/>



Uses Hypertext Markup Language ([HTML](#))

[http://his.safl.umn.edu/SAFLMC/cuahsi\\_1\\_0.asmx](http://his.safl.umn.edu/SAFLMC/cuahsi_1_0.asmx)



Uses [WaterML](#)  
(a Markup Language for water data)

# HTML as a Web Language

## HyperText Markup Language

## Text and Pictures in Web Browser

```
<title>Texas Water Development Board</title>
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head>
  <meta name = "Robots" content = "index,follow">
  <meta name = "Priority" content = "home,twdb,homepage">
  <meta name = "Author" content = "Texas Water Development Board, Agency
Number 580">
  <meta name = "Title" content = "Texas Water Development Board">
  <meta name = "Description" content = "Texas Water Development Board Home
Page">
  <meta name = "Keywords" content =
"water,drought,rain,conservation,groundwater,surfacewater,lake,reservoir,hydrolog
y,geology,desalination,TWDB,loans,grants,wastewater,sewage,Clean Water,Drinking
Water,State Revolving Fund,planning,State Water Plan,GIS,Geographic Information
Systems,Mapping,data">
```

**TWDB** Hot Topics News Jobs Search

To provide leadership, planning, financial assistance, information, and education for the conservation and responsible development of Water for Texas.

J. Kevin Ward, E.A.

Home About Assistance Customer Service Data Mapping Planning Publications Search

### TWDB News

#### Hot Topics

- [Request for Applications for Regional Facility Planning Grant](#) Deadline December 18, 2008
- [SRF Workshops](#)
- [Request for Applications for Flood Protection Planning Grant](#) Deadline January 22, 2009
- [Final Report - Water Demand Projections for Power Generation in Texas](#) (September 30, 2008)
- [2006 Texas Water Use Summary Estimates](#)
- [Sustainable, affordable, quality water for Texans, our economy, and our environment](#) AWWA presentation 9/22/08
- [Future Water Development in Texas](#) Transportation Summit presentation 8/13/08
- [Request for Applications for Planning and Project](#)

#### Calendar of Events: Monday, October 27, 2008

» Events for today: [TNRIS GIS Forum](#)

Presentation: 4 hour pre-conference workshop, GIS and Floodplain Management

[Troubleshooting and Problem Solving in Membrane Treatment Facilities: Tools, Tactics, and Techniques](#)

Presentation: Hosted by the South Central Membrane Association

Place: Austin, TX

[2008 Annual Conference & Membership Meeting](#)

Training: "Troubleshooting in & Problem Solving in Membrane

S	M	T	W	T	F	S
		1	2	3	4	
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

\*To view full month of events, click [here](#).

\*\*To add or edit events, click [here](#).

# WaterML as a Web Language

Streamflow data in WaterML language

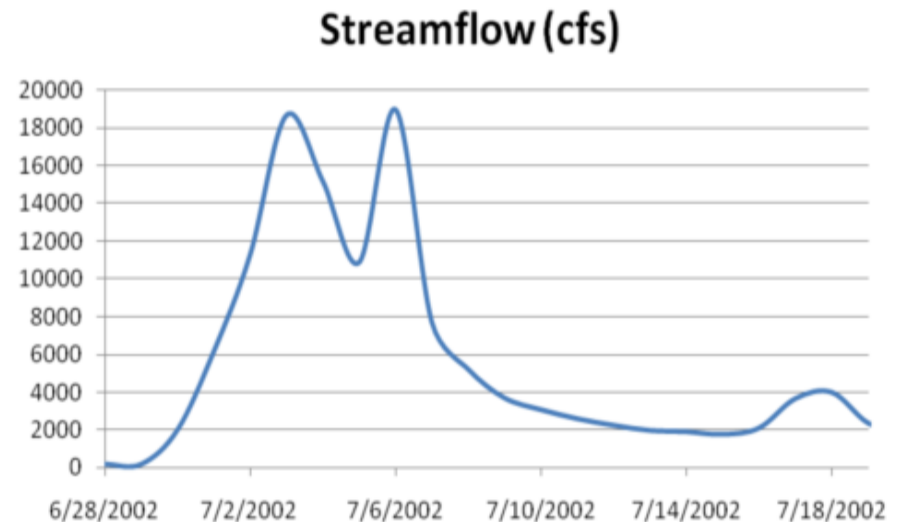
Discharge of the San Marcos River at Luling, June 28 - July 18, 2002

```
<values count="21">
```

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<value qualifiers="A" dateTime="2002-06-30T00:00:00">2010</value>
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<value qualifiers="A" dateTime="2002-07-18T00:00:00">4010</value>
```

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```

```
</values>
```



# WaterML includes location, variables, and time series

```
<timeSeriesResponse xmlns:gml="http://www.opengis.net/gml" xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:wtr="http://www.cuahsi.org/waterML/"
  xmlns="http://www.cuahsi.org/waterML/1.0/">
```

```
<queryInfo>...
<timeSeries>
```

```
<sourceInfo xsi:type="SiteInfoType">
  <siteName>Colorado Rv at Austin, TX</siteName>
  <siteCode siteID="1389">08158000</siteCode>
  <timeZoneInfo>...
  <geoLocation>...
  <note>Agency:USGS</note>
</sourceInfo>
```

location

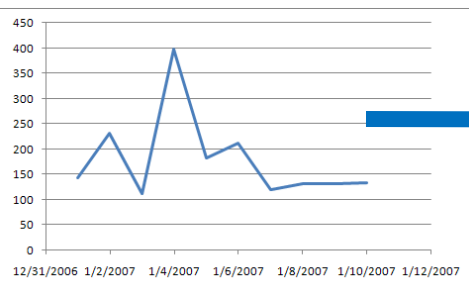
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  <variableCode vocabulary="USGS">00060</variableCode>
  <variableName>Discharge</variableName>
  <dataType>Average</dataType>
  <units>cfs</units>
  <options>...
</variable>
```

variable

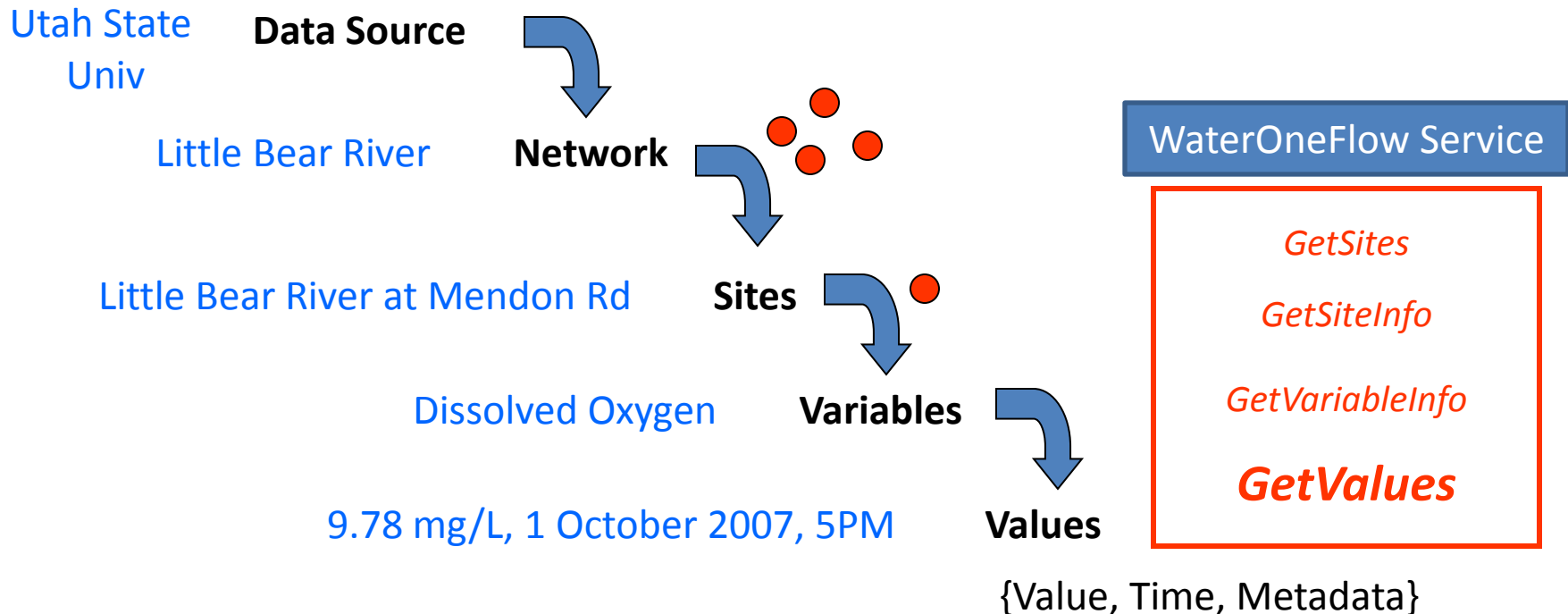
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  <value qualifiers="A" dateTime="2007-01-02T00:00:00">231</value>
  <value qualifiers="A" dateTime="2007-01-03T00:00:00">112</value>
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```

time series

```
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</timeSeriesResponse>
```



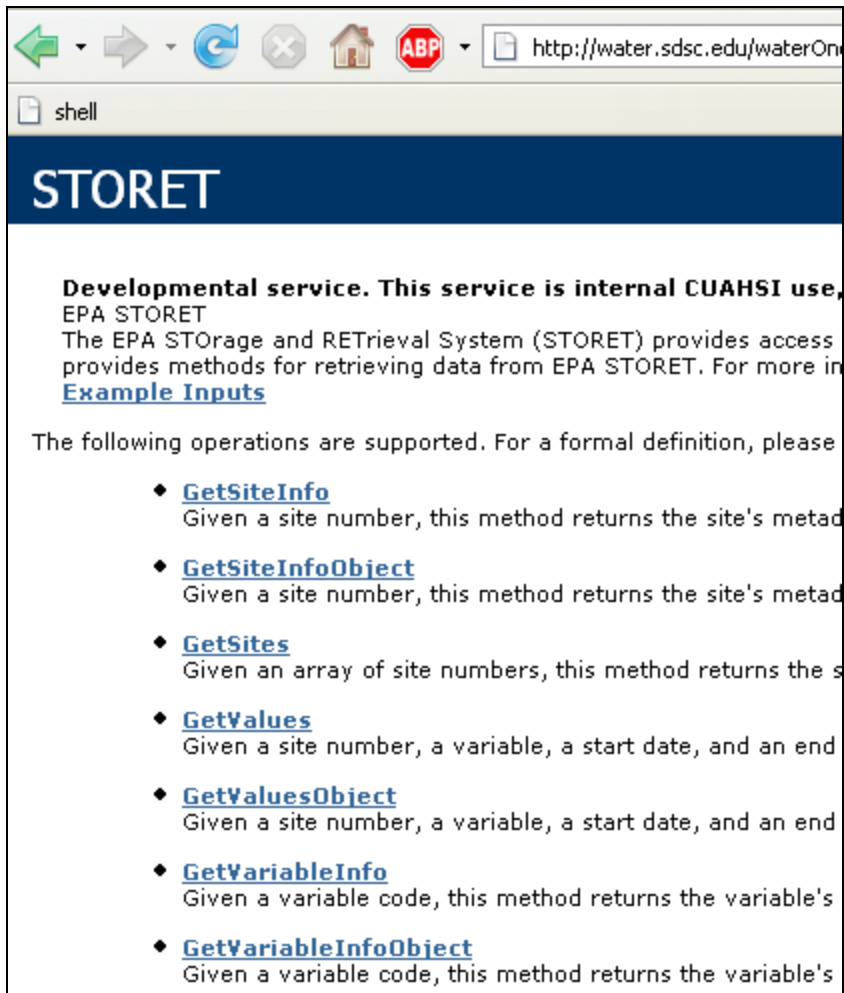
# Point Observations Information Model



- A **data source** operates an observation network
- A **network** is a set of observation sites
- A **site** is a point location where one or more variables are measured
- A **variable** is a property describing the flow or quality of water
- A **value** is an observation of a variable at a particular time
- **Metadata** provide additional information about the value

# WaterOneFlow

- Set of **query** functions
- Returns data in **WaterML**

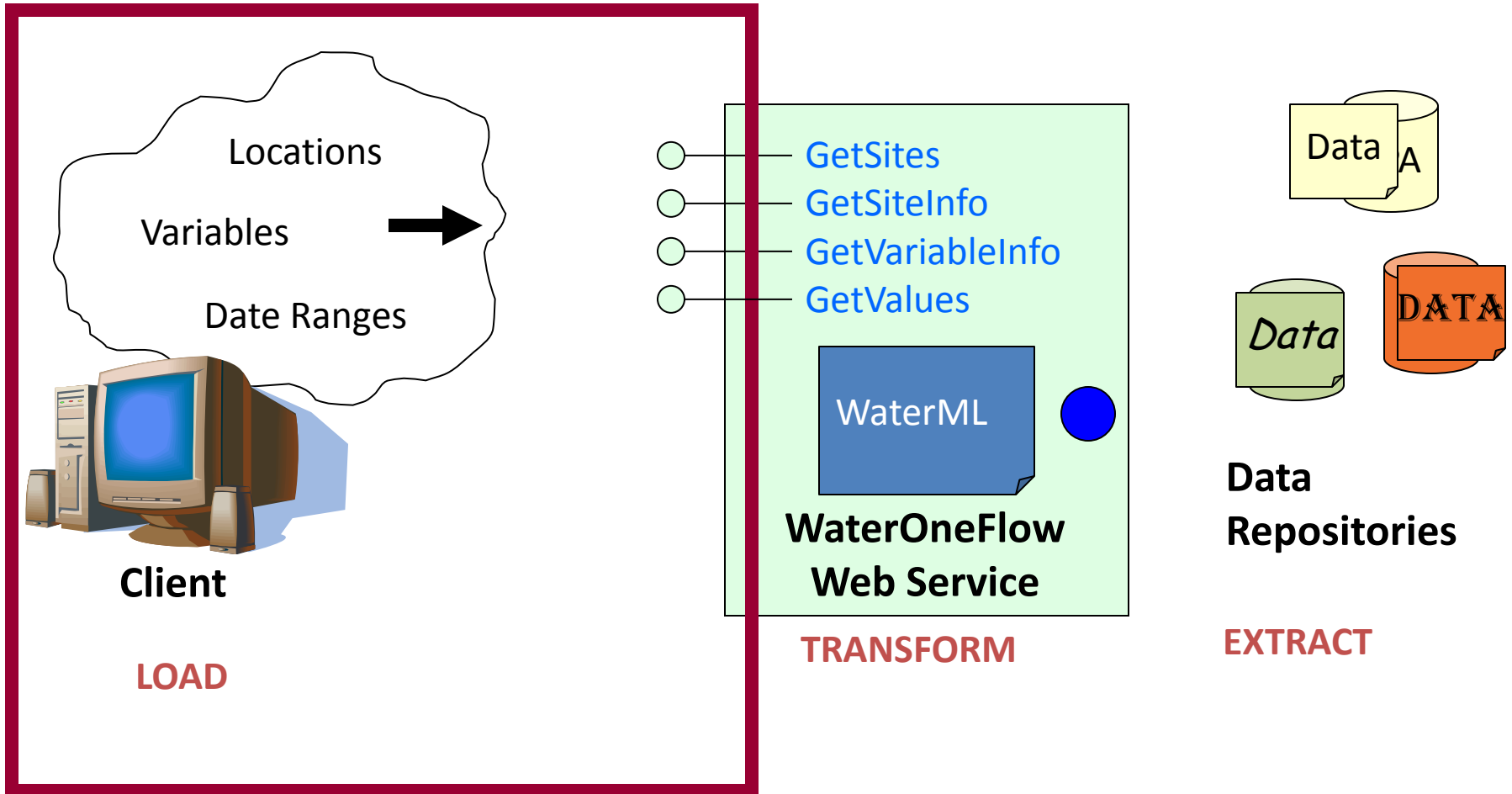


The screenshot shows a web browser window with the URL <http://water.sdsc.edu/waterOneFlow>. The page title is "STORET". Below the title, there is a description: "Developmental service. This service is internal CUAHSI use, EPA STORET. The EPA STORAGE and RETRIEVAL SYSTEM (STORET) provides access to EPA STORET. For more information, see [Example Inputs](#)." Below this, it states "The following operations are supported. For a formal definition, please see the [STORET User Manual](#)." A list of supported operations follows:

- ◆ [GetSiteInfo](#)  
Given a site number, this method returns the site's metadata.
- ◆ [GetSiteInfoObject](#)  
Given a site number, this method returns the site's metadata as an object.
- ◆ [GetSites](#)  
Given an array of site numbers, this method returns the site's metadata.
- ◆ [GetValues](#)  
Given a site number, a variable, a start date, and an end date, this method returns the variable's values.
- ◆ [GetValuesObject](#)  
Given a site number, a variable, a start date, and an end date, this method returns the variable's values as an object.
- ◆ [GetVariableInfo](#)  
Given a variable code, this method returns the variable's metadata.
- ◆ [GetVariableInfoObject](#)  
Given a variable code, this method returns the variable's metadata as an object.

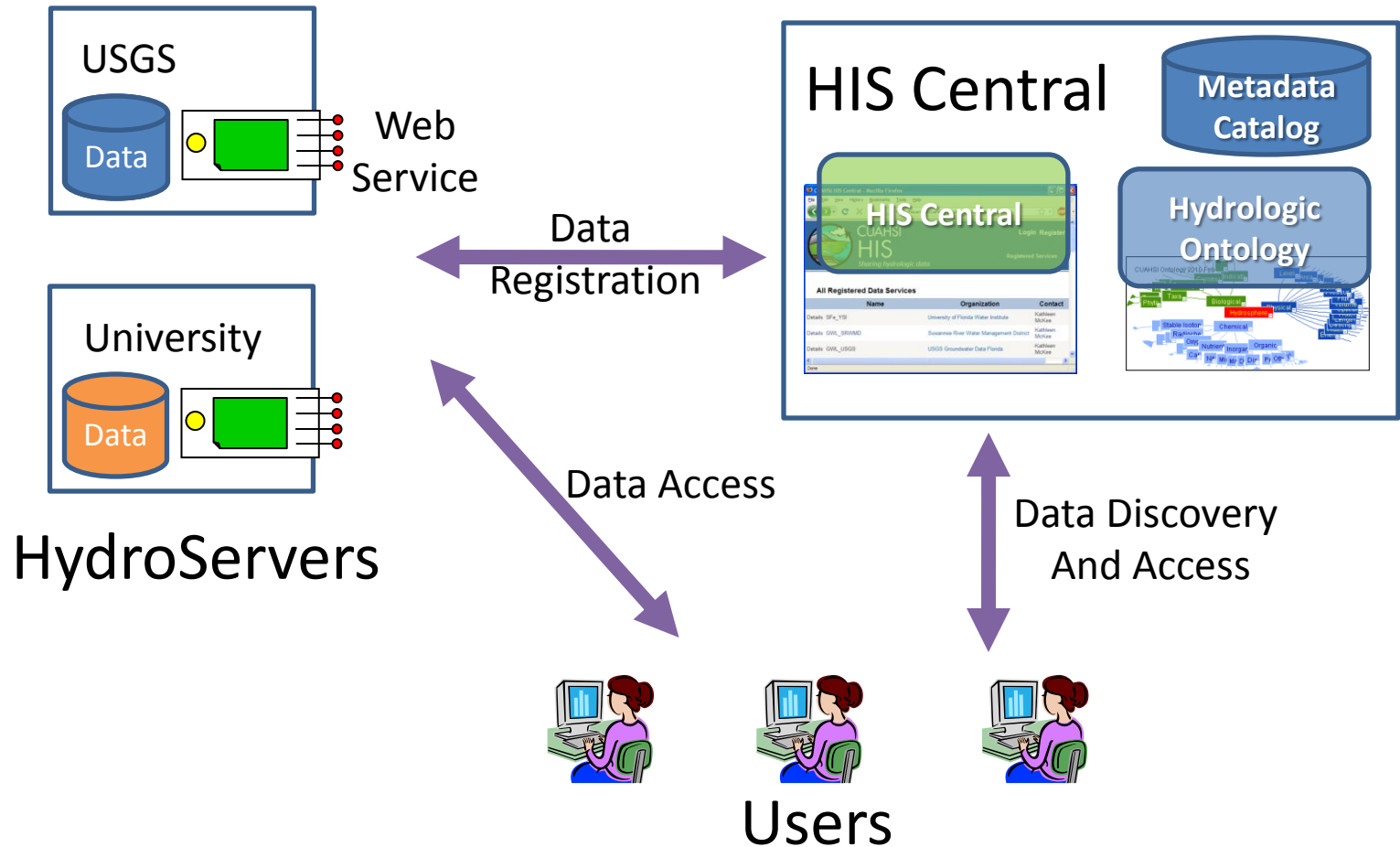
```
<timeSeries>
- <sourceInfo xsi:type="SiteInfoType">
  <siteName>Colorado Rv at Austin, TX</siteName>
  <siteCode network="NWIS" siteID="4619631">08158000</siteCode>
- <geoLocation>
  - <geogLocation xsi:type="LatLonPointType" srs="EPSG:4326">
    <latitude>30.24465429</latitude>
    <longitude>-97.694448</longitude>
  </geogLocation>
  </geoLocation>
</sourceInfo>
- <variable>
  <variableCode vocabulary="NWIS" default="true" variableName="Discharge, cubic feet per second" unitsAbbreviation="cfs" unitsCode="35">cubic feet per second</variableCode>
</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>
  <value dateTime="2006-12-31T02:15:00">124</value>
  <value dateTime="2006-12-31T02:30:00">124</value>
  <value dateTime="2006-12-31T02:45:00">122</value>
```

# WaterML and WaterOneFlow



**WaterML** is an XML language for communicating water data  
**WaterOneFlow** is a set of web services based on WaterML

# HIS System – HydroServer



# HydroServer Goals

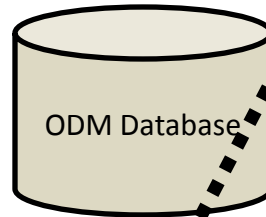
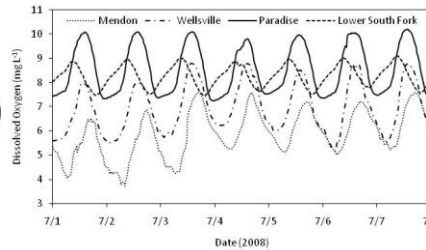
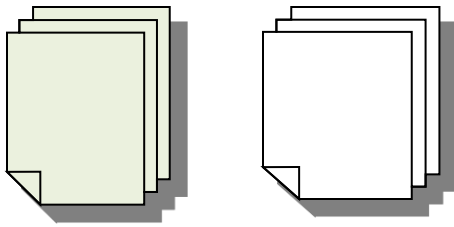
- A platform for publishing space-time hydrologic datasets that:
  - Provides local control of data
  - Makes data universally available
  - Is open source ([hydroserver.codeplex.com](http://hydroserver.codeplex.com))

# Point Observations Data

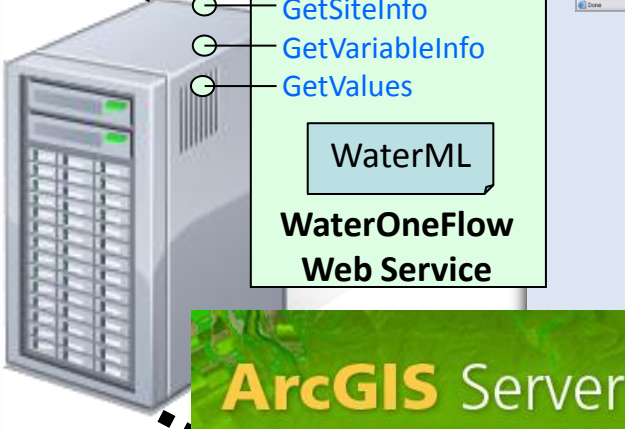
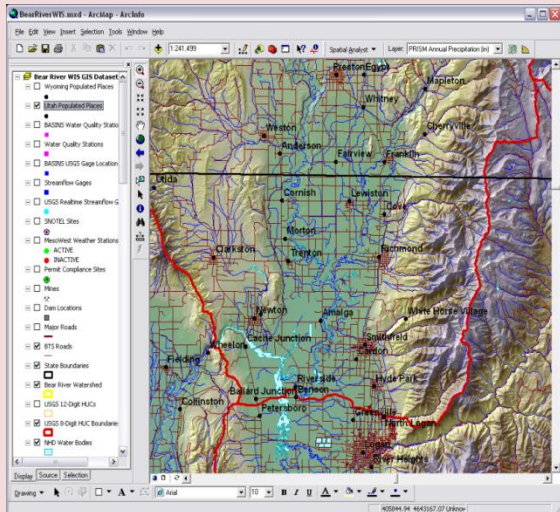
## Ongoing Data Collection



## Historical Data Files



## GIS Data



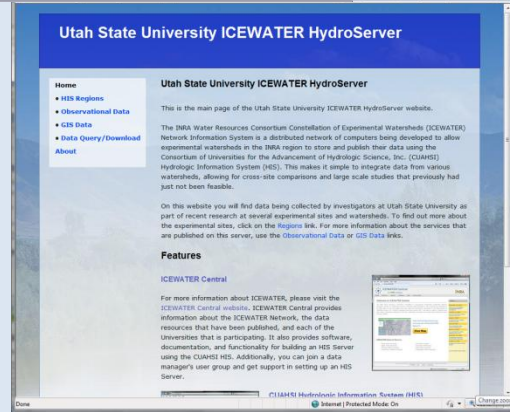
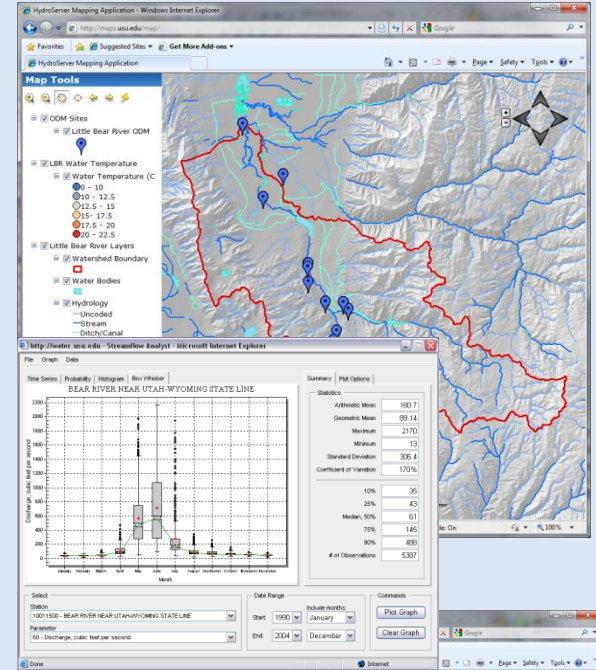
## HydroServer

- GetSites
- GetSiteInfo
- GetVariableInfo
- GetValues

WaterML

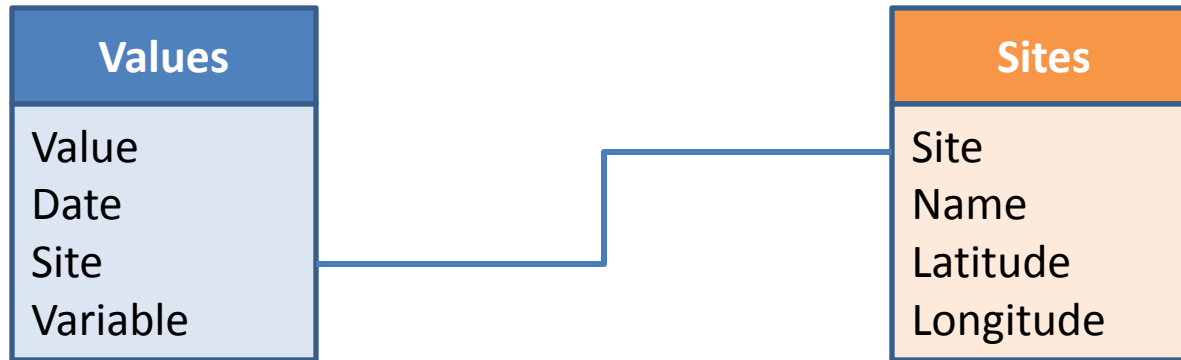
WaterOneFlow  
Web Service

# Internet Applications



Data presentation, visualization, and analysis through Internet enabled applications

# Data Storage – Relational Database

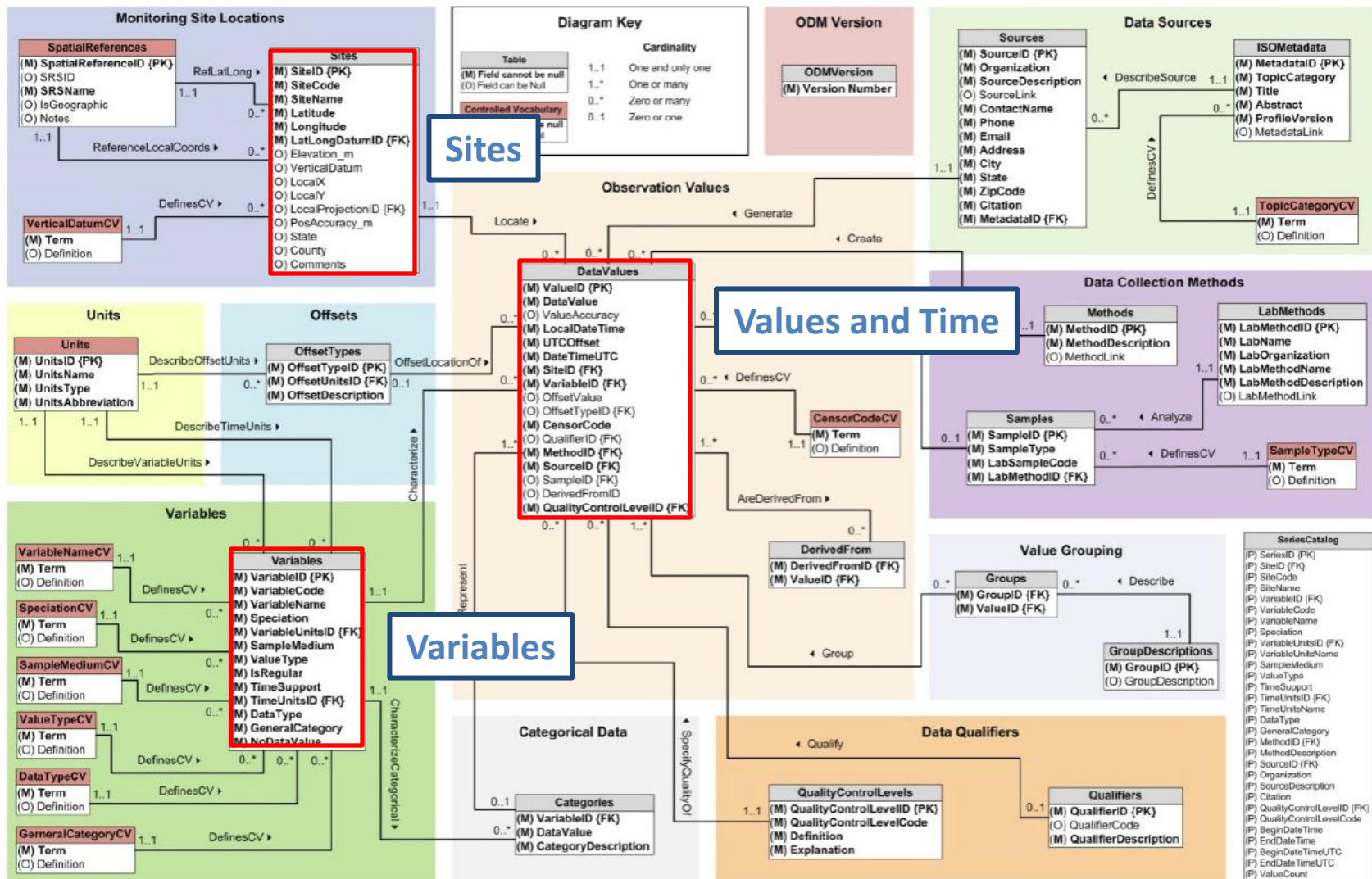


Value	Date	Site	Variable
4.5	3/3/2007	1	Streamflow
4.2	3/4/2007	1	Streamflow
33	3/3/2007	2	Temperature
34	3/4/2007	2	Temperature

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

Simple Intro to “What Is a Relational Database”

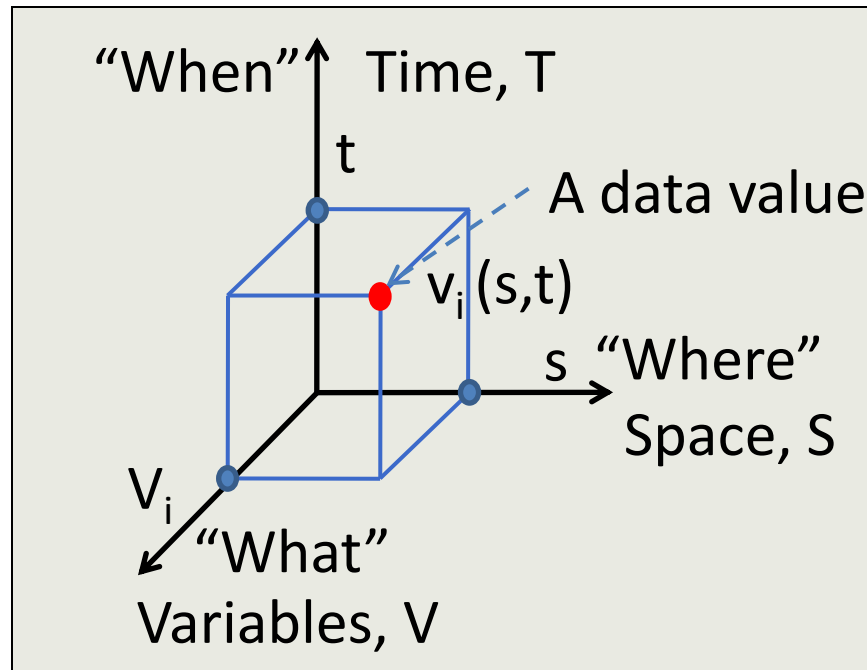
# Observations Data Model



Horsburgh, J. S., D. G. Tarboton, D. R. Maidment and I. Zaslavsky, (2008), "A Relational Model for Environmental and Water Resources Data," Water Resour. Res., 44: W05406, doi:10.1029/2007WR006392.

# Observations Data Model (ODM)

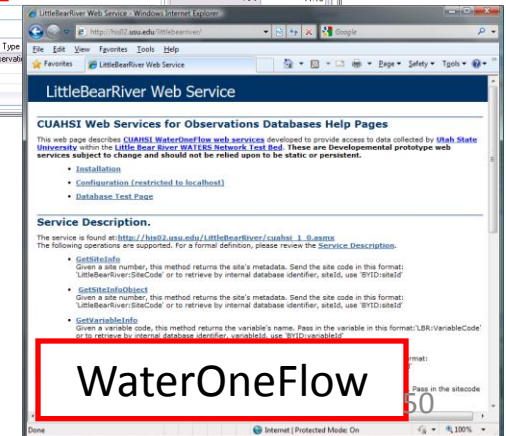
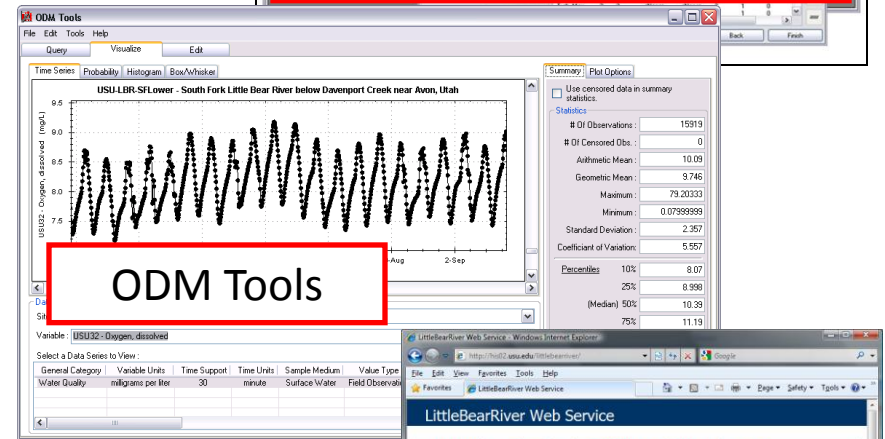
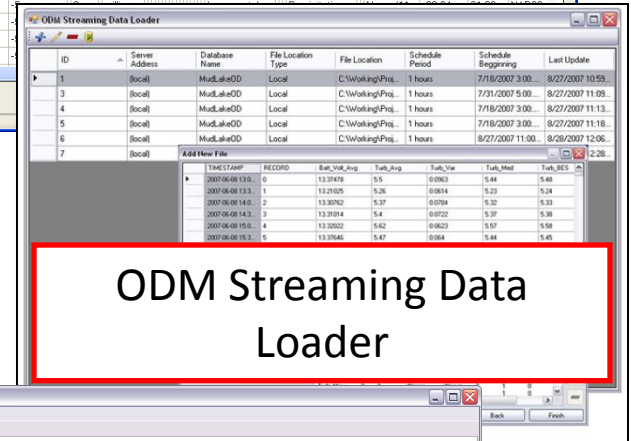
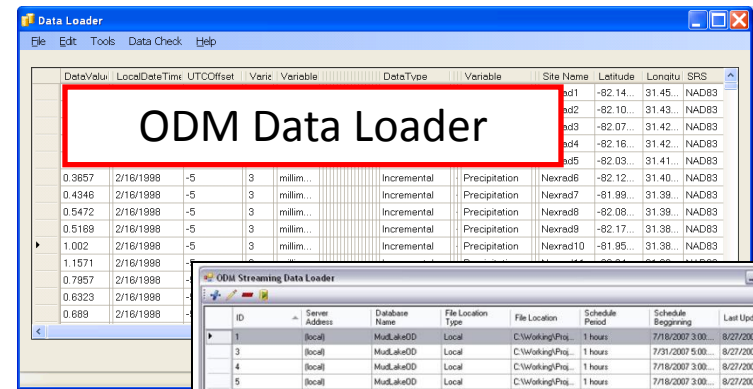
A Relational Model at the Single Observation Level



- **Observations** 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

# Publication of Point Observations Data

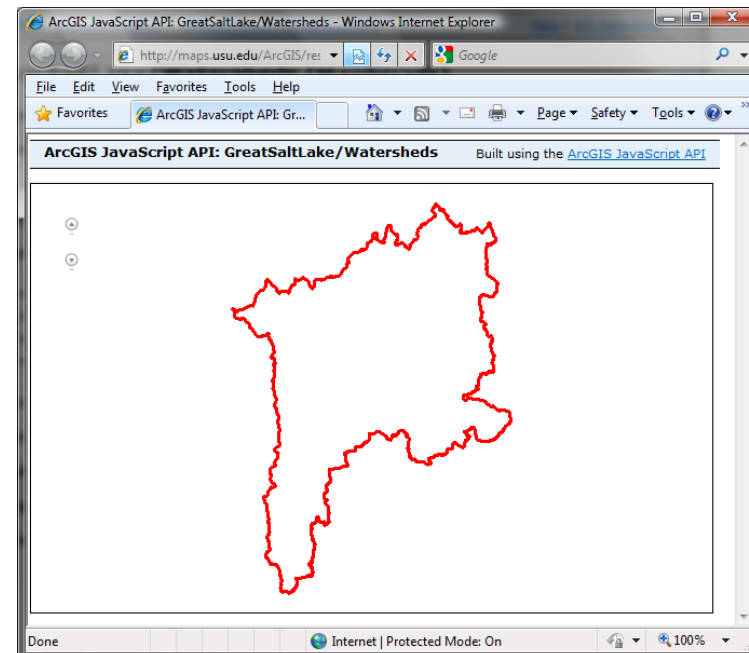
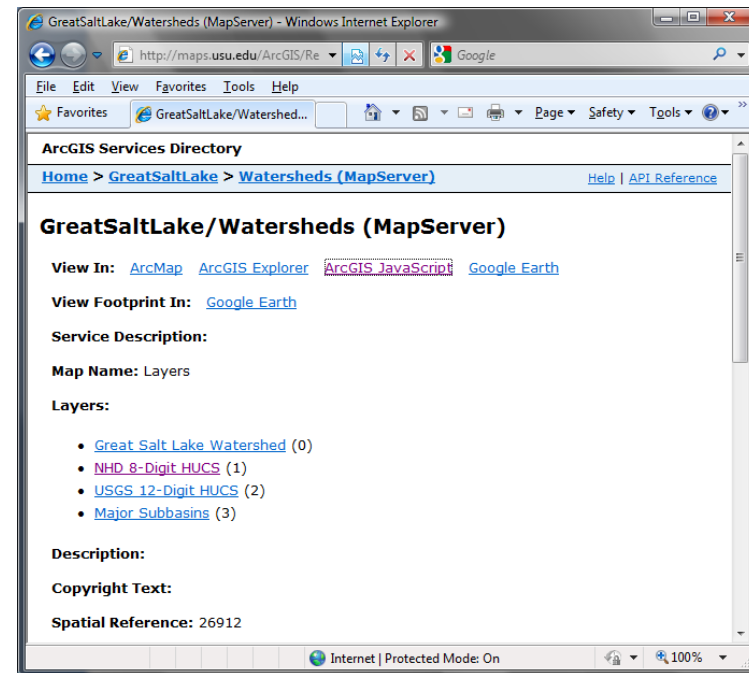
- Loading Data into ODM Databases
  - ODM Data Loader
  - ODM Streaming Data Loader
- Editing and managing data
  - ODM Tools
- Implementation of WaterOneFlow Web Services



Tools available at: <http://his.cuahsi.org>

# Publication of Spatial (GIS) Datasets

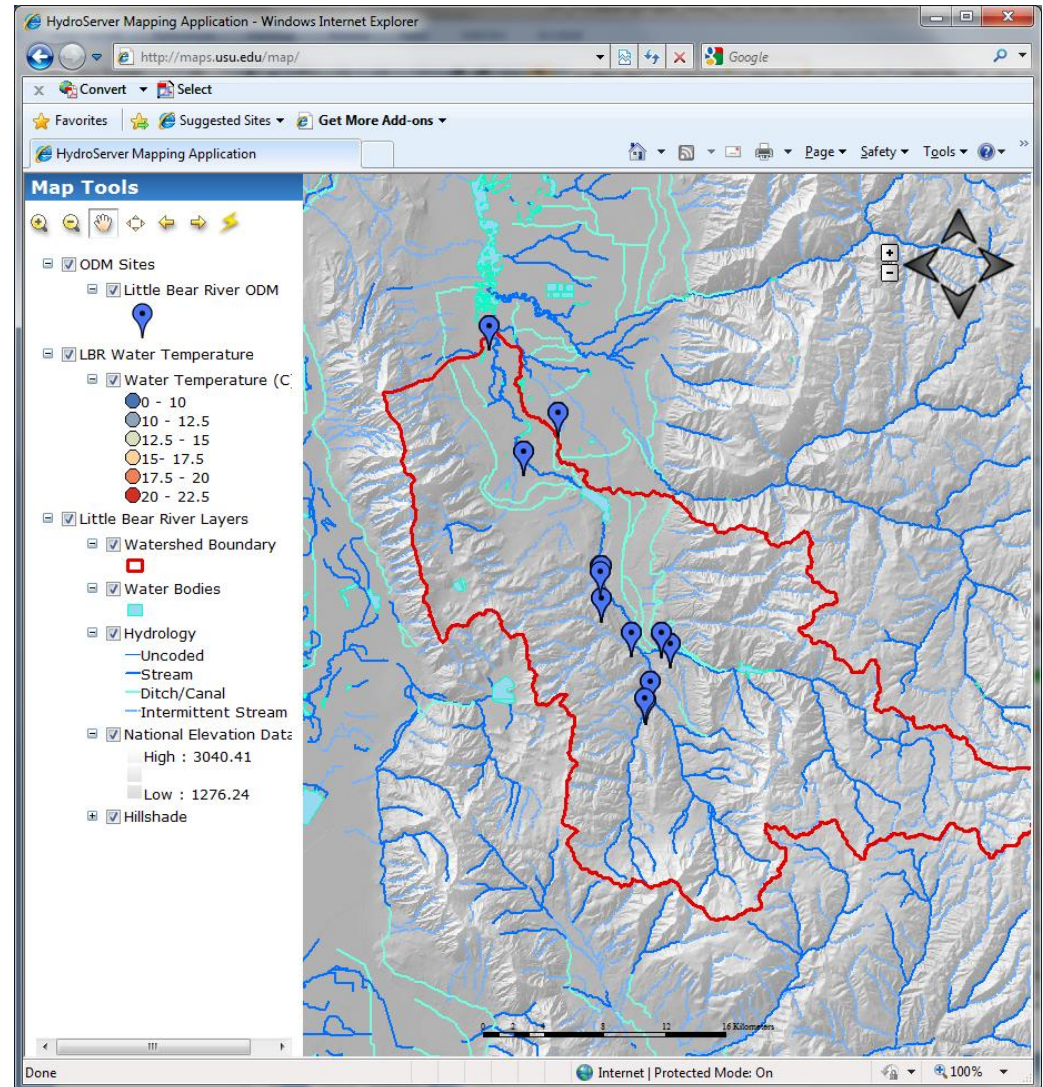
- Publishing spatial datasets using ArcGIS Server
  - Using OGC standards that can be consumed by a number of GIS clients
  - WMS, WFS, WCS



# 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

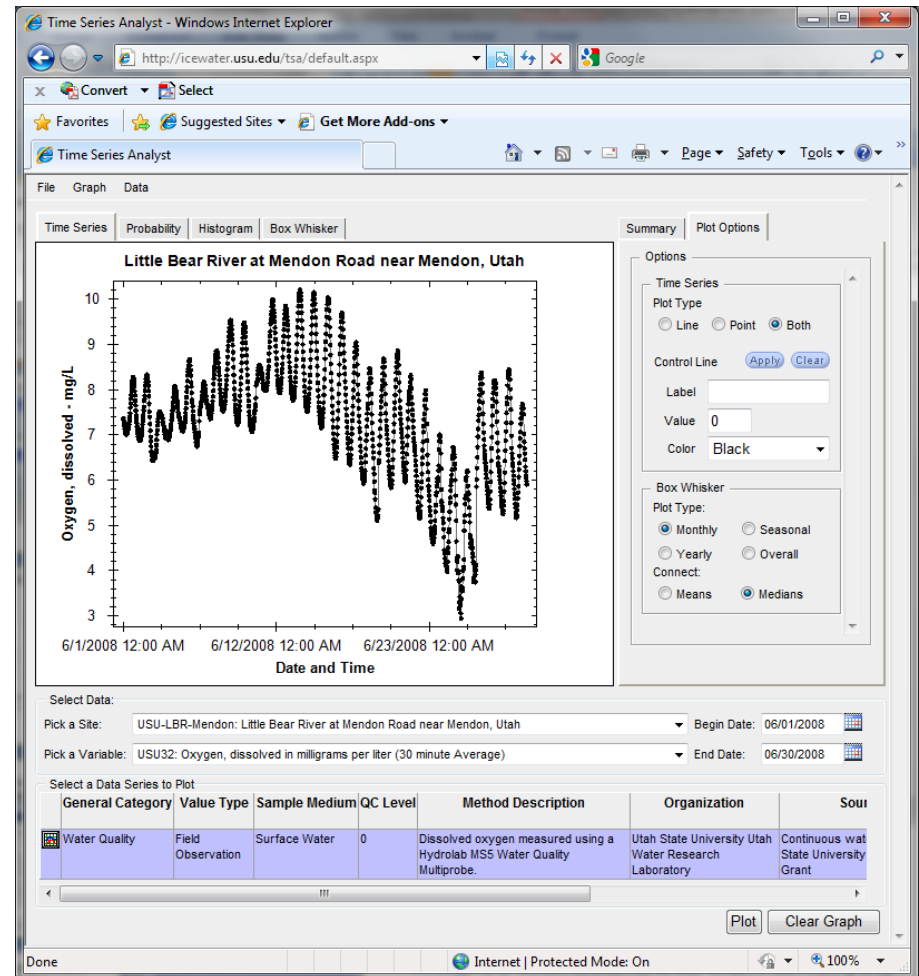
<http://maps.usu.edu/map/>



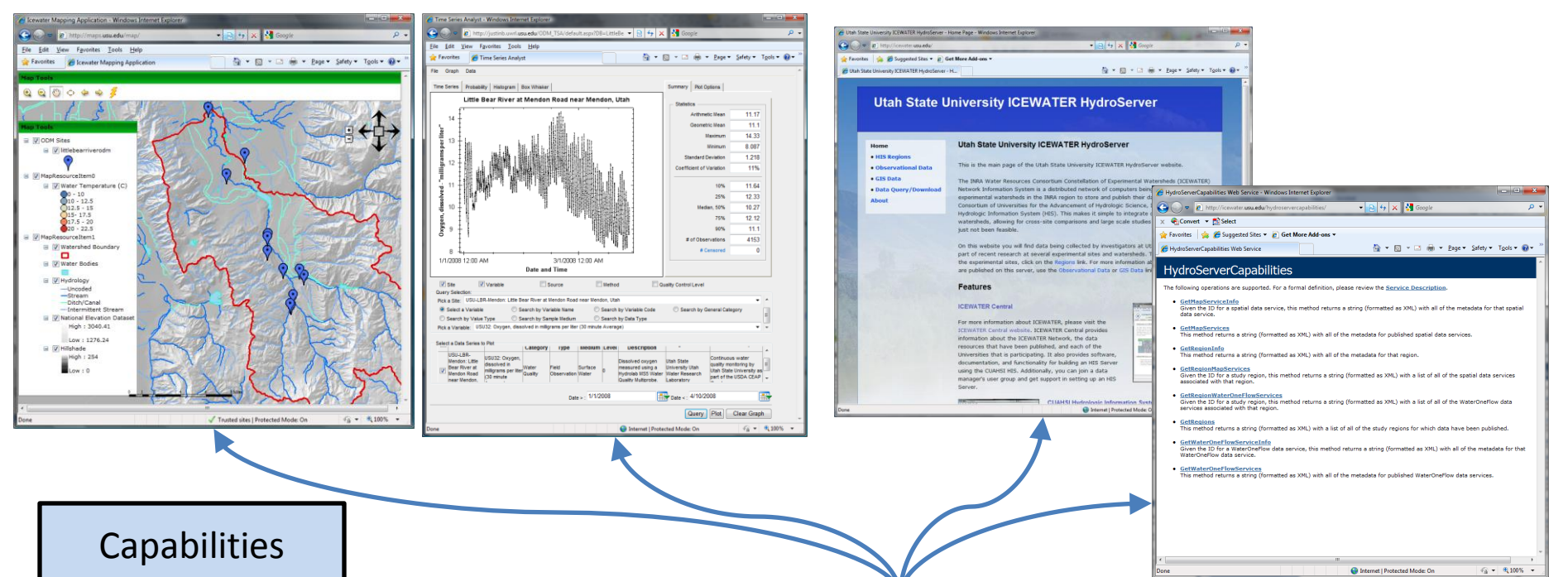
# Data Preview, Visualization, and Analysis

## Time Series Analyst

- Web browser client
- Descriptive statistics
- Linked to the map application
- Data preview and download



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



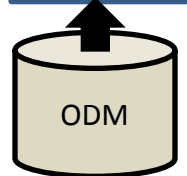
Capabilities  
Database  
Configuration  
Tool

WaterOneFlow  
Services

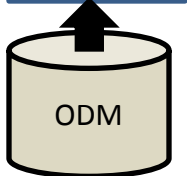
HydroServer  
Capabilities  
Database

Spatial  
Services

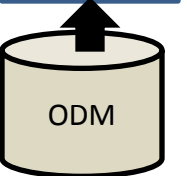
WaterOneFlow



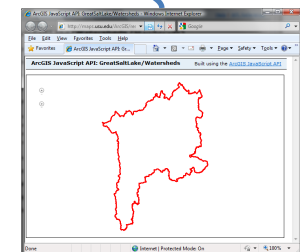
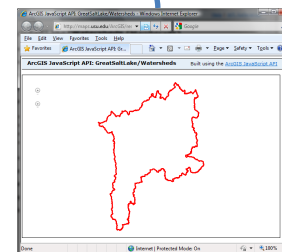
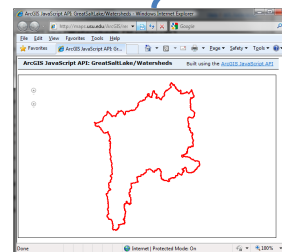
WaterOneFlow



WaterOneFlow



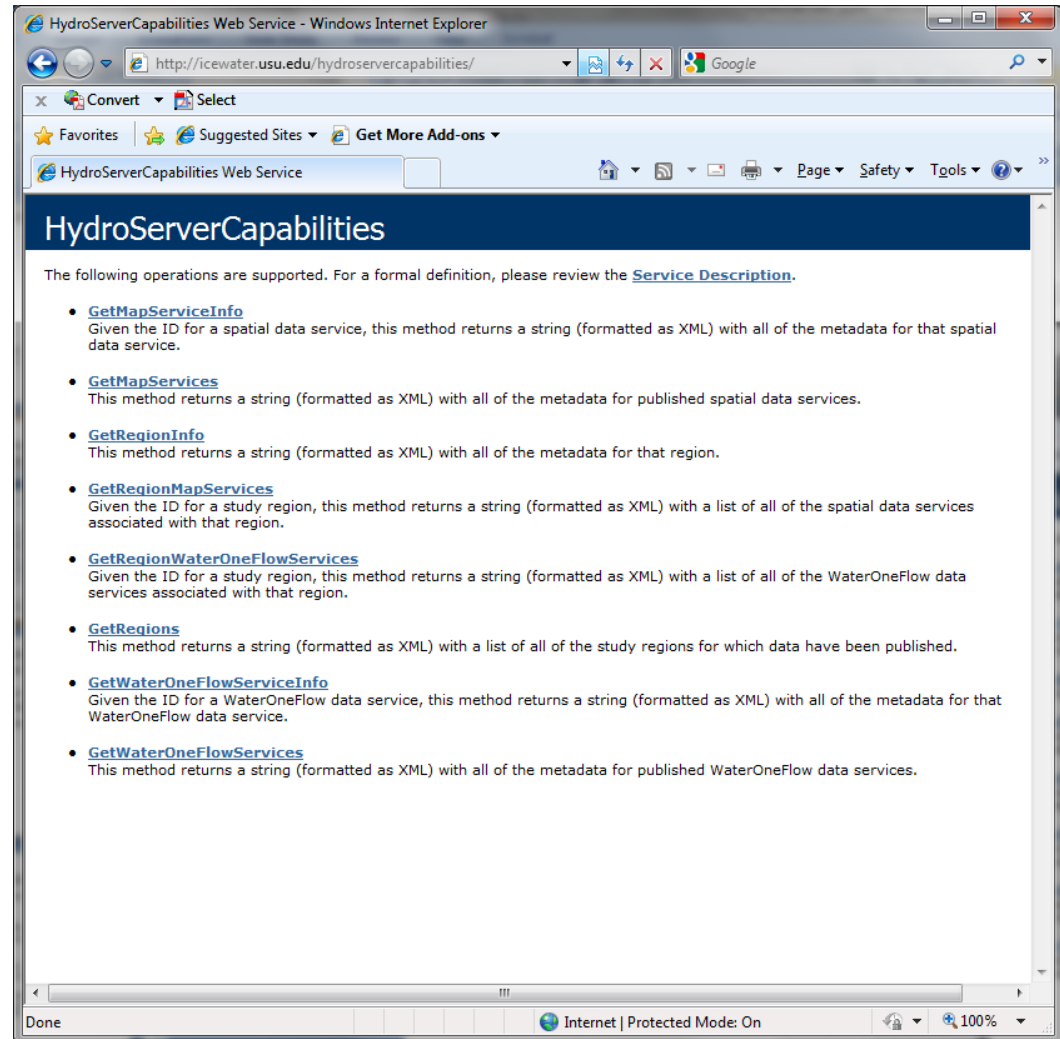
ODM Databases and Web Services



ArcGIS Server Spatial Data Services

# HydroServer Capabilities Web Service

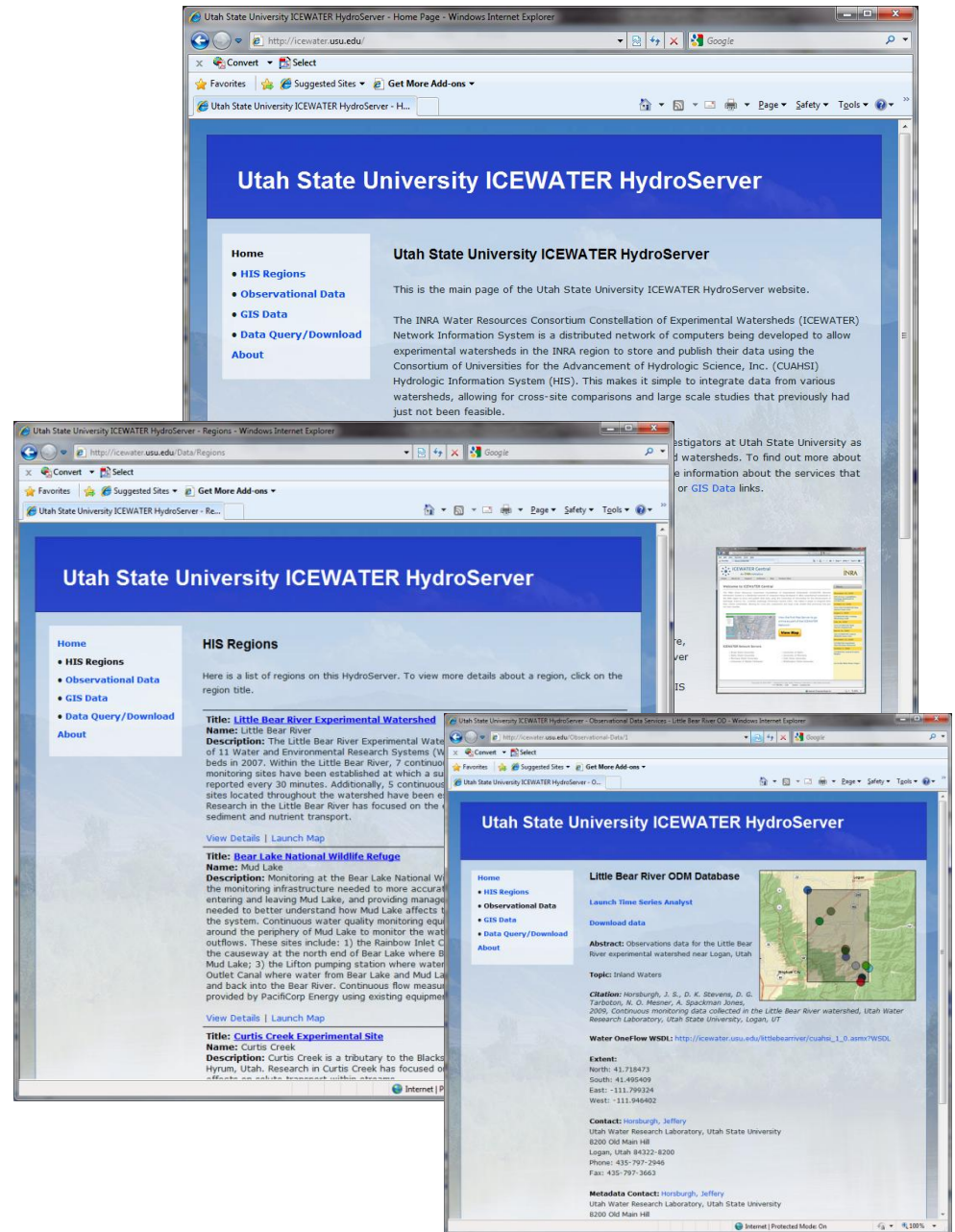
- Publish capabilities of each HydroServer
  - Published observational data services
  - Published spatial data services
  - Information transmitted in XML format
- **Makes HydroServers self describing**

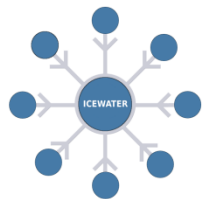


# HydroServer Website

- HydroServer home page
- Observational data services
- GIS data services
- Online map
- Time Series Analyst
- Data Query and Download

<http://icewater.usu.edu>

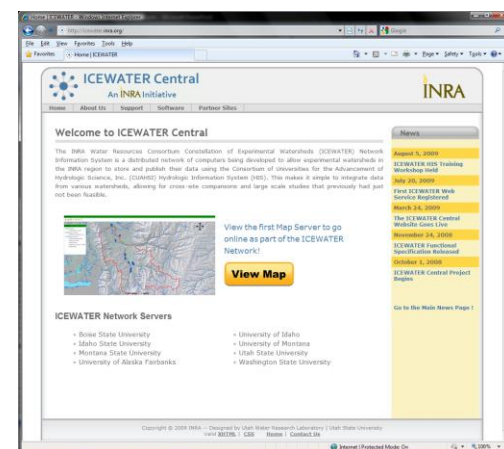
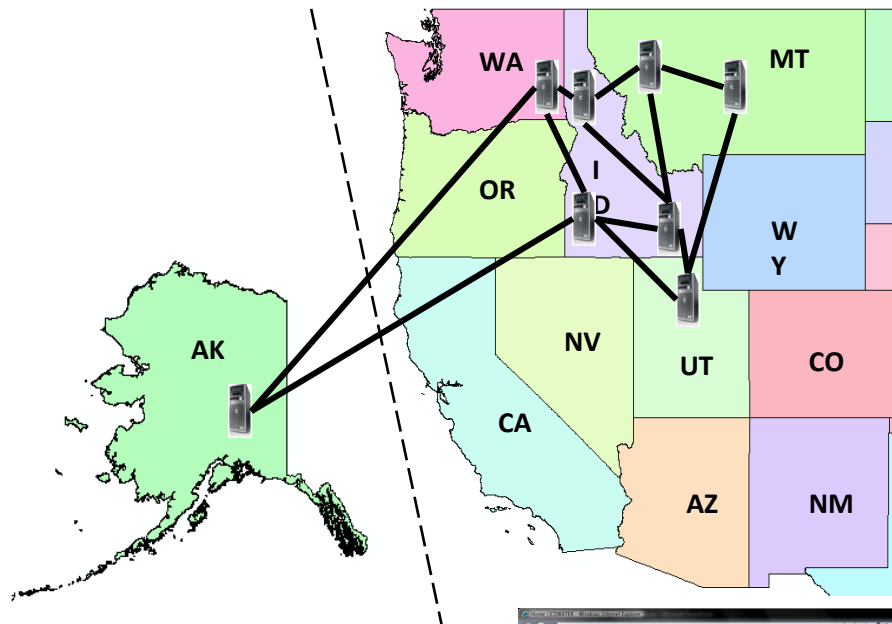




# ICEWATER – A Regional HIS



- **ICEWATER – INRA**  
Constellation of  
**Experimental WATERsheds**
- Coalition of 8 universities
- Point Observations
  - Stream gages
  - Water quality sampling
  - Weather stations
  - Soil moisture
  - Snow monitoring
  - Groundwater level/quality
- Spatially Distributed Data
  - Land use/cover
  - Terrain
  - Hydrography

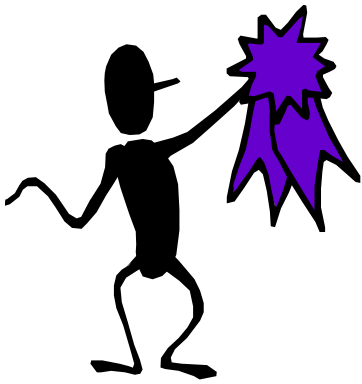


<http://icewater.inra.org>

# How Do I Create a HydroServer?

1. Get a Windows Server Machine with IIS and .NET Framework
2. Install Microsoft SQL Server
3. Install FREE HydroServer software from <http://hydroserver.codeplex.com/>
  - Database
  - WaterOneFlow
  - Website
4. Install ESRI ArcGIS Server
5. Create Services and Document them in Capabilities database

# Why Publish Data with HIS



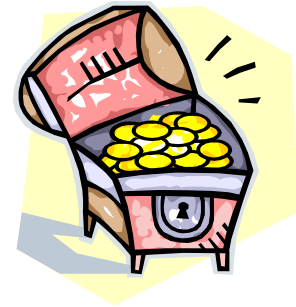
Recognition



Collaboration

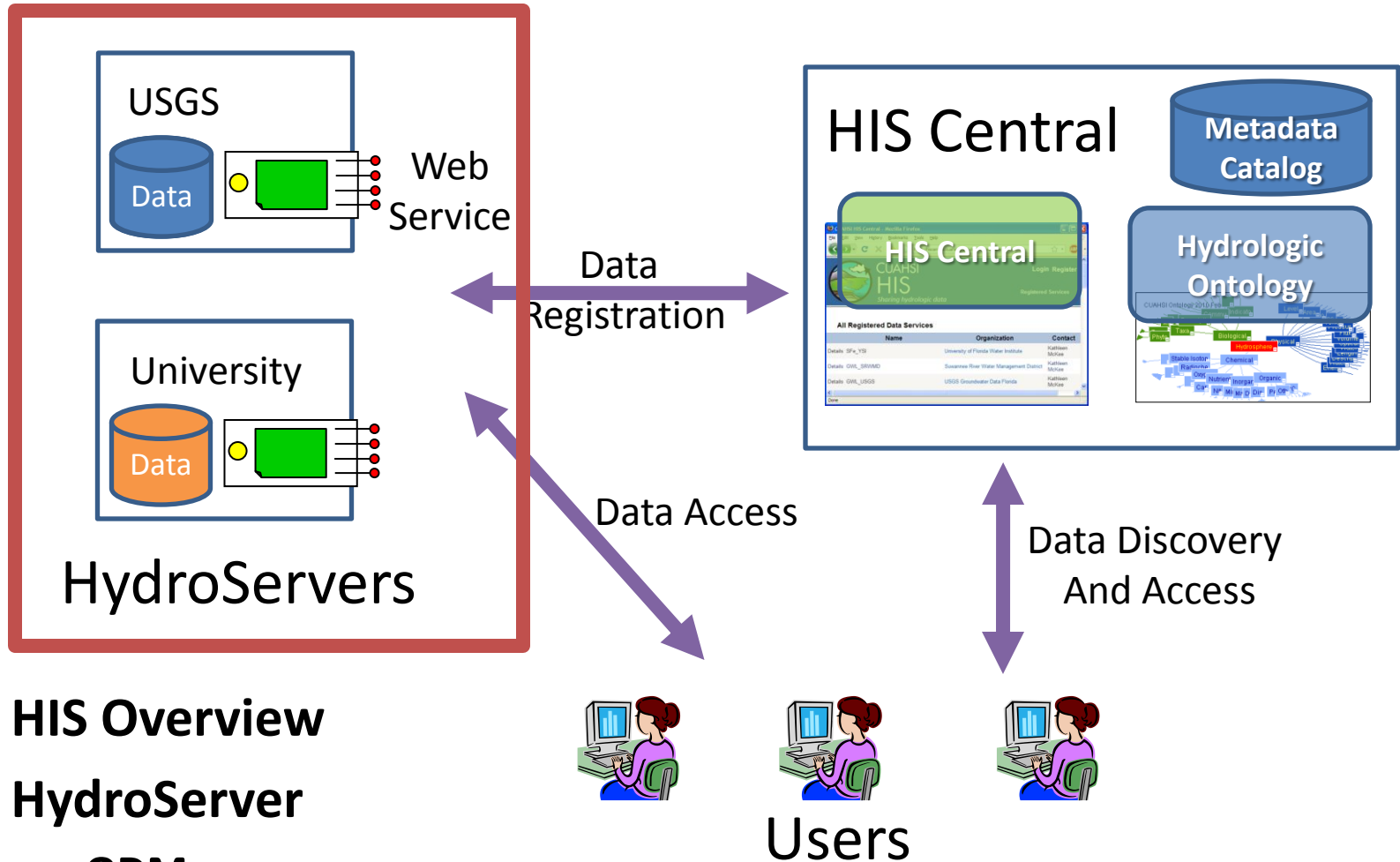


Public service



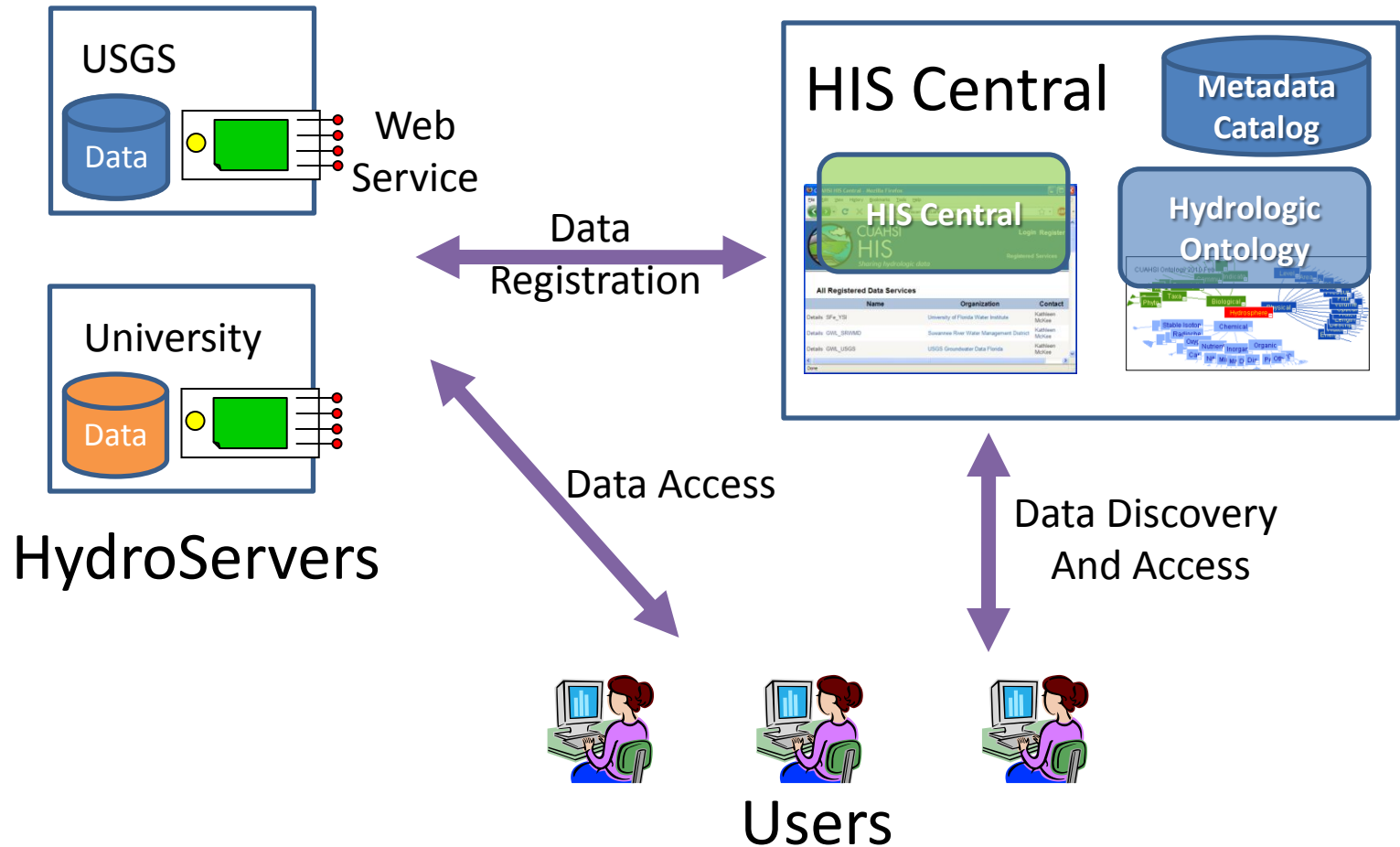
Cost savings

# What Have We Covered



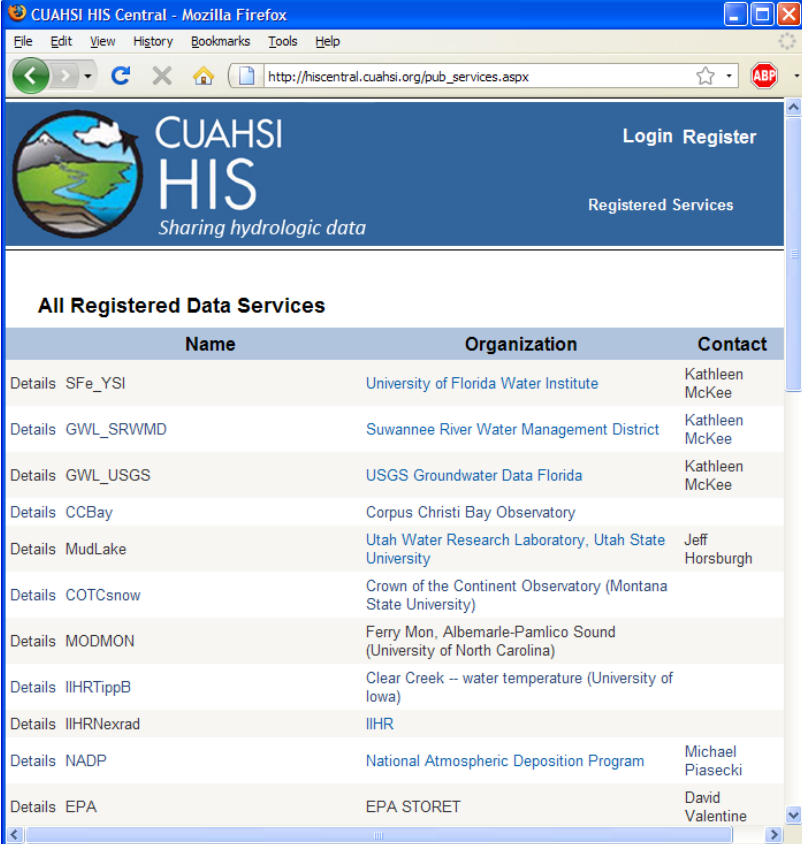
- **HIS Overview**
- **HydroServer**
  - ODM
  - WaterML

# HIS System – HIS Central



# HIS Central

- Publishers
  - Register a data service
- Users
  - Find a data service
- Supported by
  - Metadata Catalog
  - Hydrologic Ontology



CUAHSI HIS Central - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://hiscentral.cuahsi.org/pub\_services.aspx

CUAHSI HIS  
Sharing hydrologic data

Login Register

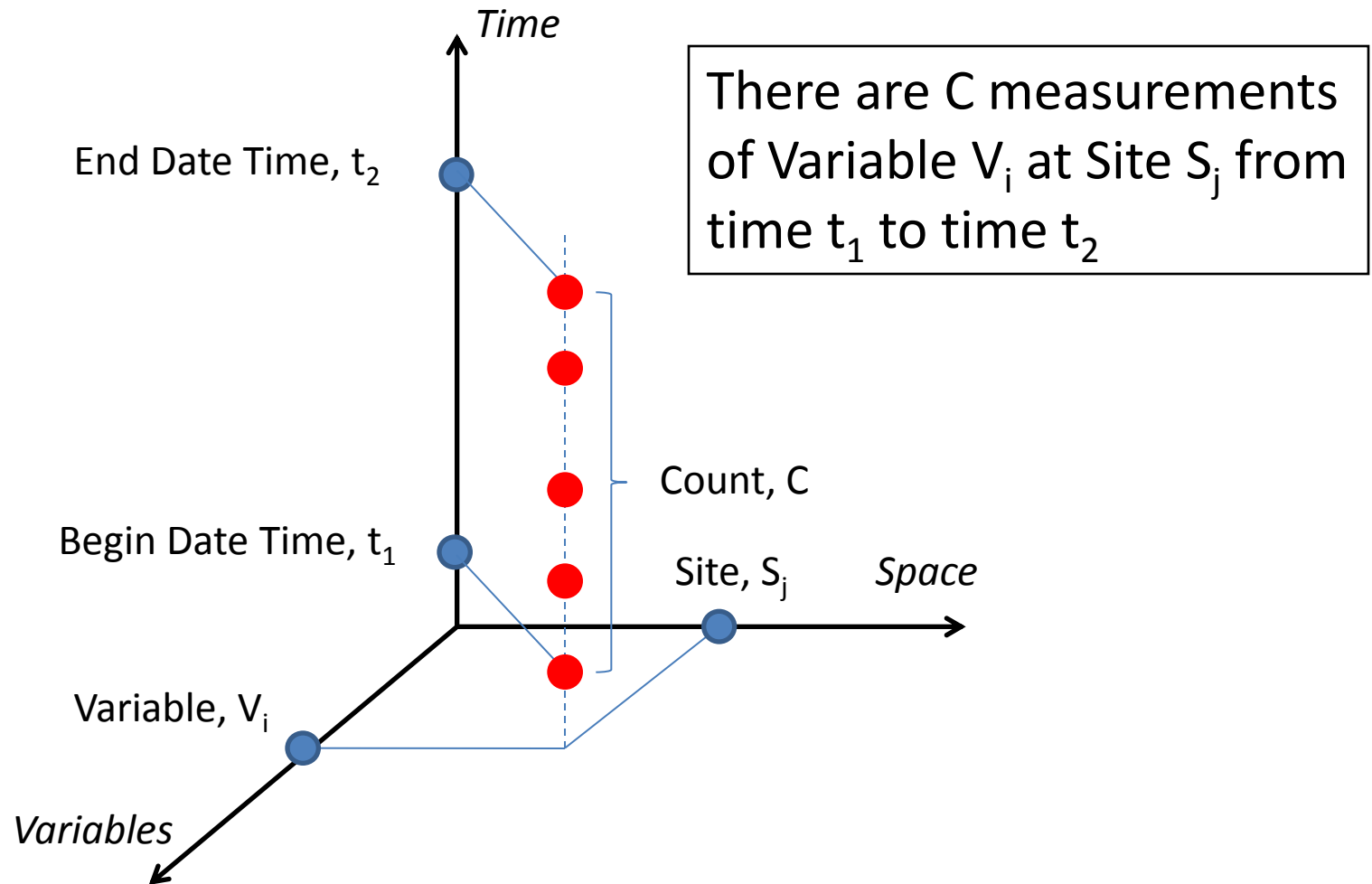
Registered Services

**All Registered Data Services**

Name	Organization	Contact
Details SFe_YSI	University of Florida Water Institute	Kathleen McKee
Details GWL_SRWMD	Suwannee River Water Management District	Kathleen McKee
Details GWL_USGS	USGS Groundwater Data Florida	Kathleen McKee
Details CCBay	Corpus Christi Bay Observatory	
Details MudLake	Utah Water Research Laboratory, Utah State University	Jeff Horsburgh
Details COTCsnow	Crown of the Continent Observatory (Montana State University)	
Details MODMON	Ferry Mon, Albemarle-Pamlico Sound (University of North Carolina)	
Details IIHRTippB	Clear Creek -- water temperature (University of Iowa)	
Details IIHRNexrad	IIHR	
Details NADP	National Atmospheric Deposition Program	Michael Piasecki
Details EPA	EPA STORET	David Valentine

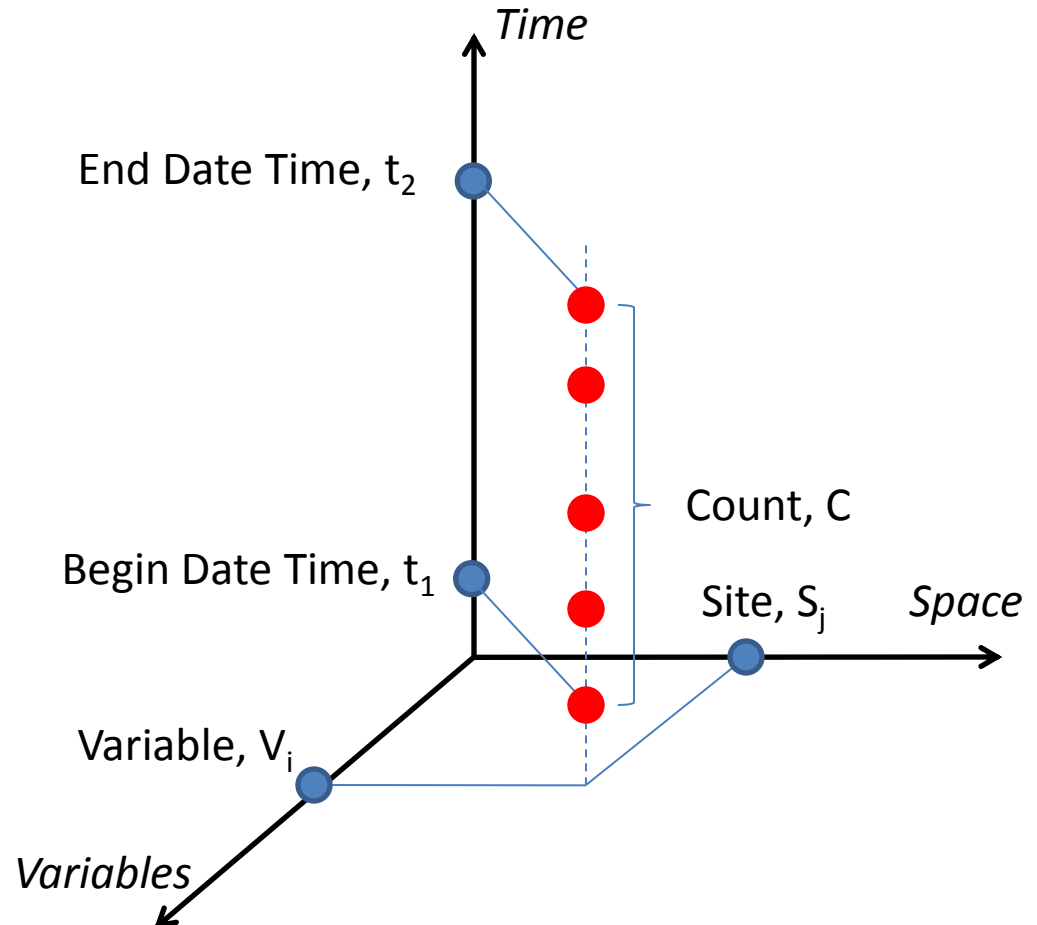
<http://hiscentral.cuahsi.org>

# Data Series – Metadata description

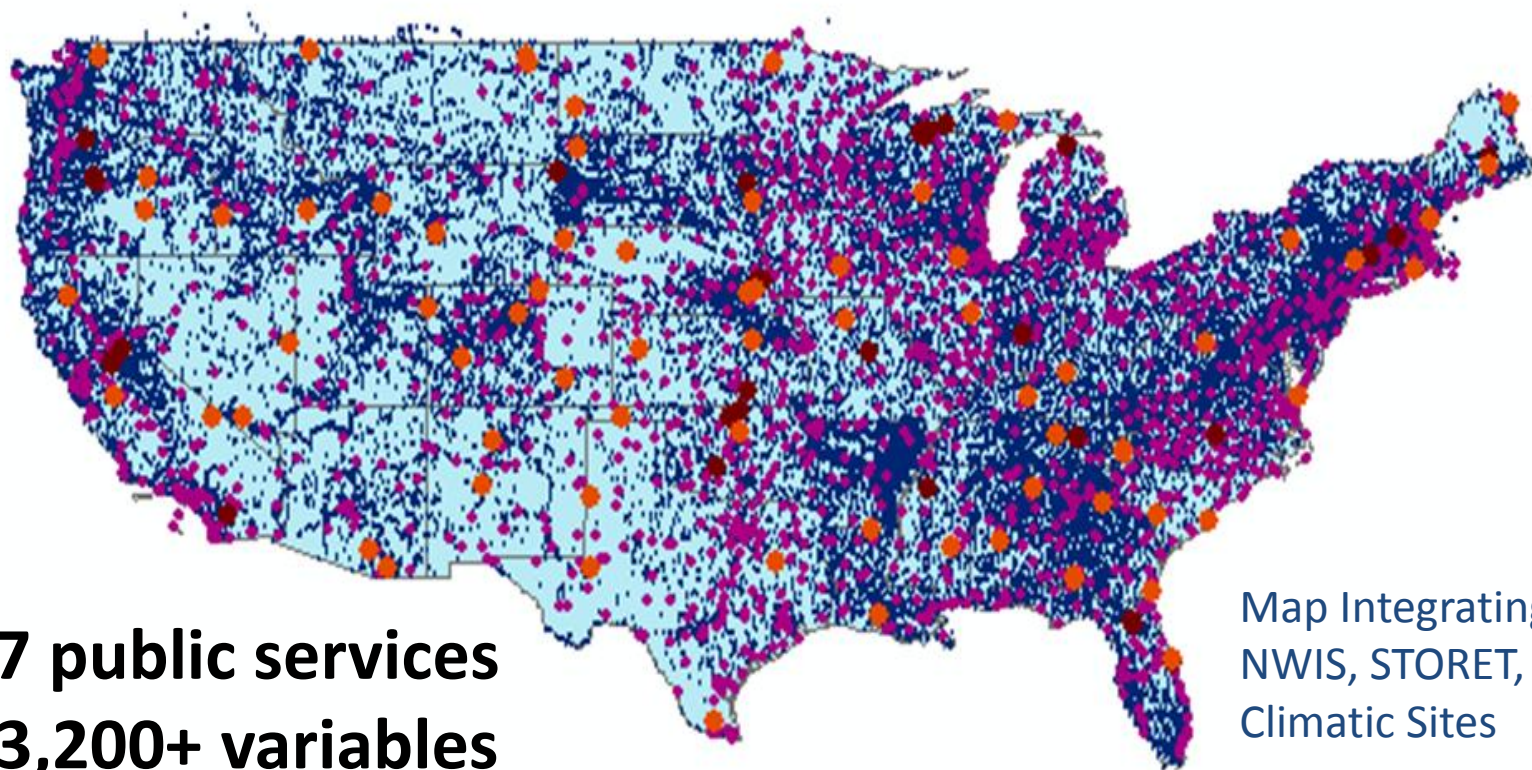


# Series Catalog

SeriesCatalog	
SeriesID {PK}	
SiteID {FK}	$S_j$
SiteCode	
SiteName	
VariableID {FK}	$V_i$
VariableCode	
VariableName	
Speciation	
VariableUnitsID {FK}	
VariableUnitsName	
SampleMedium	
ValueType	
TimeSupport	
TimeUnitsID {FK}	
TimeUnitsName	
DataType	
GeneralCategory	
MethodID {FK}	
MethodDescription	
SourceID {FK}	
Organization	
SourceDescription	
Citation	
QualityControlLevelID {FK}	
QualityControlLevelCode	
BeginDateTime	$t_1$
EndDateTime	$t_2$
BeginDateTimeUTC	
EndDateTimeUTC	
ValueCount	$C$



# CUAHSI Water Data Services, April 2010



Map Integrating  
NWIS, STORET, &  
Climatic Sites

**47 public services**  
**13,200+ variables**  
**1.8 million sites**  
**22.9 million series**  
**4.7 billion data values**

*The largest water data  
catalog in the world*

# Data Heterogeneity

- **Syntactic mediation**

- Heterogeneity of format

- Use WaterML to get data into the same format

```
<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:4326">
    <latitude>30.24465429</latitude>
    <longitude>-97.694448</longitude>
  </geogLocation>
</geoLocation>
</sourceInfo>
- <variable>
  <variableCode vocabulary="NWIS" default="true" variableName="Discharge, cubic feet per second">08158000</variableCode>
  <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>
  <value dateTime="2006-12-31T02:15:00">124</value>
  <value dateTime="2006-12-31T02:30:00">124</value>
  <value dateTime="2006-12-31T02:45:00">122</value>
</values>
</timeSeries>
```

- **Semantic mediation**

- Heterogeneity of meaning

- Each water data source uses its **own vocabulary**
  - Match these up with a concept from the **CUAHSI hydrologic ontology**
  - **Make standard scientific data queries** and have these automatically translated into **specific queries** on each data source

# Streamflow

FLOW,STREAM,MEANDAILY(CUBICFEETPERSEC)
FLOW:1=NoFlow,2=Low,3=Normal,4=Flood,5=High,6=D
FLOWRATE(GALLONSPERDAY)
FLOWRATEINSTANTANEOUS(MGD)
FLOWSTREAM,INSTANTANEOUS(CUBICFEETPERSEC)
INSTANTANEOUSSTREAMFLOW(CU.METERS/SEC.)
Discharge, cubic feet per second

# Water Temperature

Continuous Temperature
Temperature
Temperature, water, degrees Celsius
TEMPERATURE,WATER(DEGREESCENTIGRADE)
TEMPERATURE,WATER(DEGREESCENTIGRADE)24HRMIN
TEMPERATURE,WATER(DEGREESCENTIGRADE,24HRAVG
TEMPERATURE,WATER(DEGREESFAHRENHEIT)
WaterTemperature
WATERTEMPERATURE,#OFMEASUREMENTSIN24-HRS
WATERTEMPERATURE,DEGREESCENTIGRADE,24HRMAX

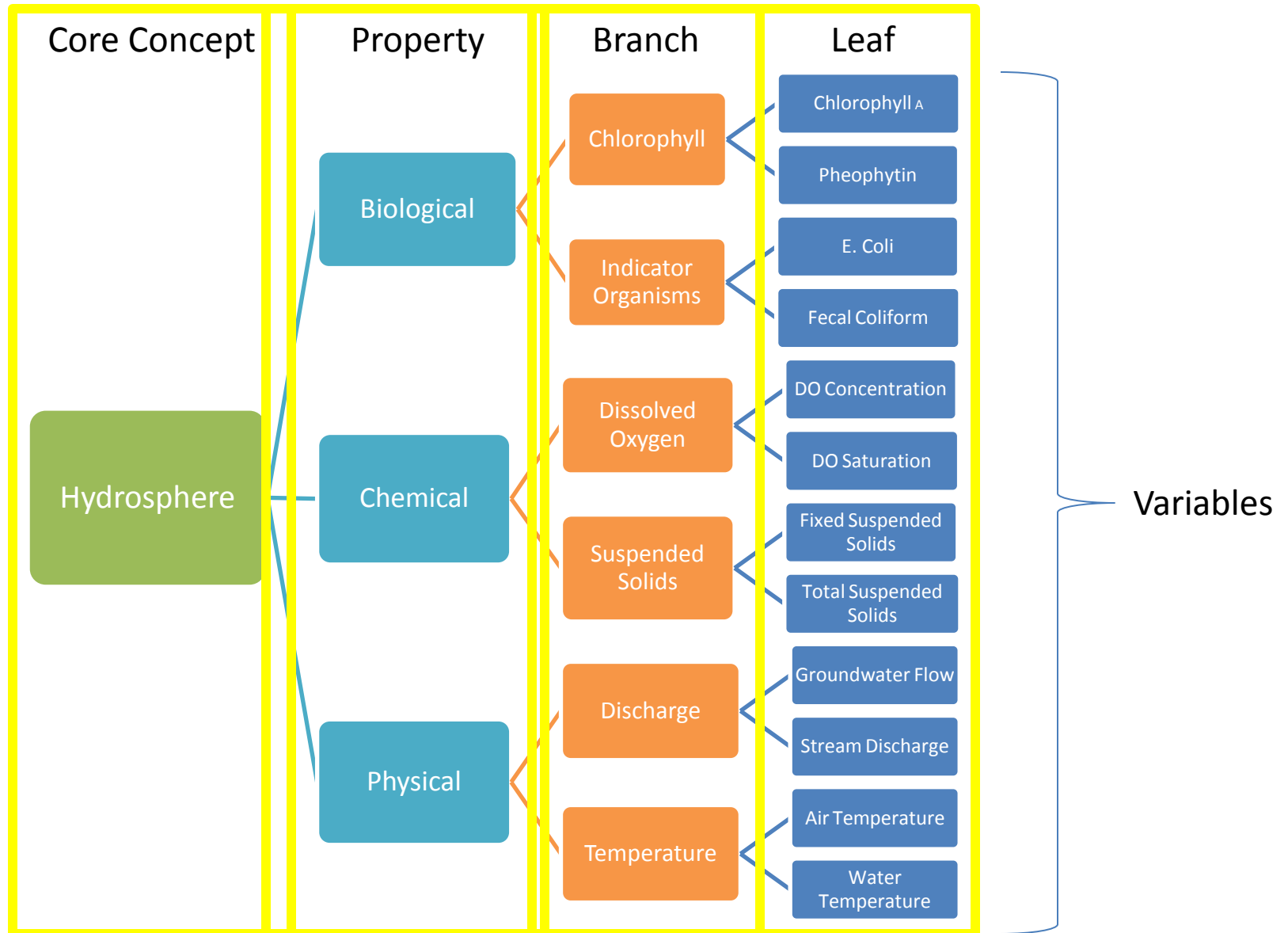
# Nutrients

NITRATENITROGEN,BOTTOMDEPOS.(MG/KG-NDRYWT)
NITRATENITROGEN,DISSOLVED(MG/LASN)
NITRATENITROGEN,TOTAL(MG/LASN)
NITRITE,DISSOLVED(MG/LASN)
NITRITENITROGEN,BOTTOMDEPOS.(MG/KG-NDRYWT)
NITRITENITROGEN,TOTAL(MG/LASN)
NITRITEPLUSNITRATE,BOT.DEPOS.(MG/KG-NDRYWT)
NITRITEPLUSNITRATE,DISS1DET.(MG/LASN)
NITRITEPLUSNITRATE,TOTAL1DET.(MG/LASN)
NITROGEN,AMMONIA,BOTTOMDEPOSITS(MG/KG-N)
NITROGEN,AMMONIA,DISSOLVED(MG/LASN)
NITROGEN,AMMONIA,TOTAL(MG/LASN)
NITROGEN,KJELDAHL,DISSOLVED(MG/LASN)
NITROGEN,KJELDAHL,TOTAL(MG/LASN)
NITROGEN,ORG.KJEL,BOT.DEPOS(MG/KG-NDRYWT)
NITROGEN,ORGANIC,DISSOLVED(MG/LASN)
NITROGEN,ORGANIC,TOTAL(MG/LASN)
NITROGEN,TOTAL(MG/LASN)
NITROGEN,TOTAL,BOTTOMDEPOSITS(MG/KG-NDRYWT)
NITROGENKJELDAHLTOTALBOTTOMDEPDRYWT(MG/KG)
PHOSPHATE,ORTHO(MG/LASPO4)
PHOSPHATE,TOTAL(MG/LASPO4)
PHOSPHORUS,DISSOLVED(MG/LASP)
PHOSPHORUS,TOTAL,BOTTOMDEPOSIT(MG/KGDRYWT)
PHOSPHORUS,TOTAL,WETMETHOD(MG/LASP)

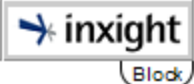
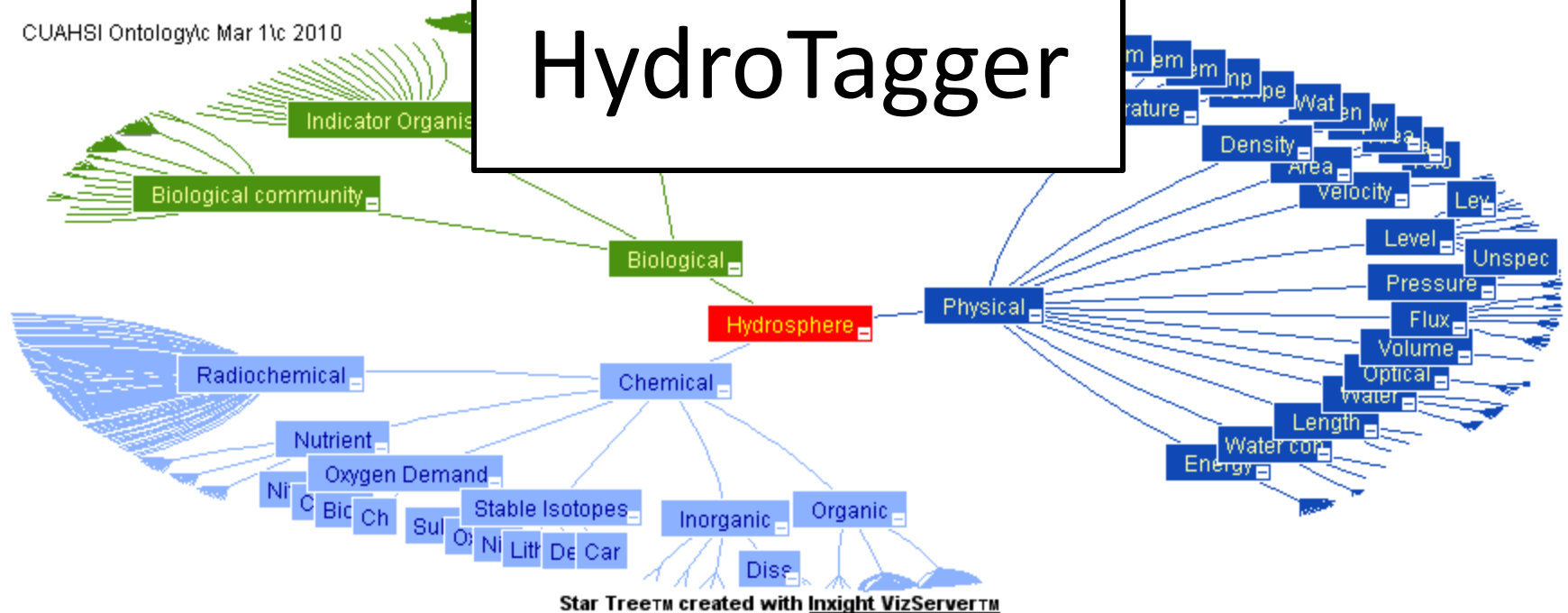
# Conceptual Framework

- **Chemical** descriptions from **EPA/USGS Substance Registry System**  
<http://www.epa.gov/srs/>
- **Physical** descriptions from **CF Conventions**
  - NetCDF Climate & Forecast; 137 variables<http://cf-pcmdi.llnl.gov/>
- **Biological** descriptions from **Integrated Taxonomic Information System**  
<http://www.itis.gov/>

# Thematic Concepts



# HydroTagger



Block

Variable Name	Code	Medium	Variable:	Variable	Keyword	
sampling depth, feet	nwisuv:00003	unknown	<input type="text" value="Temperature, Water, Degree"/>	gage height, feet	water depth, stream	<a href="#">delete</a>
sample accounting number	nwisuv:00008	unknown	<b>Mapping:</b>	discharge, cubic feet per second	discharge, stream	<a href="#">delete</a>
location in cross section...	nwisuv:00009	unknown	<input type="text" value="Temperature, water"/>	barometric pressure, not corrected to sea level, millibars	atmospheric pressure	<a href="#">delete</a>
temperature, water, degr...	nwisuv:00010	unknown	<input type="button" value="Map!"/>	acoustic signal strength, units		<a href="#">delete</a>
temperature, water, degr...	nwisuv:00011	unknown				
1 2 3 4 5 6 7 8 9 10 ...						

Each **Variable** in your data is connected to a corresponding **Concept**

# Water Temperature

Continuous Temperature

Temperature

Temperature, water, degrees Celsius

TEMPERATURE,WATER(DEGREESCENTIGRADE)

TEMPERATURE,WATER(DEGREESCENTIGRADE)24HRMIN

TEMPERATURE,WATER(DEGREESCENTIGRADE,24HRAVG

TEMPERATURE,WATER(DEGREESFAHRENHEIT)

WaterTemperature

WATERTEMPERATURE,#OFMEASUREMENTSIN24-HRS

WATERTEMPERATURE,DEGREESCENTIGRADE,24HRMAX

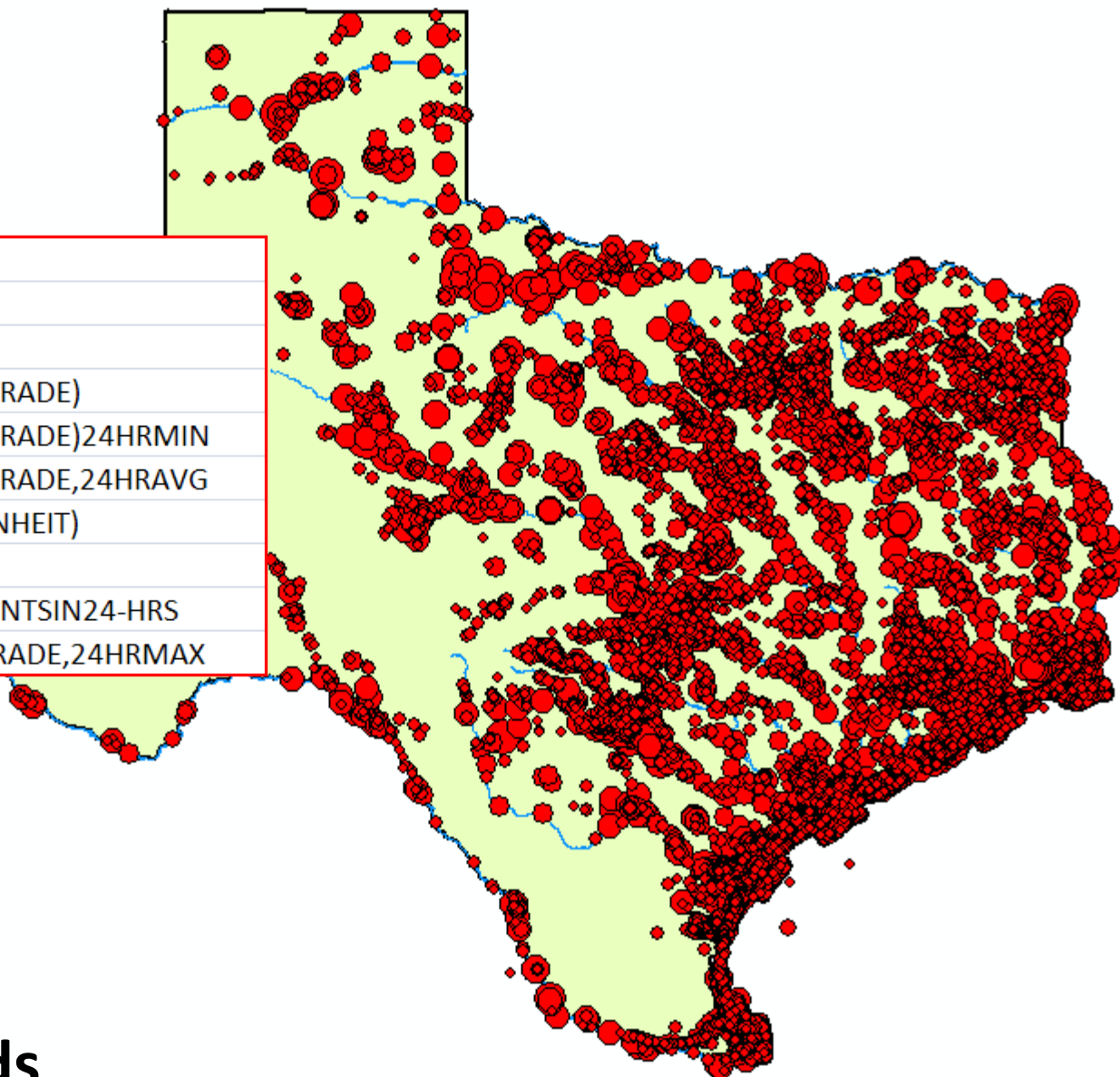
**6 services**

**11 variables**


**11,158 sites**

**22,953 series**

**1,546,841 records**



# HIS Central Web Page



**CUAHSI  
HIS**  
*Sharing hydrologic data*

[Login](#) [Register](#)

[Home](#) [All Data Services](#)

## All Registered Data Services

Data Service Title	Observation Name
<a href="#">Baltimore Precipitation</a>	<a href="#">BaltPrecip</a>
<a href="#">Baltimore Ecosystem Study Stream Chemistry Data</a>	<a href="#">BESOD</a>
<a href="#">Baltimore Ecosystem Study Soils Data</a>	<a href="#">BESSoil</a>
<a href="#">Baltimore Waters Test Bed Ground Water Level Data</a>	<a href="#">BaltimoreGW</a>
<a href="#">Beacon Institute for River and Estuary</a>	<a href="#">BEACON_IBM</a>
<a href="#">Dry Creek Experimental Watershed, SW Idaho</a>	<a href="#">ODMDCEW2</a>
<a href="#">Chesapeake Bay Information Management System</a>	<a href="#">CIMS</a>



**CUAHSI  
HIS**  
*Sharing hydrologic data*

[Login](#) [Register](#)

[Home](#) [All Data Services](#)

### Dry Creek Experimental Watershed, SW Idaho



**Boise State University, Hydrologic Sciences Department**  
ODMDCEW2

[http://cewater.boisestate.edu/dcew2dataservices/cuahsi\\_1\\_0.asmx?WSDL](http://cewater.boisestate.edu/dcew2dataservices/cuahsi_1_0.asmx?WSDL)

**Contact:** Pam Aishlin  
pamaishlin@boisestate.edu  
208-426-2220

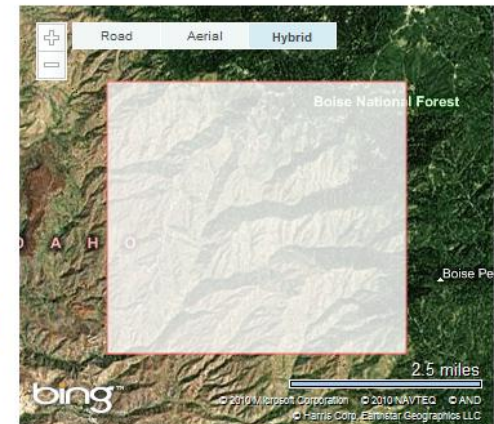
#### Service Statistics:

<b>Sites:</b> 68	<b>Geographic Extent:</b>	
<b>Variables:</b> 24		43.74071
<b>Values:</b> 4738590		-116.1786 -116.089
		43.68834

Last Harvested on 7/25/2010 1:12:50 PM

#### Abstract

Dry Creek Experimental Watershed was established by Dr. Jim McNamara in 1998 as an outdoor laboratory for student and faculty research toward improving understanding of hydrologic processes in semi-arid mountainous terrain and testing and improving data integration and hydrologic modeling. Continuous and discrete data collection includes climate, surface water, groundwater and soil



#### Citation

Boise State University, Hydrologic Sciences Dept,  
Dr. Jim McNamara

<http://hiscentral.cuahsi.org>

# HIS Central *Web Service*

- Programmatic methods to query the national metadata catalog
- Search by:
  - Location
  - Variable (concept)
  - Date Range
  - Data source (WaterOneFlow service)

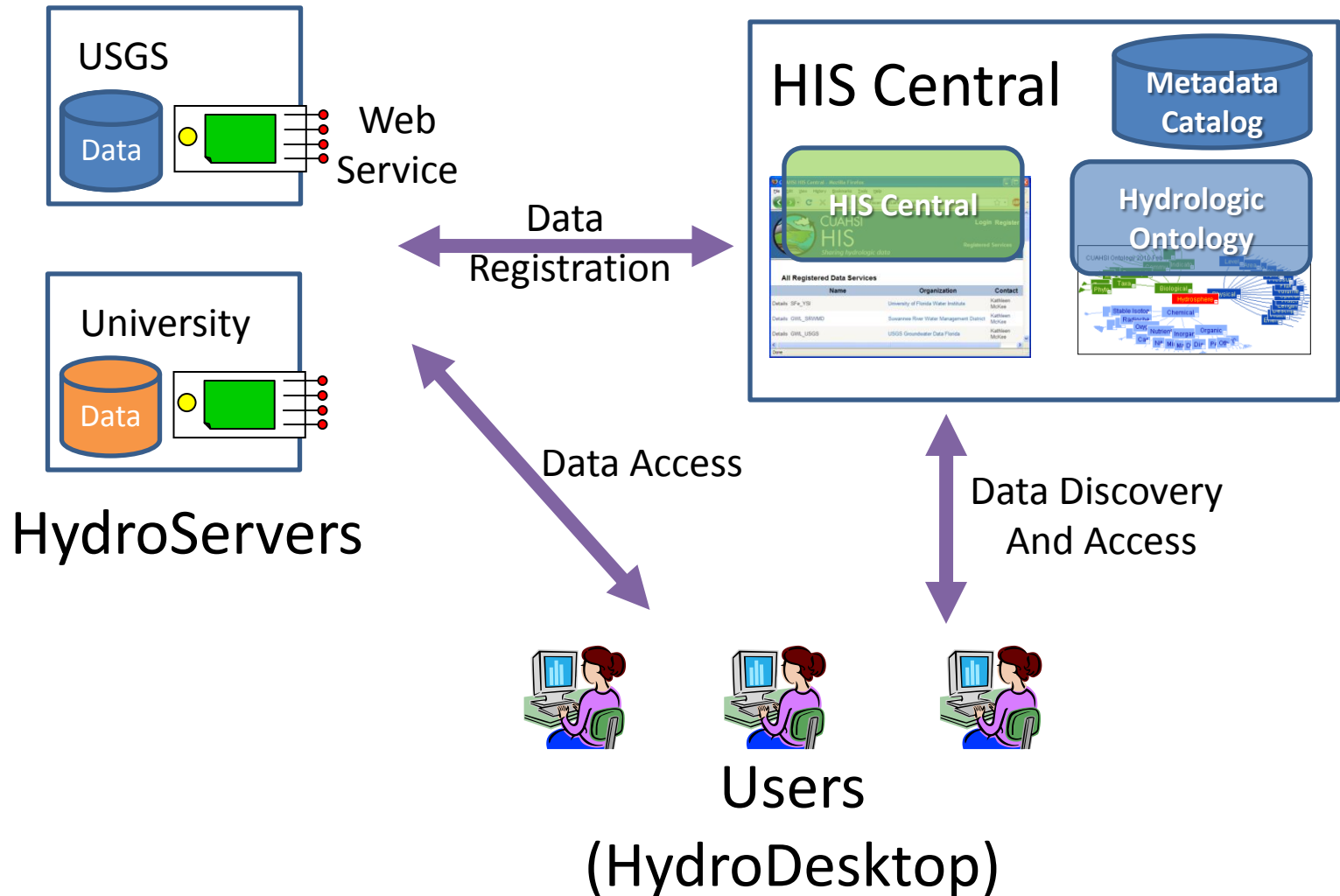
**hiscentral**

The following operations are supported. For a formal definition, please review the [Service Description](#).

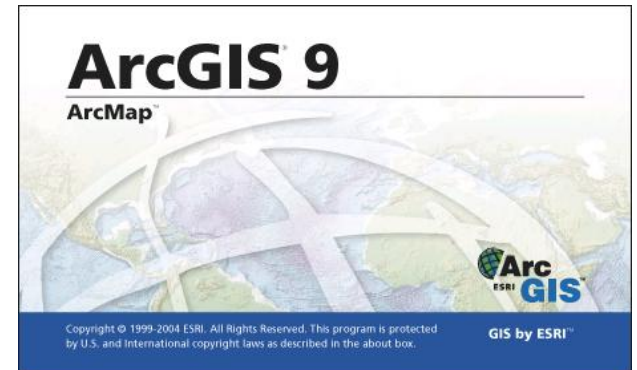
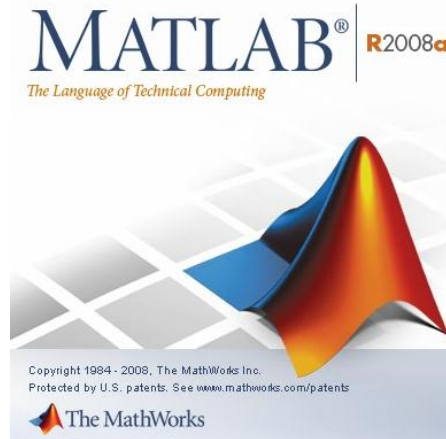
- [GetMappedVariables](#)
- [GetMappedVariables2](#)
- [GetSearchableConcepts](#)
- [GetSeriesCatalogForBox](#)
- [GetSeriesCatalogForBox2](#)
- [GetServicesInBox](#)
- [GetServicesInBox2](#)
- [GetSitesInBox](#)
- [GetSitesInBox2](#)
- [GetWaterOneFlowServiceInfo](#)
- [GetWordList](#)
- [getOntologyTree](#)
- [getSearchablePaths](#)
- [getSeriesCatalogInBoxPaged](#)

<http://hiscentral.cuahsi.org/webservices/hiscentral.asmx>

# HIS System – HIS Desktop



# HIS in Familiar Software





CUAHSI  
HIS  
Sharing hydrologic data

# HydroExcel

Hydrologic Information System (CUAHSI-HIS)  
services, tools, standards and procedures  
enhance access to more and better data for  
hydrologic analysis.

[Home](#)[How To](#)[Components](#)[Community](#)[Publications](#)[About Us](#)[Contact Us](#)[Google™ Custom Search](#)[Search HIS](#)

## HydroExcel: WaterOneFlow Excel Client

HydroExcel is an Excel spreadsheet that provides direct access to WaterOneFlow web services, serving data both from national data providers and universities. The spreadsheet uses VBA macros and an object library called HydroObjects to communicate with and retrieve data from WaterOneFlow web services.

### Before you begin:

- Enable Excel macros. Your security settings may prevent the macros in this spreadsheet from running. If macros are disabled, and you don't see an option to enable them, you may need to go into Excel's security settings and allow macros or at least disable macros with notification. You will likely then have to close the spreadsheet and reopen it in order for the macros to work.
- HydroExcel uses HydroObjects, an object library for communicating with the WaterOneFlow web services. So if you want to use HydroExcel, get and install [HydroObjects](#).
- HydroObjects requires the .Net Framework 2.0 from Microsoft. If you are using Office 2003, then [Service Pack 3 for Microsoft Office 2003](#) is also required.

### HydroExcel Version 1.1.2 Resources:

This latest version of HydroExcel features right-click menus and additional buttons to improve the workflow, the ability to save raw WaterML files to disk as XML files, and the display of some additional items available in WaterML such as variable speciation.

- [Microsoft Office 2003 version \[XLS; 7.5M\]](#) (requires [HydroObjects](#))
- [Microsoft Office 2007 version \[XLSB; 1.1M\]](#) (requires [HydroObjects](#))
- [HydroExcel Version 1.1.2 Software Manual \[PDF; 3.8M; 48 pages\]](#)

The screenshot shows the 'Data Source' worksheet in the HydroExcel spreadsheet. Callouts point to various elements:

- Active Web Service:** Points to the 'WSDL Location' field, which contains the URL: `http://his02.usu.edu/littlebearriver/cuahsi_1_0.asmx?WSDL`.
- Informative Text:** Points to the 'Data Source' section, which provides instructions on how to use the web service and lists available services.
- Learning about the Service:** Points to the 'Get Capabilities' button, which is used to view the service's capabilities.
- Worksheet Shortcuts:** Points to the 'Get Sites' and 'Get Variables' buttons, which are used to retrieve site and variable information.
- Example Web Services:** Points to the 'Web Services for National Data Sources' and 'Web Services for Academic Investigator Data' sections, which list various data providers and their WSDL locations.

The 'Web Services for National Data Sources' section includes the following table:

Data Source	WSDL Location	Description
United States Geological Survey	<code>http://river.sdsc.edu/wateroneflow/NWIS/DailyValues.asmx?WSDL</code>	NWIS daily values
United States Geological Survey	<code>http://river.sdsc.edu/wateroneflow/NWIS/Groundwater.asmx?WSDL</code>	NWIS groundwater
United States Geological Survey	<code>http://river.sdsc.edu/wateroneflow/NWIS/UnitValues.asmx?WSDL</code>	NWIS real time
United States Geological Survey	<code>http://river.sdsc.edu/wateroneflow/NWIS/Data.asmx?WSDL</code>	NWIS instant
Oak Ridge National Laboratory	<code>http://river.sdsc.edu/wateroneflow/DAYMET/Service.asmx?WSDL</code>	Daymet Meteorology
National Centers for Environmental Prediction	<code>http://river.sdsc.edu/wateroneflow/1AM12k/Service.asmx?WSDL</code>	North American Monsoon
Environmental Protection Agency	<code>http://river.sdsc.edu/wateroneflow/EPA/cuahsi_1_0.asmx?WSDL</code>	STORET water quality
NASA	<code>http://river.sdsc.edu/wateroneflow/MODIS/Service.asmx?WSDL</code>	Atmospheric data

The 'Web Services for Academic Investigator Data' section includes the following table:

University	WSDL Location	Description
Utah State University	<code>http://his02.usu.edu/littlebearriver/cuahsi_1_0.asmx?WSDL</code>	Utah State University
Utah State University	<code>http://his02.usu.edu/mudlake/cuahsi_1_0.asmx?WSDL</code>	Utah State University
University of Iowa	<code>http://his08.ihr.uiowa.edu/nexrad/cuahsi_1_0.asmx?WSDL</code>	Nick Arnold <
University of Iowa	<code>http://his08.ihr.uiowa.edu/water_quality/cuahsi_1_0.asmx?WSDL</code>	Nick Arnold <
University of Iowa	<code>http://his08.ihr.uiowa.edu/water_quality/cuahsi_1_0.asmx?WSDL</code>	Nick Arnold <

# Choosing a Service

**Specify the web service that will be used in all worksheets**

**WSDL Location** [http://cbe.cae.drexel.edu/SRBHOS/cuahsi\\_1\\_0.asmx?WSDL](http://cbe.cae.drexel.edu/SRBHOS/cuahsi_1_0.asmx?WSDL)

Get Capabilities | **Open Service Web Page** | Get Sites | Get Variables

Below, results from Get Capabilities in selected Web Service.

	Sites	Variables	Site Info	Site Catalog	Time Series
7					
8	TRUE				
9		TRUE			
10			TRUE		
11				TRUE	
12					TRUE
13					

**Web Services for National Data Sources**

Data Source	WSDL Location	Description
United States Geological Survey	<a href="http://river.sdsc.edu/wateroneflow/NWIS/DailyValues.asmx?WSDL">http://river.sdsc.edu/wateroneflow/NWIS/DailyValues.asmx?WSDL</a>	NWIS daily value data (e.g., daily average)
United States Geological Survey	<a href="http://river.sdsc.edu/wateroneflow/NWIS/Groundwater.asmx?WSDL">http://river.sdsc.edu/wateroneflow/NWIS/Groundwater.asmx?WSDL</a>	NWIS groundwater data
United States Geological Survey	<a href="http://river.sdsc.edu/wateroneflow/NWIS/UnitValues.asmx?WSDL">http://river.sdsc.edu/wateroneflow/NWIS/UnitValues.asmx?WSDL</a>	NWIS real time data
United States Geological Survey	<a href="http://river.sdsc.edu/wateroneflow/NWIS/Data.asmx?WSDL">http://river.sdsc.edu/wateroneflow/NWIS/Data.asmx?WSDL</a>	NWIS instantaneous irregular data (e.g., rain gauge)
Oak Ridge National Laboratory	<a href="http://river.sdsc.edu/wateroneflow/DAYMET/Service.asmx?WSDL">http://river.sdsc.edu/wateroneflow/DAYMET/Service.asmx?WSDL</a>	Daymet Meteorological model
National Centers for Environmental Prediction	<a href="http://river.sdsc.edu/wateroneflow/NAM12k/Service.asmx?WSDL">http://river.sdsc.edu/wateroneflow/NAM12k/Service.asmx?WSDL</a>	North American Mesoscale (NAM) model
Environmental Protection Agency	<a href="http://river.sdsc.edu/wateroneflow/EPA/cuahsi_1_0.asmx?WSDL">http://river.sdsc.edu/wateroneflow/EPA/cuahsi_1_0.asmx?WSDL</a>	STORET water quality data
NASA	<a href="http://river.sdsc.edu/wateroneflow/MODIS/Service.asmx?WSDL">http://river.sdsc.edu/wateroneflow/MODIS/Service.asmx?WSDL</a>	Atmospheric data derived from remote sensing
USDA-ARS	<a href="http://river.sdsc.edu/snotel/cuahsi_1_0.asmx?WSDL">http://river.sdsc.edu/snotel/cuahsi_1_0.asmx?WSDL</a>	USDA-NRCS Snotel data network

**CUAHSI HIS** Sharing hydrologic data

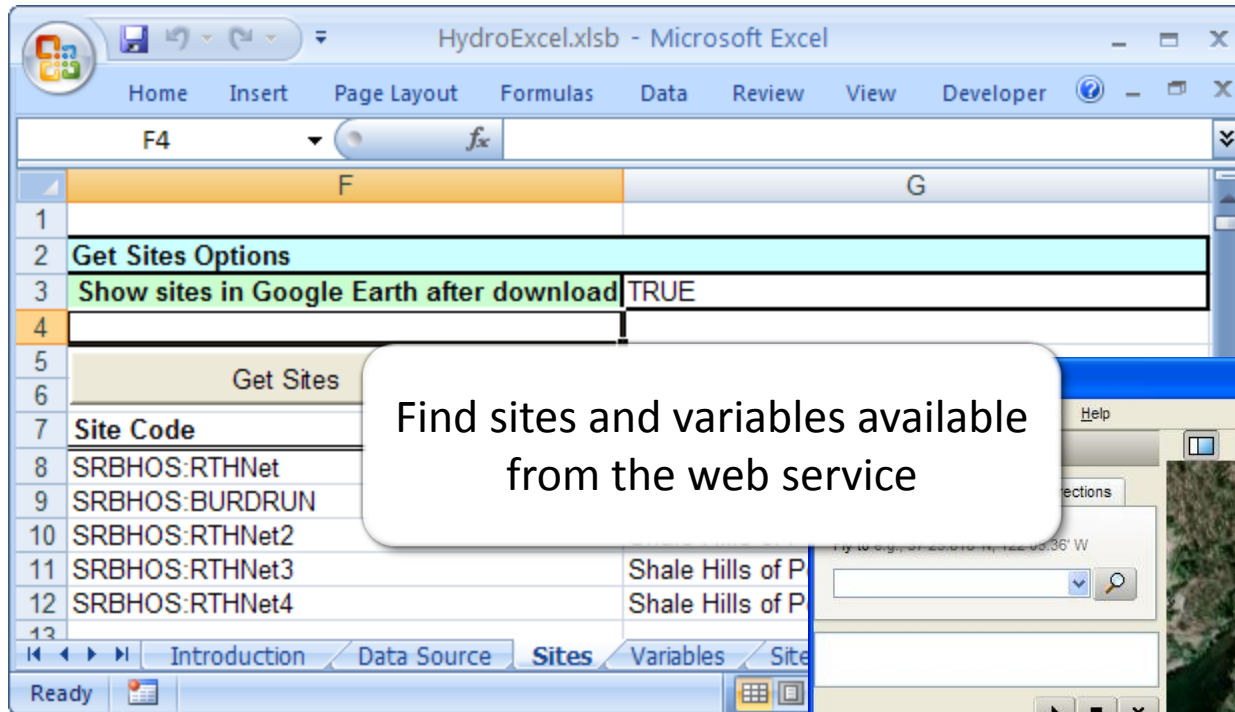
Login Register  
Registered Services

**Data Service Details:**

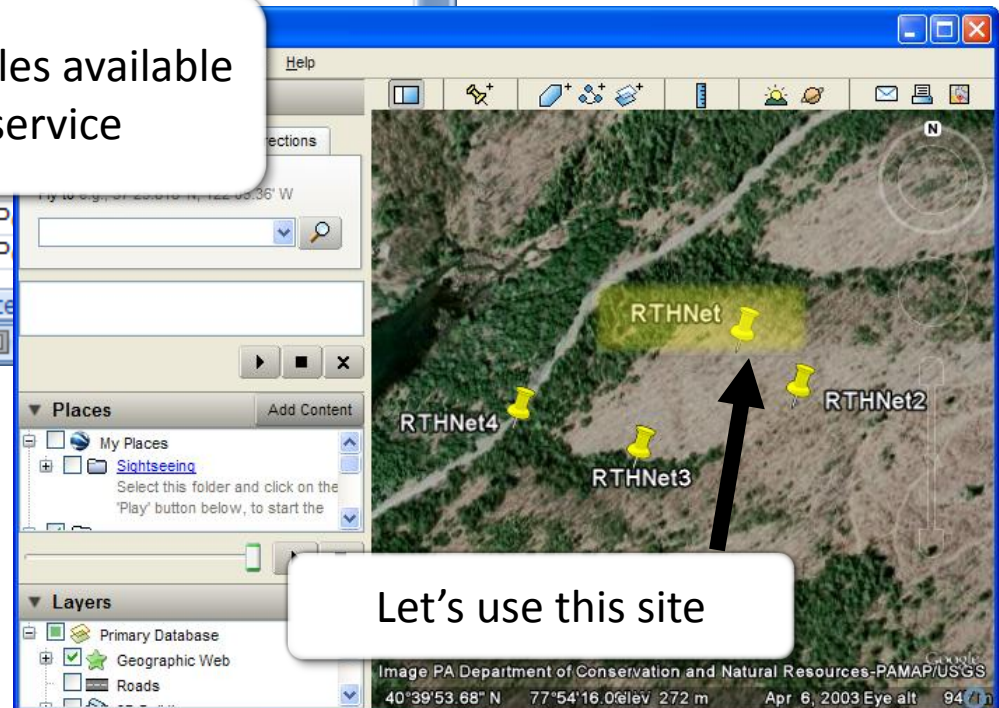
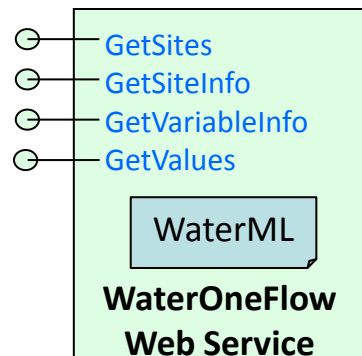
**Data Service:** SRBHOS  
**Service WSDL:** [http://cbe.cae.drexel.edu/SRBHOS/cuahsi\\_1\\_0.asmx?WSDL](http://cbe.cae.drexel.edu/SRBHOS/cuahsi_1_0.asmx?WSDL)  
**Service Info:** Susquehanna River Basin Hydrologic Observatory System  
**Organization:** <http://www.srbhos.org>  
**URL:** <http://www.srbhos.org>

**Contact Info:** Name: Michael Piasecki  
Email: [michael.piasecki@drexel.edu](mailto:michael.piasecki@drexel.edu)  
**Citation:** mp29@drexel.edu

# Choosing a Site



Google Earth opens, showing our sites



# Downloading Time Series

HydroExcel.xlwb - Microsoft Excel

Home Insert Page Layout Formulas

F10

Get Values Options ☒ Ignore

Site Code/Location SRBHOS:RTHNet

Variable Code SRBHOS:516

Start Date 3/1/2007 0:00

End Date 3/31/2007 23:59

Get Values

Site Name Shale Hills of Penn State University

Latitude 40.665817

Longitude -77.904011

Data Source [http://cbe.cae.drexel.edu/SRBHOS/cuahsi\\_1\\_0.a](http://cbe.cae.drexel.edu/SRBHOS/cuahsi_1_0.a)

Obtained 9/26/2008 17:12

Ignore NoDataValue TRUE

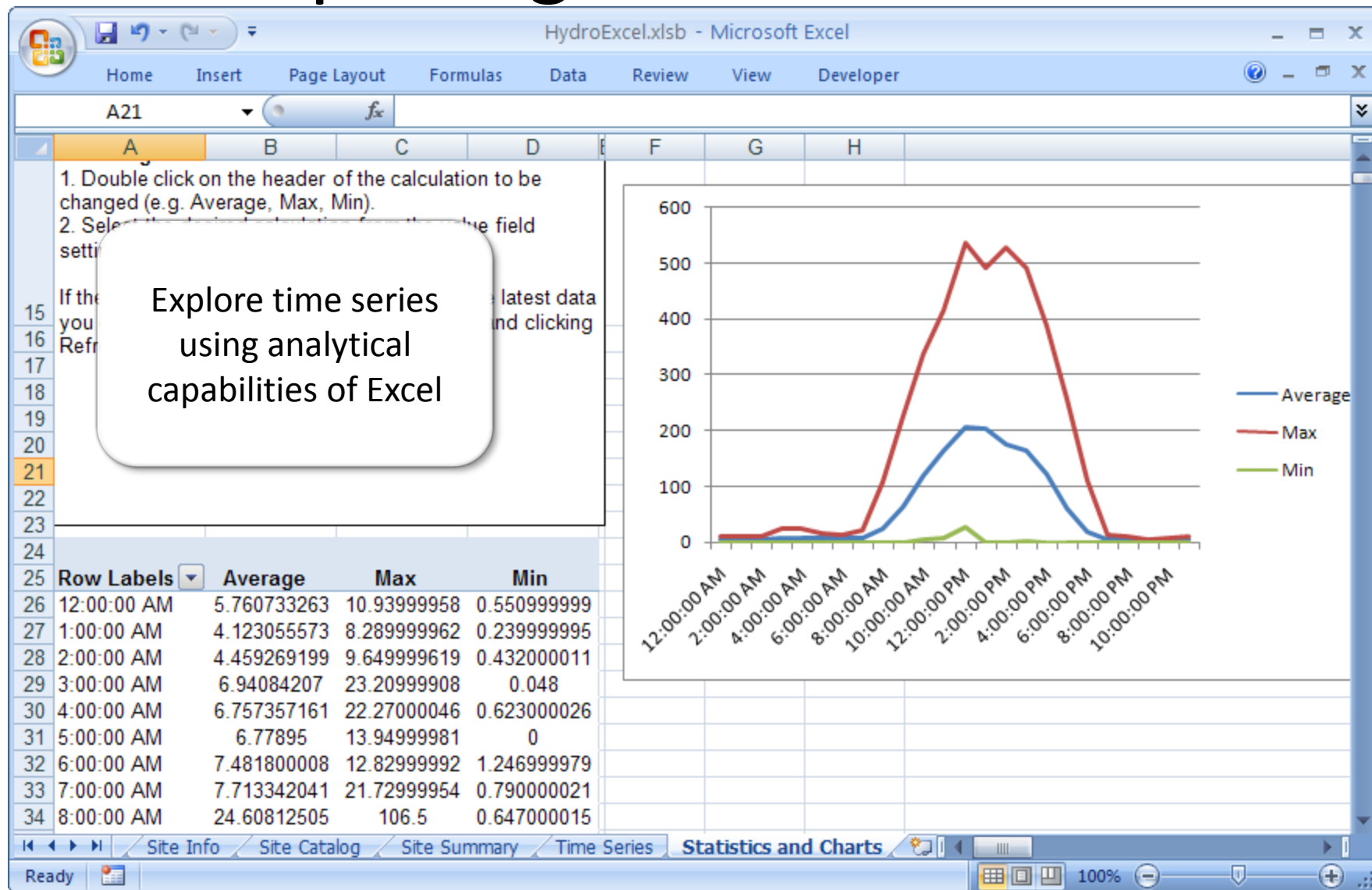
DateTime	Value	Offset	Offset Units	Offset Description	Censor Code	Method
3/1/2007 7:30	6.861999989				nc	No method
3/1/2007 8:40	12.89999962				nc	No method
3/1/2007 8:50	15.59000015				nc	No method
3/1/2007 9:00	39.95000076				nc	No method
3/1/2007 9:10	25.65999985				nc	No method
3/1/2007 9:20	11.27000046				nc	No method
3/1/2007 9:30	128.8000031				nc	No method
3/1/2007 9:40	84.80000305				nc	No method
3/1/2007 9:50	34.47000122				nc	No method
3/1/2007 10:00	49.5				nc	No method
3/1/2007 10:10	58.56000137				nc	No method
3/1/2007 10:20	63.79999924				nc	No method
3/1/2007 10:30	62.02999878				nc	No method

Sites Variables Site Info Site Catalog Site Summary Time Series Statistics

Ready

100%

# Exploring the Time Series



# HydroExcel Limitations

- Can't hold much data
  - No dates before year 1900
  - Not truly geospatially enabled
  - Not free
- 
- How can I use HIS in software built to work with HIS from the ground up?

# HydroDesktop

- Free, open source solution for HIS data access
- [www.hydrodesktop.org](http://www.hydrodesktop.org)



The screenshot shows the HydroDesktop project page on the CodePlex Open Source Community. The page features a header with the HydroDesktop logo (CUAHSI Open Source Hydrologic Data Tools) and a search bar. A navigation menu includes links for Home, Downloads, Documentation, Discussions, Issue Tracker, Source Code, People, and License. Below the menu, there are links for 'Create New Page', 'Edit', 'View All Comments', 'Print View', 'Page Info', and 'Change History (all pages)'. A search bar for 'Search Wiki & Documentation' is also present.

**Project Summary**

HydroDesktop is a free and open source desktop application developed in C# .NET that serves as a client for CUAHSI HIS WaterOneFlow web services data and includes data discovery, download, visualization, editing, and integration with other analysis and modeling tools.

**Building the HydroDesktop Team**

This is an open project that is actively seeking partners to help with coding and testing. 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
- » Read the [Functional Specifications](#)
- » Look at the [Documentation](#) for HydroDesktop users and developers

**Download**

CURRENT	1.1 Beta RC6
DATE	Tue Aug 31 2010 at 7:00 AM
STATUS	Beta
RATING	No Ratings 412 downloads
MORE	<a href="#">View all downloads</a>

**Activity**

Page Views	1556
Visits	284
Downloads	198
Application Runs	N/A

[View Detailed Stats](#)

**Related Projects**

# GIS fully integrated with HIS

The screenshot displays the CUAHSI HydroDesktop application window. The title bar reads "CUAHSI HydroDesktop - default.hdpri". The interface includes a menu bar (Home, Table, Graph, Edit, Help) and a toolbar with icons for Search, Pan, Zoom In, Zoom Out, Max Extents, Previous, Next, Add, Identify, Select, Attribute, Measure, and an "Enable Basemap" button. A "Map Layers" panel on the left lists various layers: "Search Results", "NWISDV", "Themes", "Online Basemap", "Base Map Data" (with sub-items for lakes and rivers), "U.S. HUC" (with sub-items for HUC and NAME), "U.S. Counties" (with sub-item for NAME), "U.S. States" (with sub-item for NAME), "Canada Provinces" (with sub-item for NAME), and "Countries" (with sub-item for NAME). The main map area shows a topographic map of a region including Jollyville Plateau and Austin, with blue triangles indicating data points. A "Keywords" panel on the right shows a search for "Discharge, stream" with a list of results including "Flux, precipitation", "Flux, wind", "Flux, evaporation", "Flux, discharge", "Discharge, groundwater", and "Discharge, stream". A "Run Search" button is at the bottom right. A status bar at the bottom left shows coordinates: "Longitude: 97°23'39\"W, Latitude: 30°23'28\"N".

CUAHSI HydroDesktop - default.hdpri

Home Table Graph Edit Help

Search Pan Zoom In Zoom Out Max Extents Previous Next Add Identify Select Attribute Measure

Opacity 100  
ESRI World Topo  
Online Basemap

Map Layers

- ☒ "Search Results"
- ☒ NWISDV
- ☒ Themes
- ☒ Online Basemap
- ☒ Base Map Data
  - ☒ lakes
  - ☒ rivers
- ☒ U.S. HUC
  - ☒ HUC
  - ☒ NAME
- ☒ U.S. Counties
  - ☒ NAME
- ☒ U.S. States
  - ☒ NAME
- ☒ Canada Provinces
  - ☒ NAME
- ☒ Countries
  - ☒ NAME

Keywords: Type in first few letters  
Hydrosphere|Physical|Flux|Flux, discharge|Discharge, stream

Discharge velocity  
Discharge, ground  
Discharge, in conc  
Discharge, per bat  
**Discharge, stream**  
Discharge, unspec  
Discharge, well flo  
Dispio uncinata  
Dissolved Gas

Flux  
+ Flux, precipitation  
+ Flux, wind  
+ Flux, evaporation  
+ Flux, discharge  
+ Discharge, groundw  
+ Discharge, stream

Keywords Display  
☐ List ☐ Tree ☒ Both

Selected Keywords  
Discharge, stream

Search Server  
HIS C

Web Se  
NWIS Daily Values

Keywords Date Range 8/27/2009 :: 8/27/2010  
Discharge, stream

Run Search

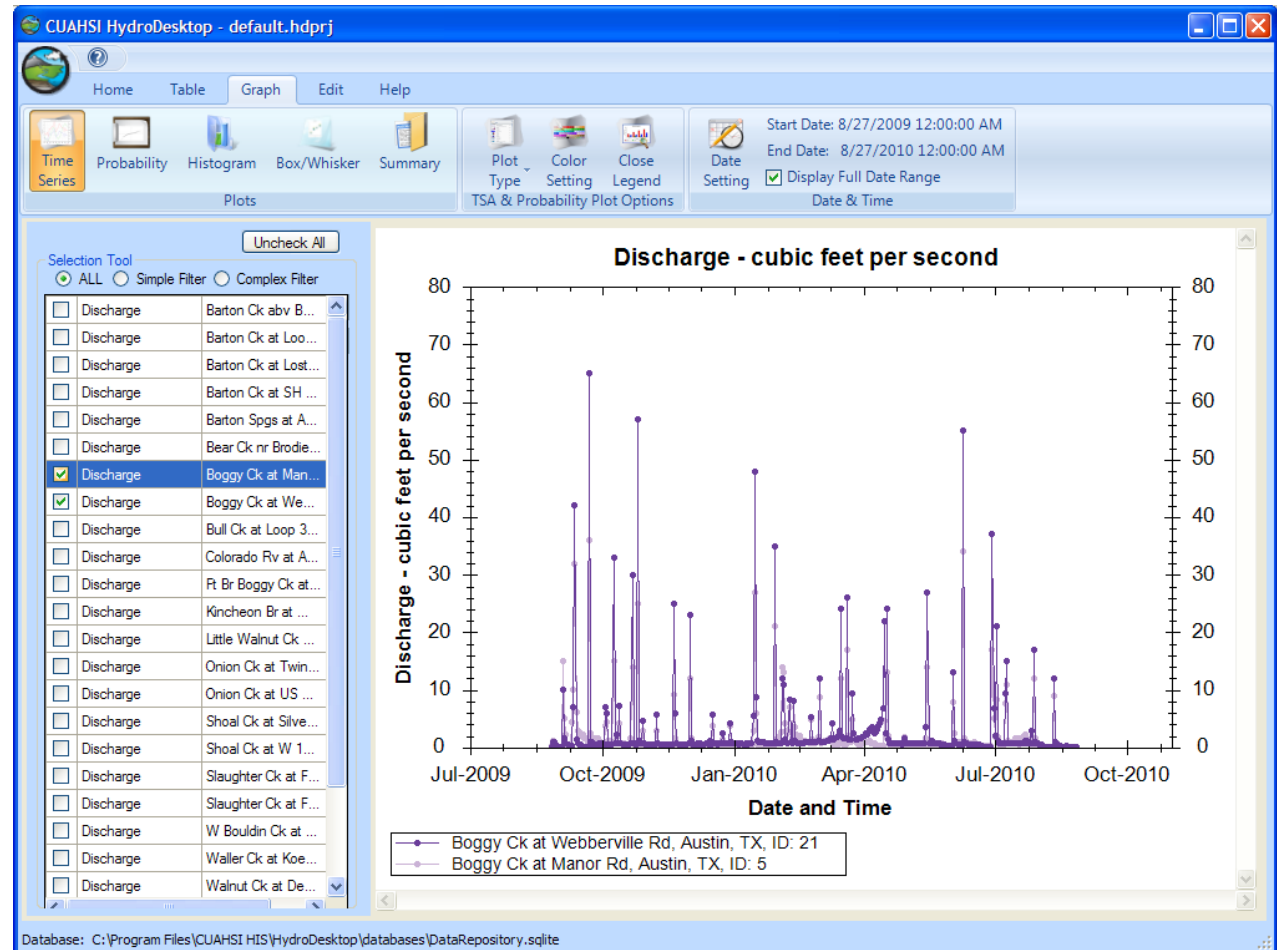
Longitude: 97°23'39"W, Latitude: 30°23'28"N

- Metadata catalog
- Ontology keywords
- WaterOneFlow/WaterML

Discovery  
Access  
Analysis

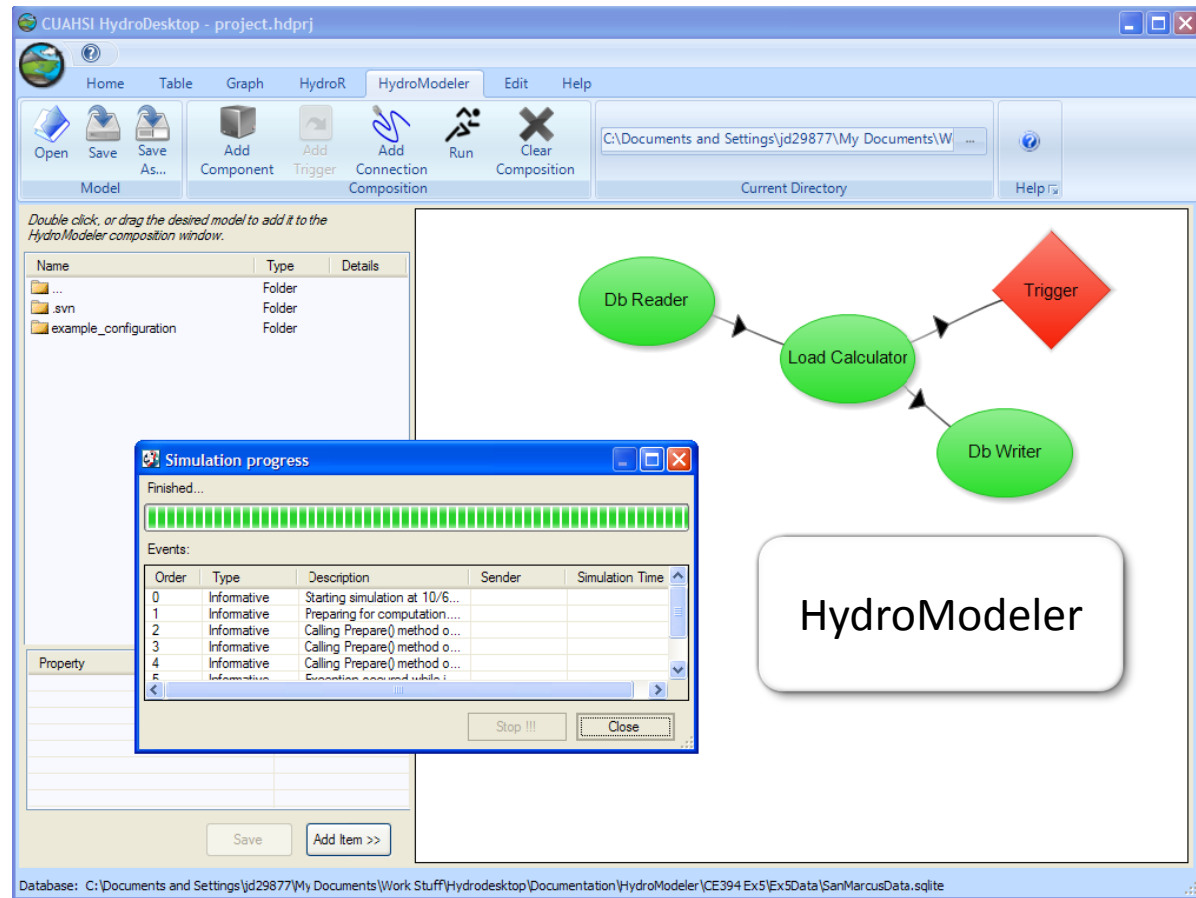
# Built-in Analysis

- Tables
- Graphs
- Editing
- Export



# Customizable with Plug-ins

- Community development
- Build on the HydroDesktop framework



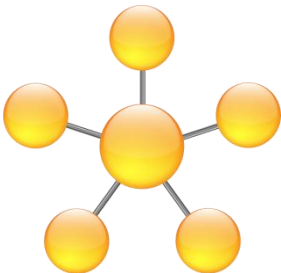
# Outline



- The HIS Story

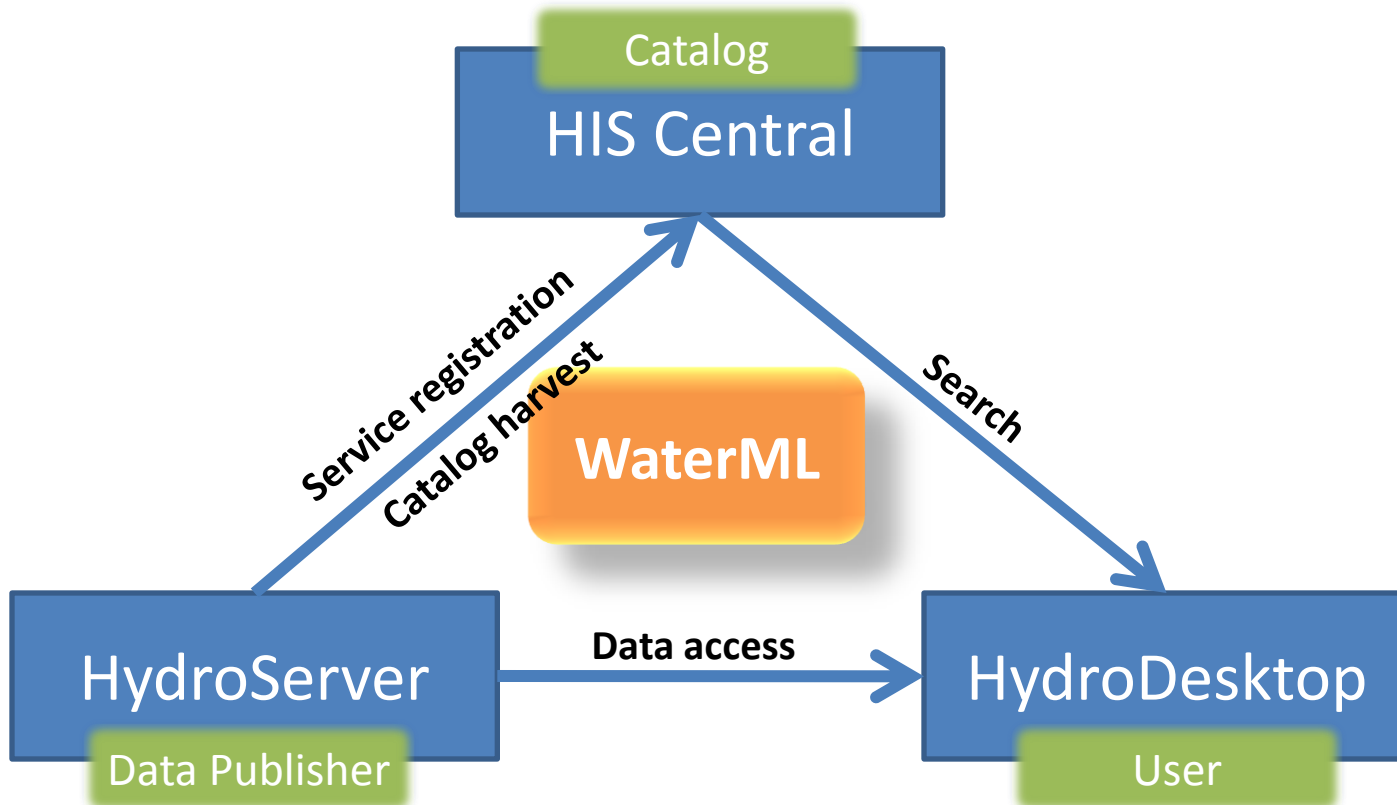


- HIS components



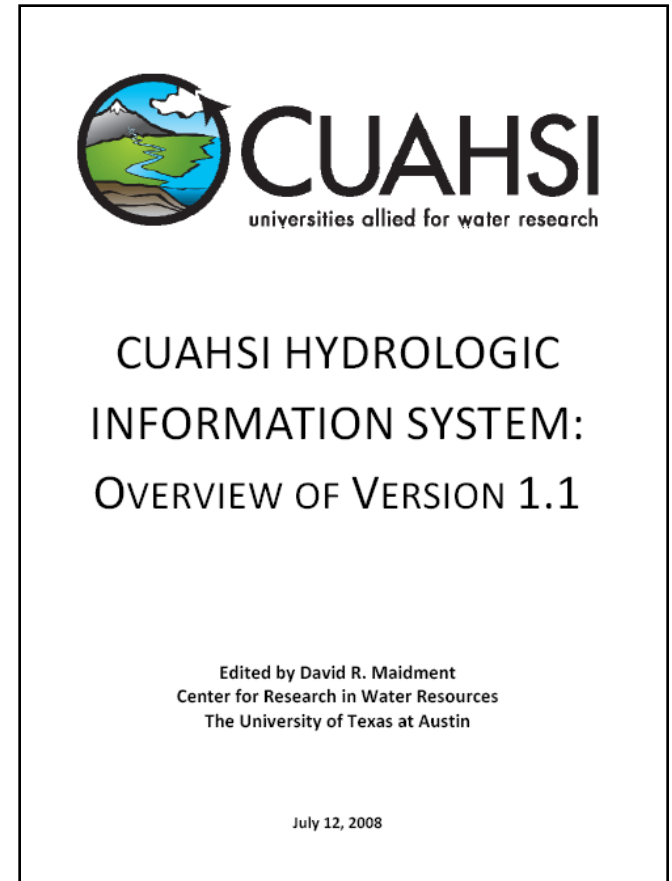
- *Putting the pieces together*

# Services-Oriented Architecture for Water Data



# HIS Overview Report

- Summarizes the conceptual framework, methodology, and application tools for **HIS version 1.1**
- Shows how to develop and publish a **CUAHSI Water Data Service**
- Available at:



<http://his.cuahsi.org/documents/HISOverview.pdf>

# The Road Ahead

- WaterML 2.0
  - World Meteorological Organization
  - Open Geospatial Consortium
  - Hydrology Domain Working Group
- HydroServer – Data access control
- HydroDesktop – Refinement

# Put Your Dots on the Map



# Start Using HIS

- HIS Website
  - [his.cuahsi.org](http://his.cuahsi.org)
- HydroDesktop
  - [www.hydrodesktop.org](http://www.hydrodesktop.org)
- CUAHSI User Support Specialist
  - Yoori Choi
  - [ychoi@cuahsi.org](mailto:ychoi@cuahsi.org)