



CUAHSI
HIS
Sharing hydrologic data



Using CUAHSI HIS to Support Large Scale Collaborative Research in Utah

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CUAHSI HIS Cyberseminar
5-1-2013

innovative Urban Transitions and Aridregion Hydro-sustainability (iUTAH)

- Statewide effort
- \$20 million competitive award from NSF EPSCoR
- Research capacity building
- Interdisciplinary and multi-institution
- Focused on sustainable management of Utah's water resources



Support:
EPS 1208732

<http://www.iutahepscor.org>

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iUTAH
EPSCoR

Preserving Utah's Water Resources

Innovative Urban Transitions and Aridregion Hydro-sustainability

About iUTAH Research Focus Areas Education & Outreach Data & Modeling Resources

Opportunities

iUTAH will have opportunities, resources and project activities available to support the involvement of students, teachers and researchers at all academic levels.

[Learn More](#)



News & Announcements

[Let's hear it for](#)
Utah Water Watch is educating "citizen scientists" how to measure water quality...

[Healthy STEM 5K and STEM FAIR](#)
Utah Dept of Education is looking for STEM Fair presenters for their June 1st...

[TURFO Call for Congress Session Proposals](#)
Deadline April 30, 2013 - The International Union of Forest Research Organizations (IUFRO)...

Highlights & Upcoming Events

[Science Unwrapped](#)
On April 26, 2013 join iUTAH at the Science Unwrapped Water Series: "Changing the World..."

[iUTAH partners with the Leonardo Museum to promote water...](#)
iUTAH sponsored a scholarship to provide the funding for 500 elementary students to attend a...

[Save the Date!](#)
iUTAH symposium all hands meeting is July 19, 2013 in Salt Lake City.

Opportunities

- [iUtah EPSCoR Undergraduate Summer Internships](#)
- [USU opens assistantships for PhD students](#)
- [Doctoral Research Fellowship Hydrologic Modeling of Coupled Human Natural Systems Utah State University](#)
- [Other iUTAH Fellowship Opportunities](#)
- [Other Related Opportunities](#)

[View All](#) [View All](#) [View All](#)

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UTAH EPSCoR

This project is funded through EPS-1208732. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. Web services provided by the Utah Education Network in partnership with Utah EPSCoR.

NSF

iUTAH Research Focus Areas

1. Eco-hydrology

- Expand Utah's capacity in the natural sciences through instrumentation of 3 watersheds

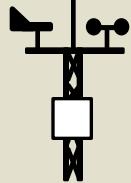
2. Social and Engineered Water Systems

- Studying demographic characteristics, water use behaviors, water infrastructure, and other measures of urban form

3. Interdisciplinary Modeling and Visualization

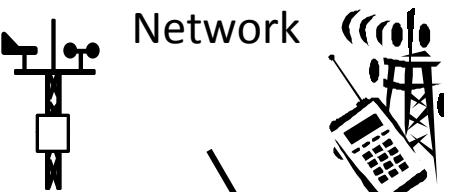
- Development of interdisciplinary models of socio-eco-hydrological systems to determine how changes in water availability and use alter water quantity and quality

iUtah Field Sites



- Little Bear River
- Red Butte Creek
- Provo River

Utah Field Station Network



Agency Data

- USGS NWIS
- NRCS SNOTEL
- Utah DWQ
- Etc.



National Science Data Networks

- CUAHSI HIS
- DataONE

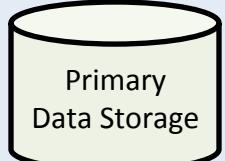


iUTAH Modeling and Data Federation

HPC@USU



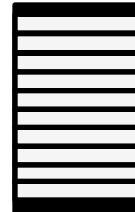
- Primary data organization and storage
- Data sharing, publication, and archival
- Data integration and synthesis
- Integrated modeling and CI Support
- HPC support



USU

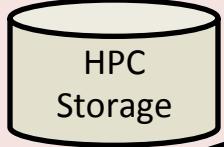
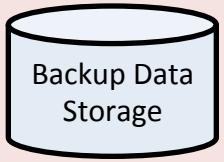
Research@UEN Network

UWyoming
(EPSCoR CI Track 2)
and National HPC
Centers



- Redundant data storage
- HPC support
- Modeling and simulation
- Collaboration technologies

UU Center for
High Performance
Computing



UU

Research@UEN Network

UEN Network

UEN Network

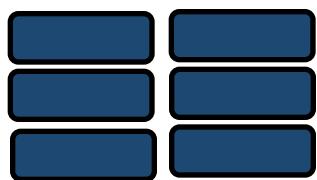
Fulton
Supercomputing
Lab

BYU

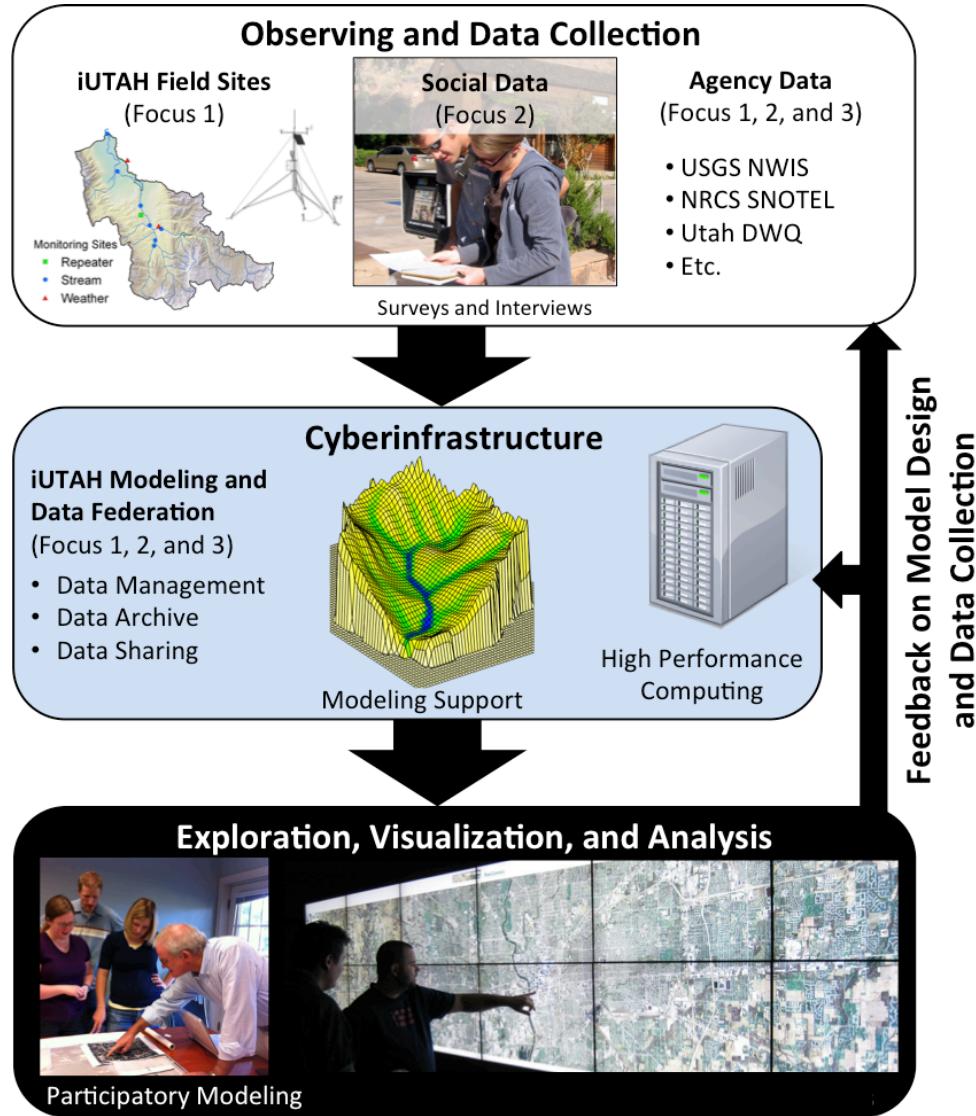
UVU

Intermountain
Network Node

UEN and K-12 Sites



iUTAH MDF – Information Flow



- Field sites and other data (e.g., agencies)
- iUTAH Modeling and Data Federation
- Modeling, visualization, and analysis

iUTAH MDF Focus Areas

1. Data management support for data from iUTAH facilities
 - GAMUT – Gradients Along Mountain to Urban Transitions
 - GIRF – Green Infrastructure Research Facility
2. Support for data discovery and access
 - iUTAH facility and investigator data
 - Agency data
 - National data networks
3. Support for integrated modeling
4. Data/model/resource sharing and collaboration

How can we create a hardware platform that supports the diverse cyberinfrastructure needs of iUTAH?

iUTAH CI Development Approach

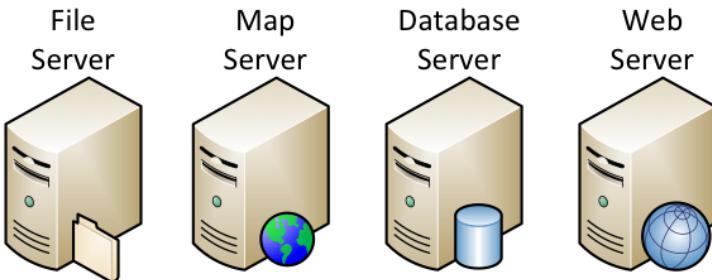
- Where possible, leverage and adopt existing cyberinfrastructure components
- Collaborate with other CI development activities to get needed functionality
- Develop pieces that we need

Required Functionality

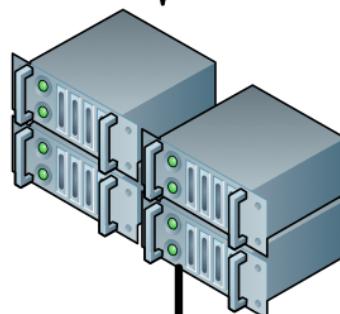
- Research platform
 - Development, prototyping, and testing of servers, software applications, and services on multiple platforms (e.g., Windows, Linux)
 - Host machines allocated for modeling, analysis, and computational tasks
- Production data service and application hosting platform
 - Web servers
 - Data web services
 - Web applications
 - Database servers
 - Map servers
 - File servers
 - Data harvesters and automated data processing applications

Hardware

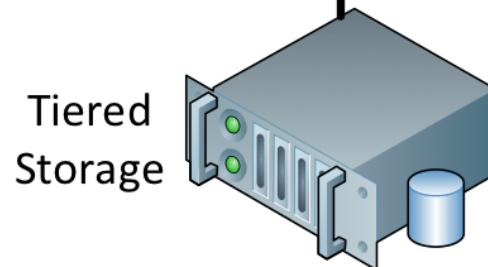
VMWare Virtual Machines



Required servers and software stacks implemented on virtual machines



VMWare
Virtual
Hosts



Tiered storage
Tier 1 and 2: Databases and operating systems
Tier 3: Lower demand file storage and access

Hardware Capabilities

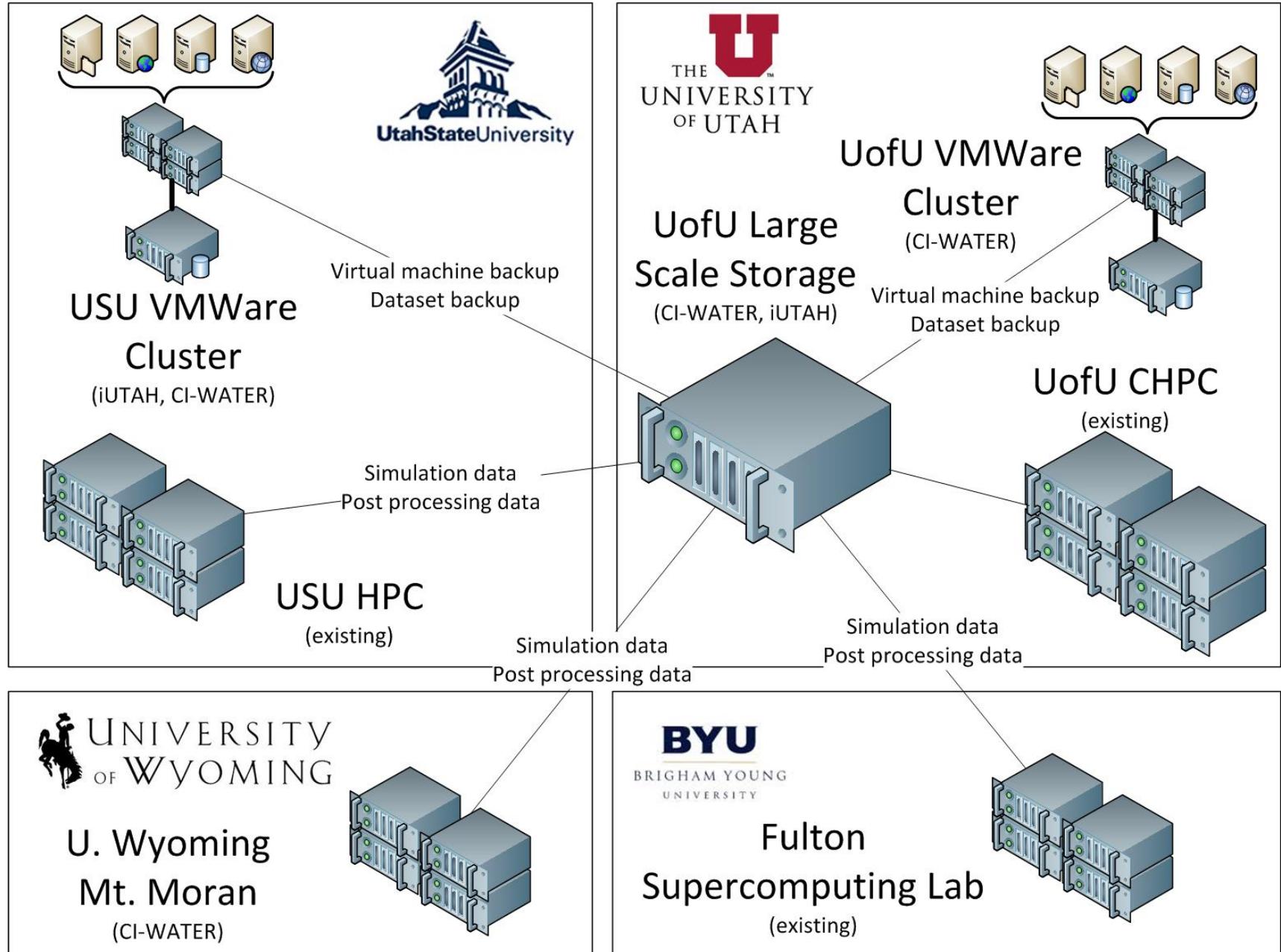
- Quickly spin up virtual machines that implement different operating systems and platforms (e.g., Windows, Linux)
- Use shared computational and storage resources rather than requiring a physical machine for each purpose
- Create and manage both development and production servers using shared hardware
- Hot-swap virtual machines across physical host machines using virtualization software
 - Ensure failover for production virtual servers
 - Efficiently allocate resources to multiple machines

Initial Specifications

- 3 virtual host servers using shared storage arrays
 - Dual 8 core processors
 - 128 GB RAM
- 7.2 TB high performance shared storage array
 - Virtual machine operating systems
 - Relational databases
- 72 TB high capacity shared storage array
 - File storage
 - Archival
- Integrated with USU Central IT VMWare infrastructure and enterprise data center

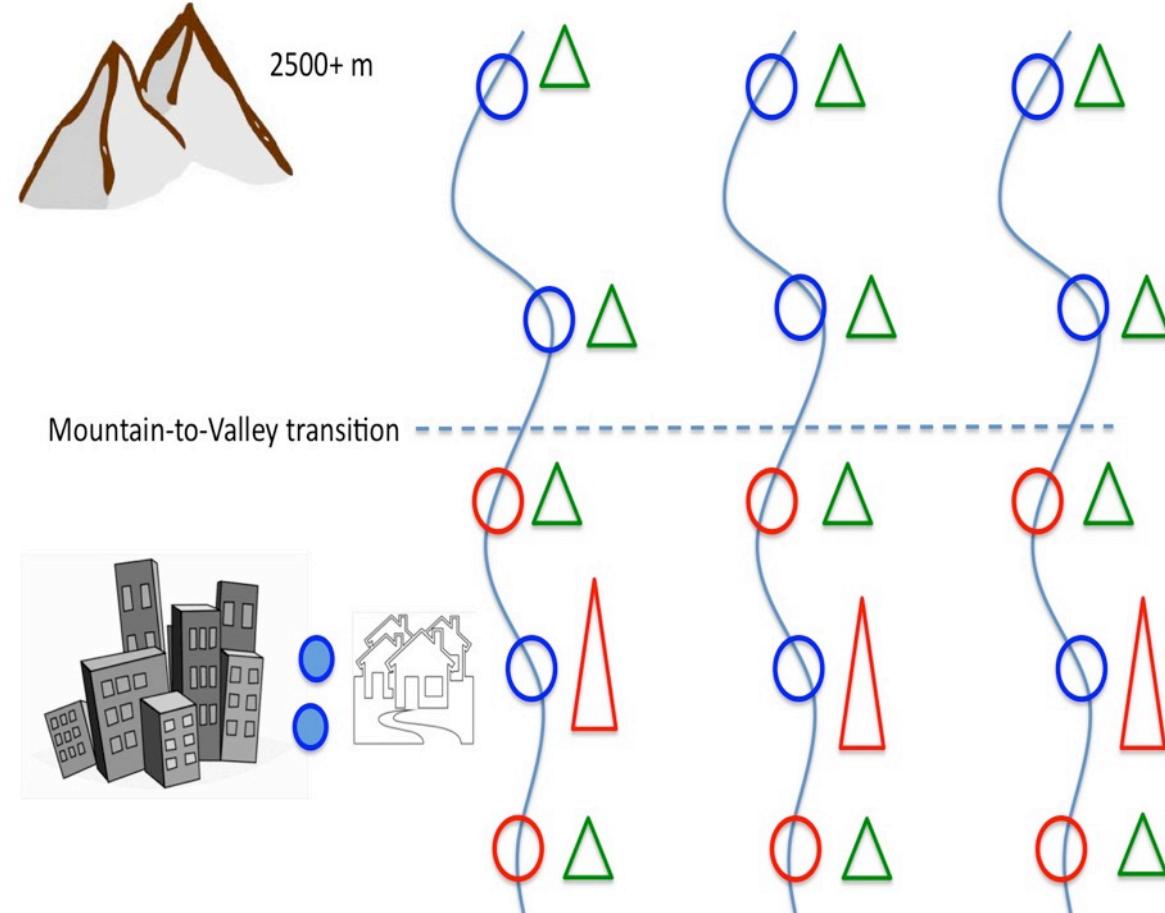
Available storage will be expanded in subsequent years

The Larger Utah EPSCoR Cyberinfrastructure Picture



What is the design of a cyberinfrastructure that enables standardized data collection and management for a network of aquatic and terrestrial monitoring sites managed by a consortium of disparate organizations?

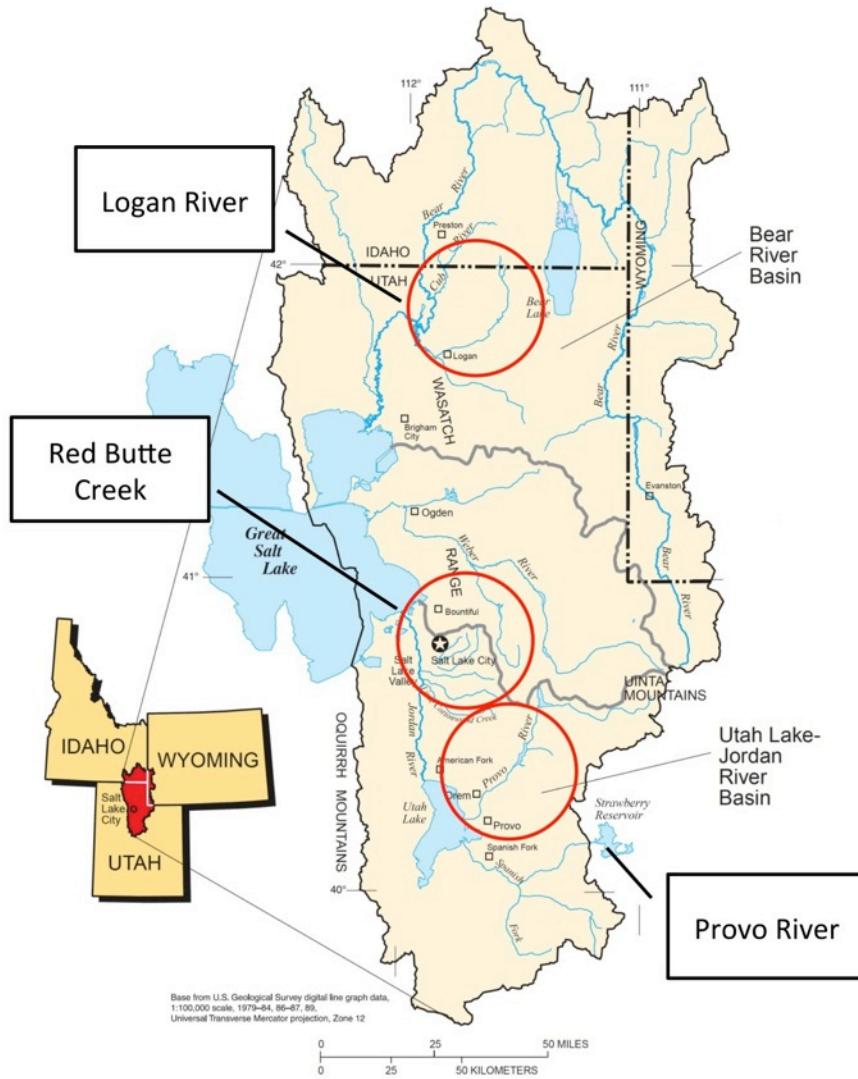
Gradients Along Mountain to Urban Transitions (GAMUT) Network



- Sensor network developed between USU/UofU/BYU
- Mix of aquatic and terrestrial *in situ* and re-locatable sensors
- Measure aspects of water inputs and outputs and water quality over gradient
- Deployed in three watersheds



Gradients Along Mountain to Urban Transitions (GAMUT) Network



- 3 watersheds have similar water source (high elevation snow) but different land use transitions
- Logan River: irrigated agriculture transitioning to moderate density urban at moderate pace
- Red Butte Creek: highly urbanized
- Provo River: irrigated agriculture transitioning to low density urban at rapid pace

Gradients Along Mountain to Urban Transitions (GAMUT) Network



Table 1. Parameters to be measured by the iUTAH Climate and Ecohydrology Sensor Network.

	Fundamental Suite	Enhanced/Urban Suite
Terrestrial Sensors	Barometric pressure Wind speed and direction Air temperature Relative humidity Precipitation Snow depth Soil temperature, moisture, conductivity Solar radiation (net radiation and PAR)	Barometric pressure Wind speed and direction Air temperature Relative humidity Precipitation Snow depth Soil temperature, moisture, conductivity Solar radiation (net radiation and PAR)
Aquatic Sensors	Stream stage Temperature Electrical Conductivity pH Dissolved oxygen Turbidity	Stream stage Temperature Electrical Conductivity pH Dissolved oxygen Turbidity Total algae (chlorophyll a + phycocyanin) fDOM Nitrate



Challenges to Managing Sensor Data

- Volume of data
- Data heterogeneity
- Multiple watersheds
- Multiple institutions
- Scale
- Synchronize timing, data access, equipment tracking
- Standardize data QA/QC

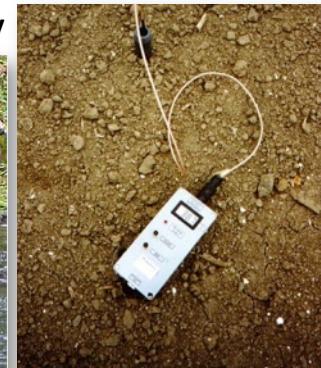
Rainfall and Meteorology



Water quantity



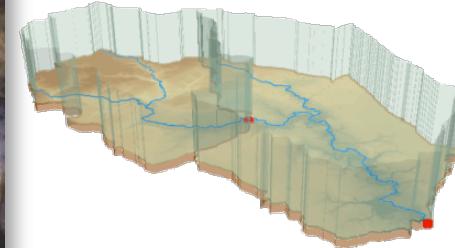
Soil water



Water quality



GIS



Groundwater



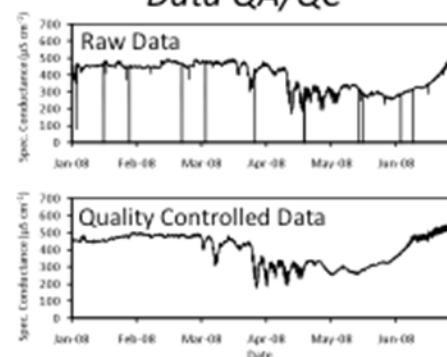
Cyberinfrastructure

Data Storage

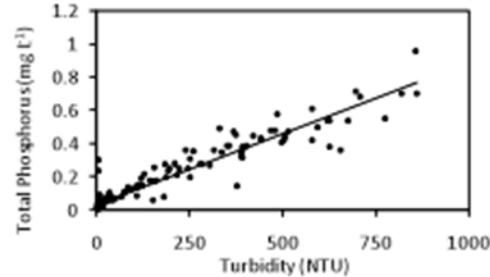
- Data Loading
- Data Manipulation
- Data Publication



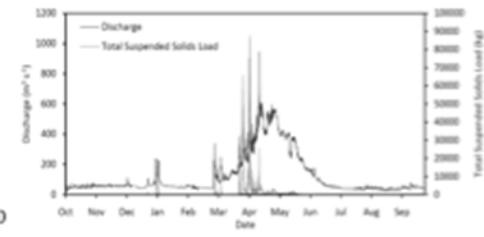
Data QA/QC



Estimation of Discharge and Concentration from Surrogates



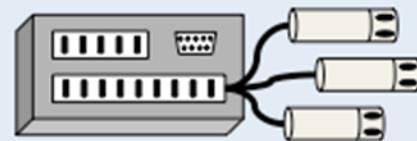
Data Visualization and Analysis



Tier 1: Sensors and Monitoring

Sensor Nodes

- Stream gauging
- Surrogate observations

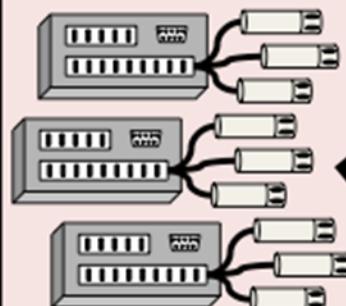


Periodic Monitoring

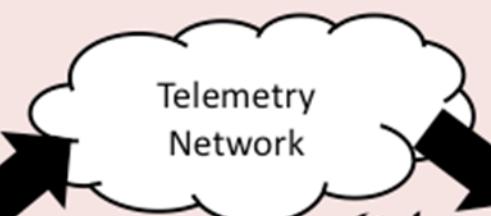
- Water quality sampling
- Discharge measurements



Tier 2: Communication



Sensor Nodes



Base Station Computer



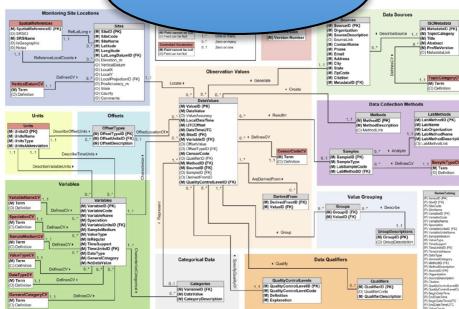
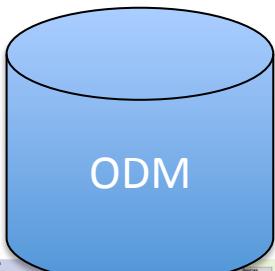
- Monitor Sensor Node Status
- Retrieve Data



HydroServer

CUAHSI Open Source Hydrologic Data Tools

Observations Data Model



ODM Data Loader

ODM Streaming Data Loader

ODM Tools

WaterOneFlow and WaterML

CUAHSI Web Services for Observations Databases Help Pages

This web page describes CUAHSI WaterOneFlow web services developed to provide access to data from the **YOUR SITE HERE** as the **YOUR SITE HERE** for demonstration purposes. These are Developmental prototype web services subject to change and should not be relied upon to be static or persistent.

- Installation
- Configuration (restricted to localhost)
- Database Test Page

Service Description.

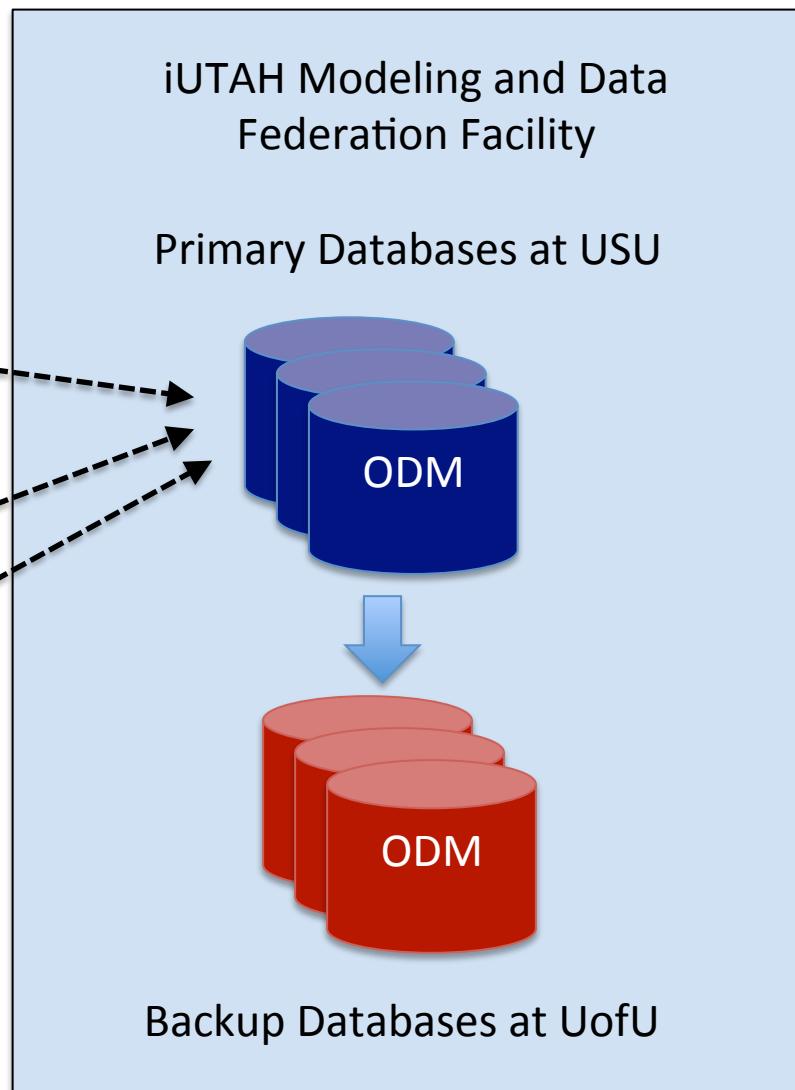
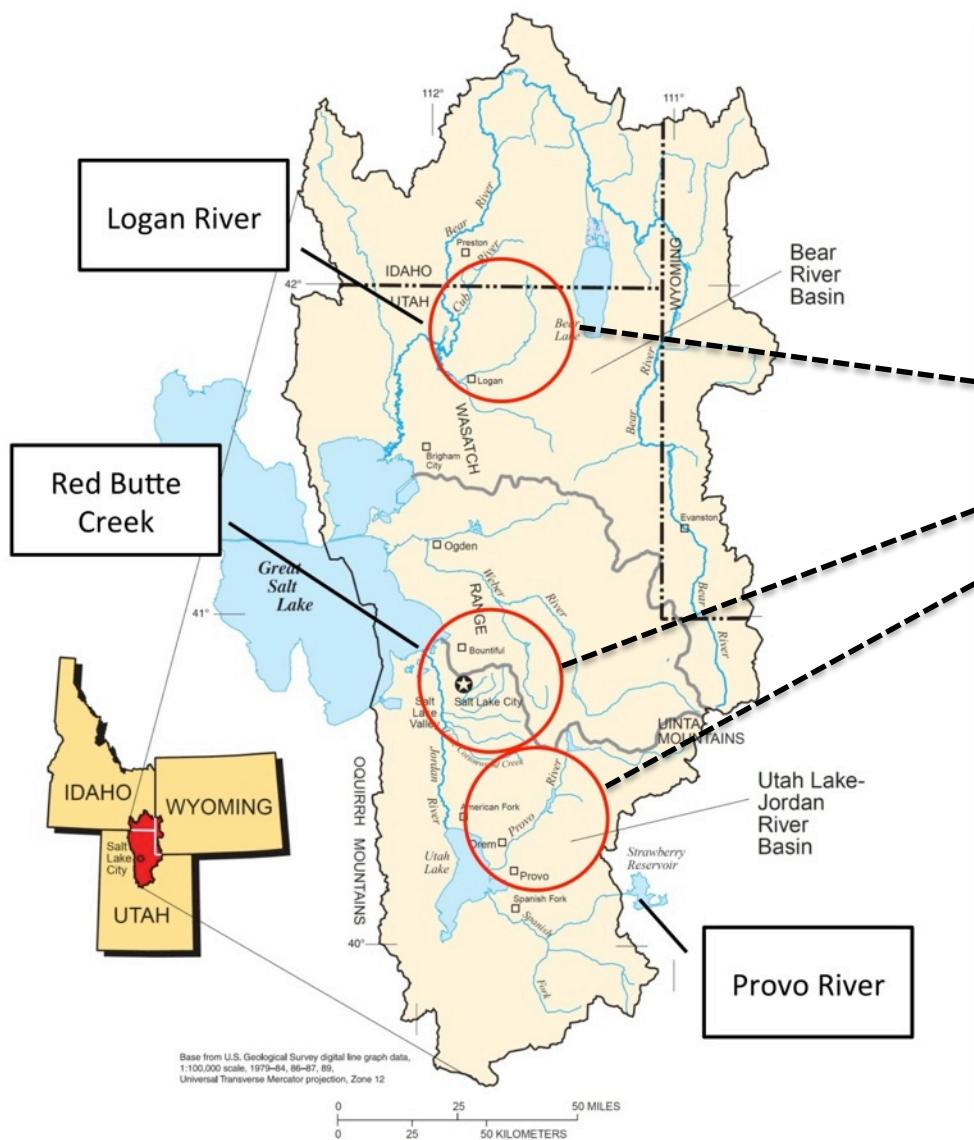
The service is found at http://hs02.usu.edu/LittleBearRiver/cuahsi_1_0.asmx.
The following services are supported. For a formal definition, please review the [Service Description](#).

- GetSiteInfo
Given a site number, this method returns the site's metadata. Send the site code in this format: 'LittleBearRiver:SiteCode' or to retrieve by internal database identifier, send the code 'BYID:siteId'
- GetSiteInfoByObject
Given a site number, this method returns the site's metadata. Send the site code in this format: 'LittleBearRiver:SiteCode' or to retrieve by internal database identifier, send the code 'BYID:siteId'
- GetSiteInfoByName
Given a site name, this method returns the site's metadata. Pass the site name in this format: 'LBR:SiteName' or to retrieve by internal database identifier, send the code 'BYID:siteId'
- GetVariableInfo
Given a variable code, this method returns the variable's name. Pass in the variable in this format: 'LBR:VariableCode' or to retrieve by internal database identifier, send the code 'BYID:variableId'
- GetVariableInfoByName
Given a variable code, this method returns the variable's siteName. Pass in the variable in this format: 'LBR:VariableCode' or to retrieve by internal database identifier, send the code 'BYID:variableId'
- GetValues
Given a site number, a variable, a start date, and an end date, this method returns a time series. Pass in the sitecode and variable in this format: 'LittleBearRiver:SiteCode and LBR:VariableCode'
- GetValuesByName
Given a site number, a variable, a start date, and an end date, this method returns a time series. Pass in the sitecode and variable in this format: 'LittleBearRiver:SiteCode and LBR:VariableCode'
- GetSites
Given an array of site numbers, this method returns the site metadata for each one. Send the array of site codes in this format: 'LittleBearRiver:SiteCode or BYID:siteId' to retrieve by the internal database identifier, siteId
- GetSitesXML
Given an array of site numbers, this method returns the site metadata for each one. Send the array of site codes in this format: 'LittleBearRiver:SiteCode or BYID:siteId' to retrieve by the internal database identifier, siteId.



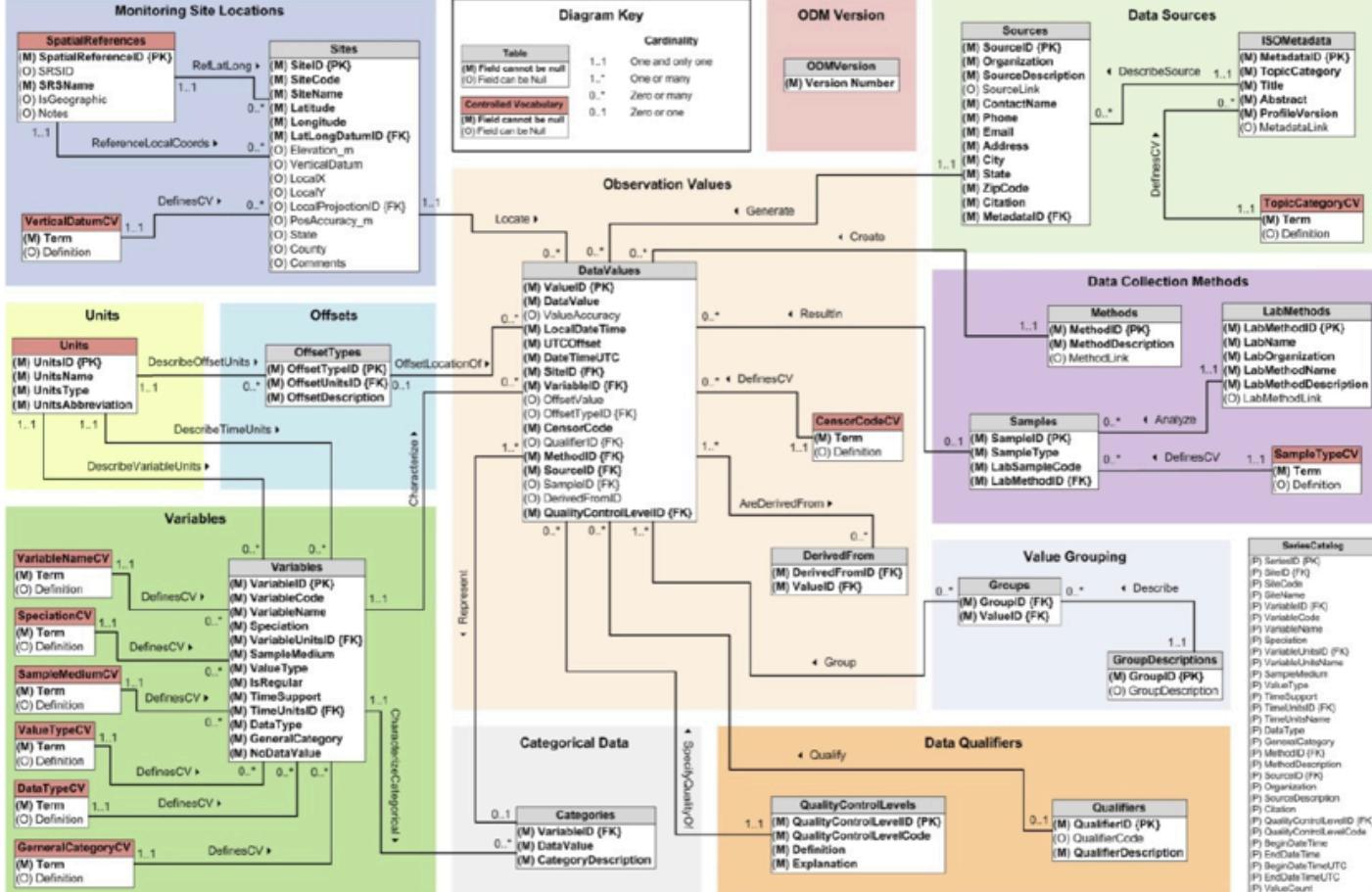
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Data Loading and Storage

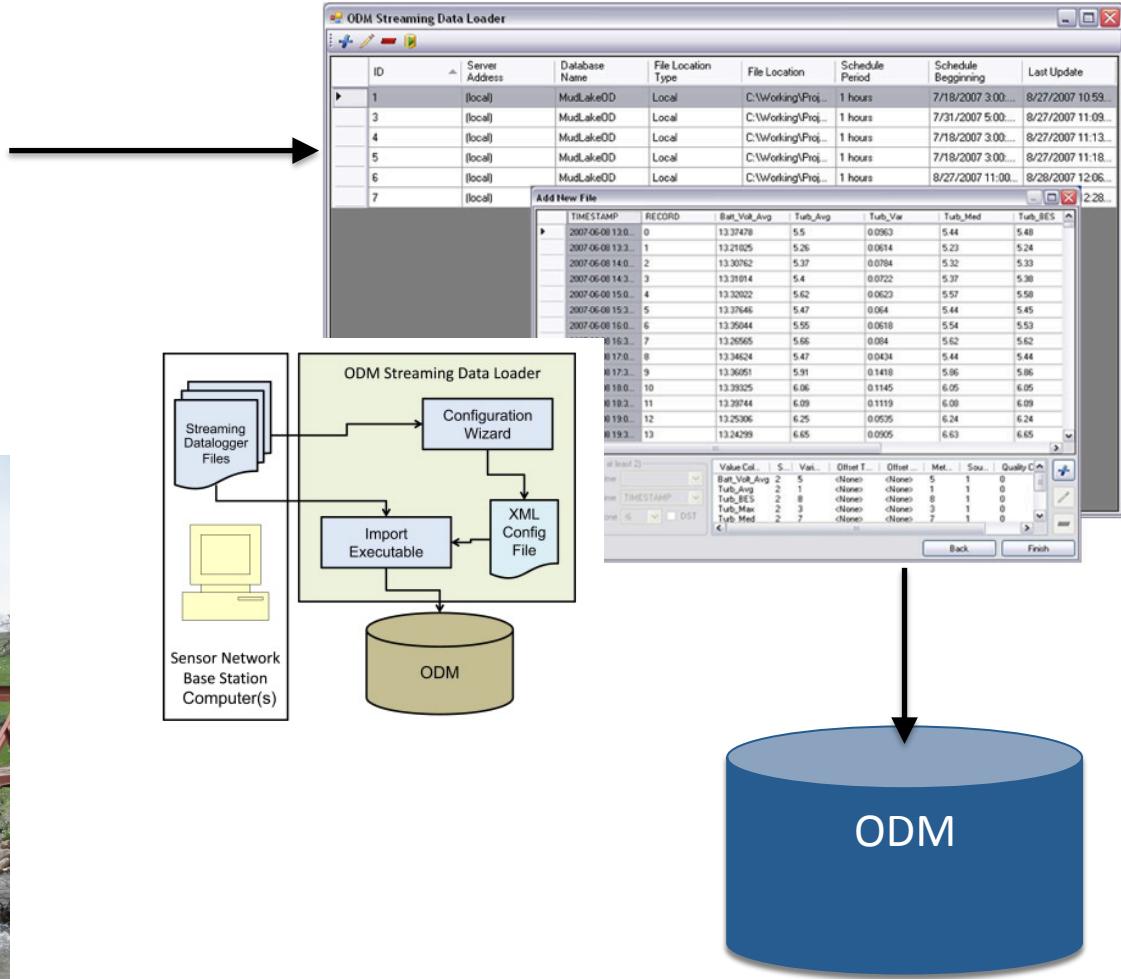
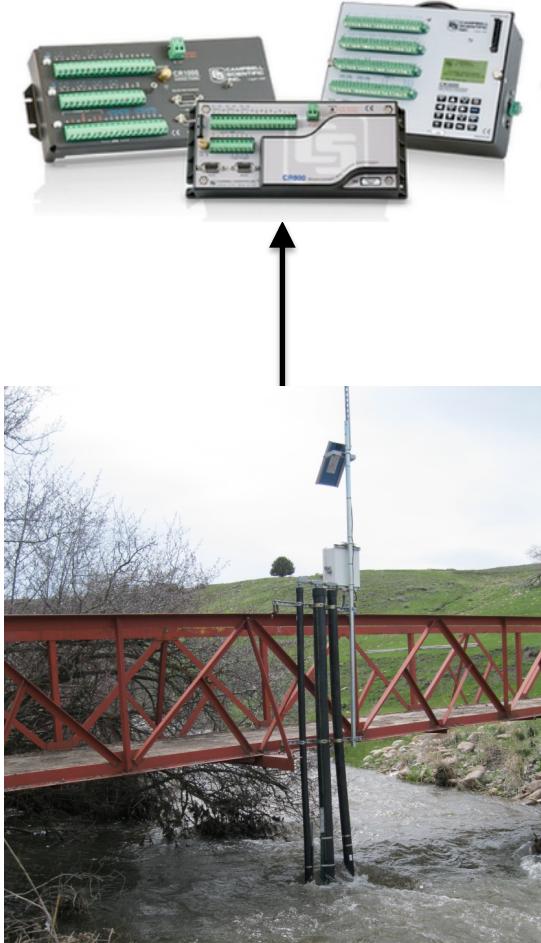


Data Loading and Storage

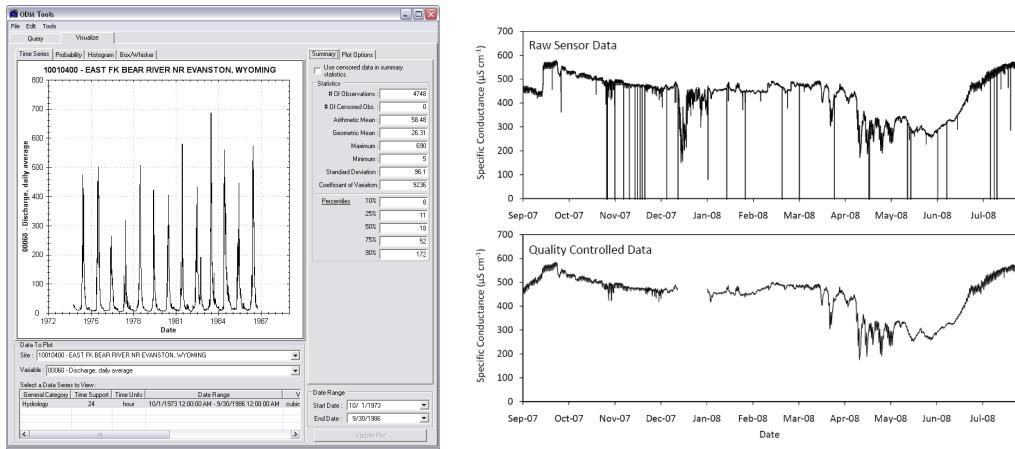
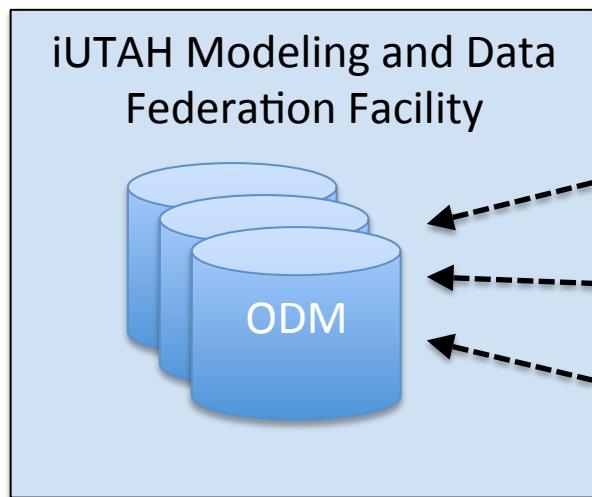
- Observations Data Model (ODM): relational database at the single observation level
- Metadata for unambiguous interpretation
- Traceable heritage from raw measurements to usable information
- Promote syntactic and semantic consistency
- Cross dimension retrieval and analysis



Loading Data Streams



Data Visualization and Management



ODM Tools

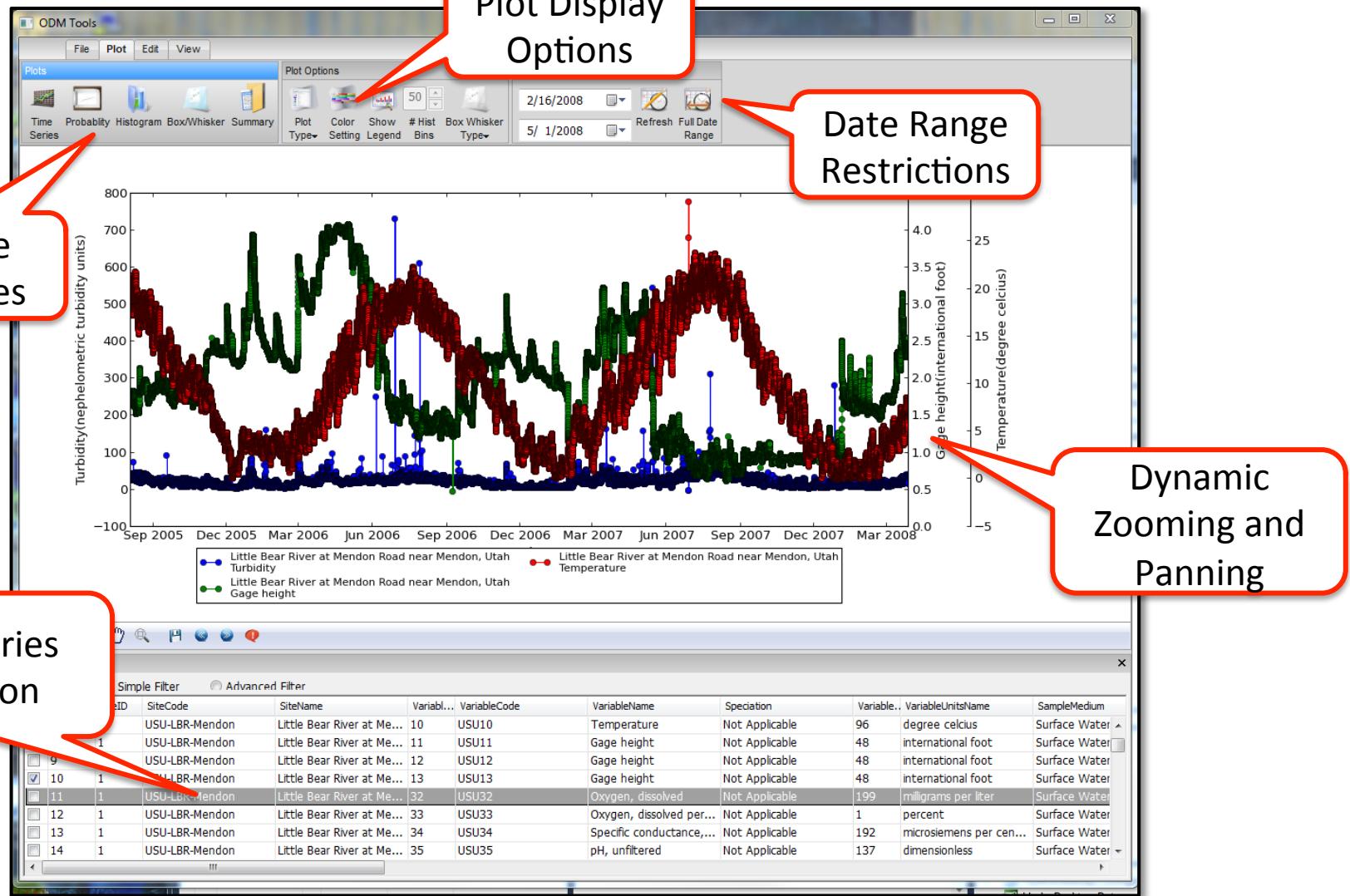
Remote Data
Managers



BYU
BRIGHAM YOUNG
UNIVERSITY

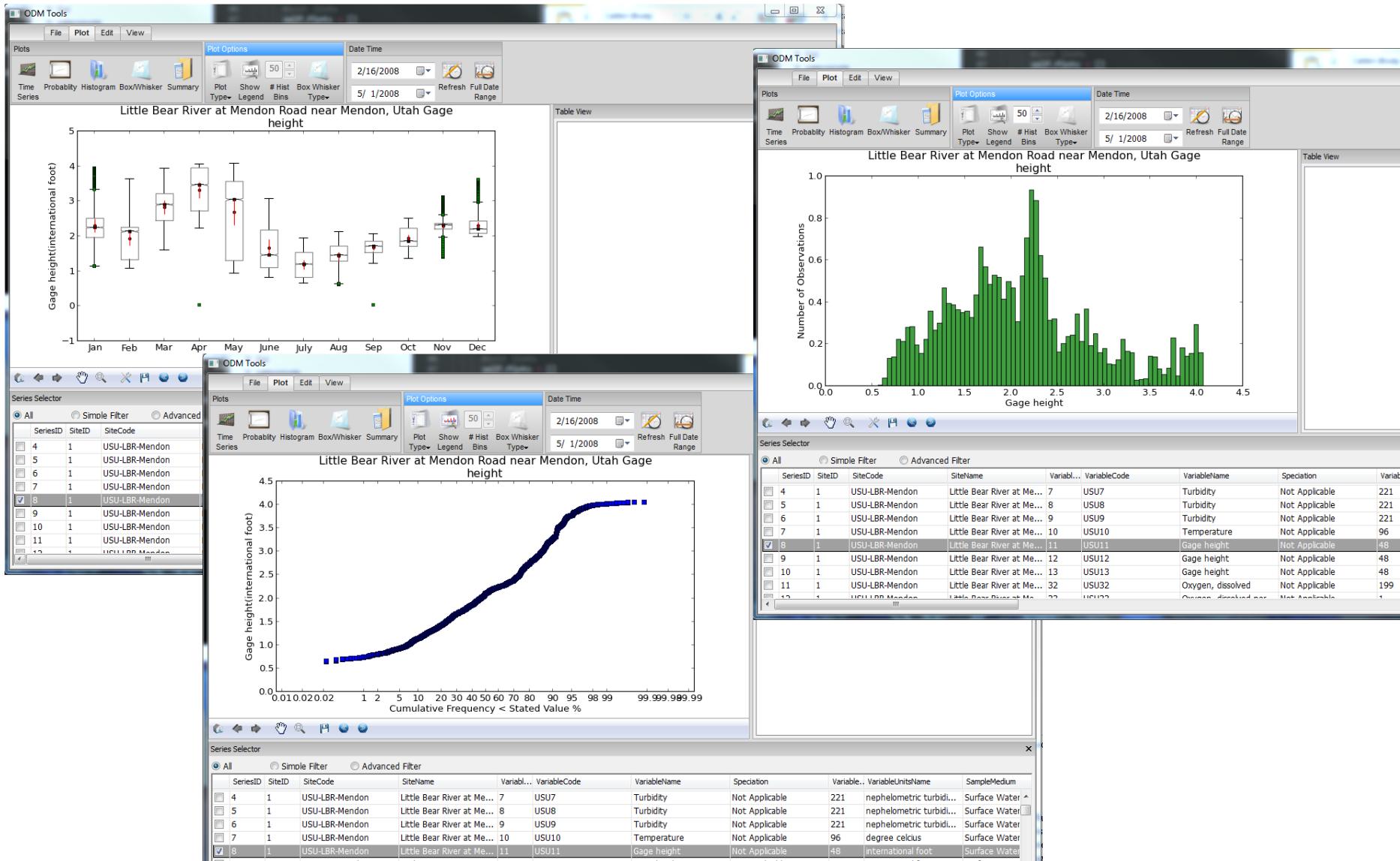
ODM Tools Python

Data Visualization and Management



ODM Tools Python

Multiple Plot Types



ODM Tools Python

Time Series Selection and Filtering

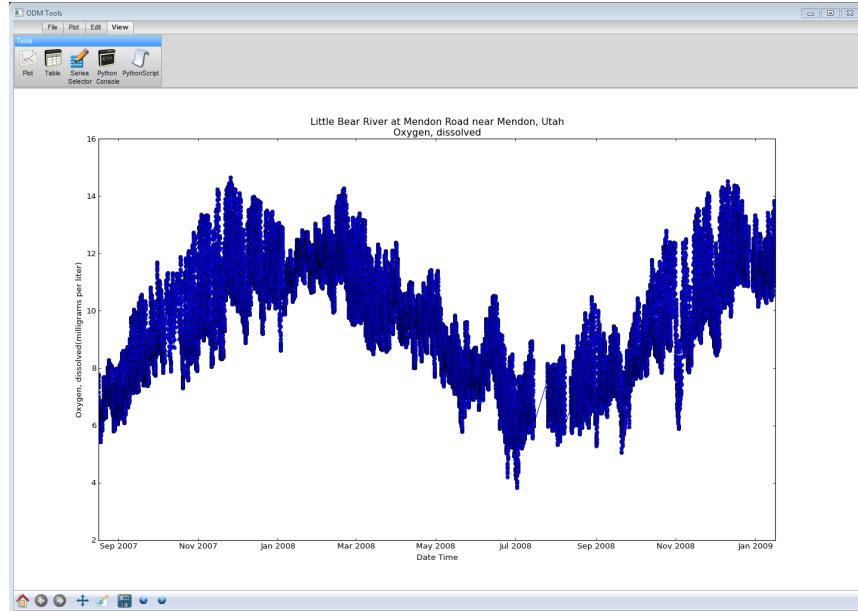
The screenshot displays the ODM Tools Python application interface, which includes a main window for plotting time series data and a separate Query Builder window.

Main Window: Shows a plot titled "Little Bear River at Mendon Road near Mendon, Utah" with "Gage height" on the Y-axis (ranging from 1.5 to 4.5) and "Date Time" on the X-axis (from 2006 to 2007). The plot shows a highly variable time series. A red box labeled "Filters on Data Series" points to the "Series Selector" table below the plot. A red arrow points from the "Build Query" button in the Query Builder window to the "SiteName" field in the "Field Names" list.

Query Builder Window: Contains a "Field Names" list and a "Unique Values" list. The "Field Names" list includes SiteName, SiteCode, Latitude, Longitude, VariableName, VariableCode, DataType, ValueType, and Speciation. The "Unique Values" list shows "Little Bear 11" and "Little Bear River at M". Below these are buttons for Is Null, Is Not Null, >=, <=, Like, Get Unique Values, And, Or, and Not. A SQL query editor at the bottom contains the command: `SELECT * FROM [Attributes] WHERE [SiteName] = 'Little Bear 11'`. A "Commit" button is located at the bottom right.

Series Selector Table: A table listing data series with columns: SeriesID, SiteID, SiteCode, SiteName, Variable..., VariableCode, VariableName, and Speciation. Row 8 is selected (indicated by a checked checkbox). A context menu is open over this row, showing options: Plot, Edit, Export Data, and Export MetaData. A red box labeled "Export Data Series" points to the "Export Data" option in the menu.

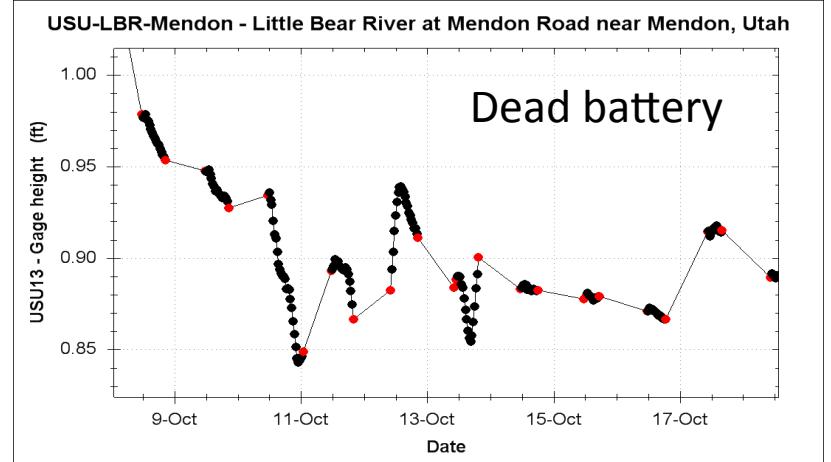
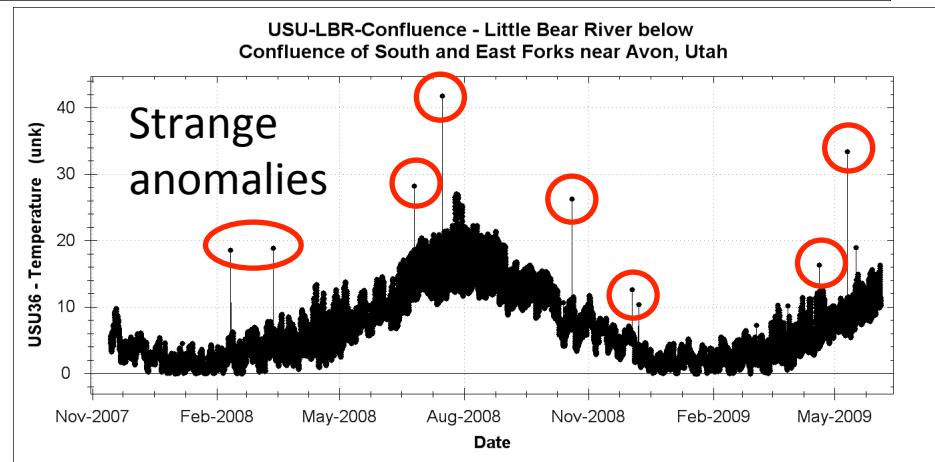
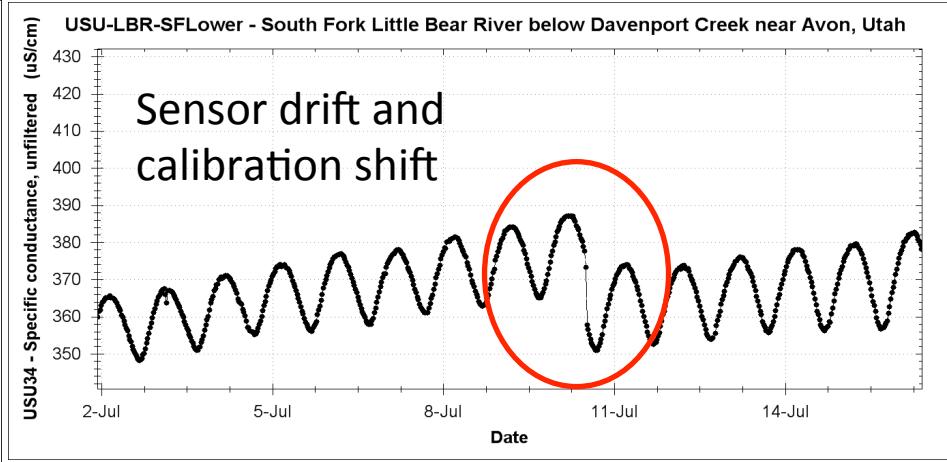
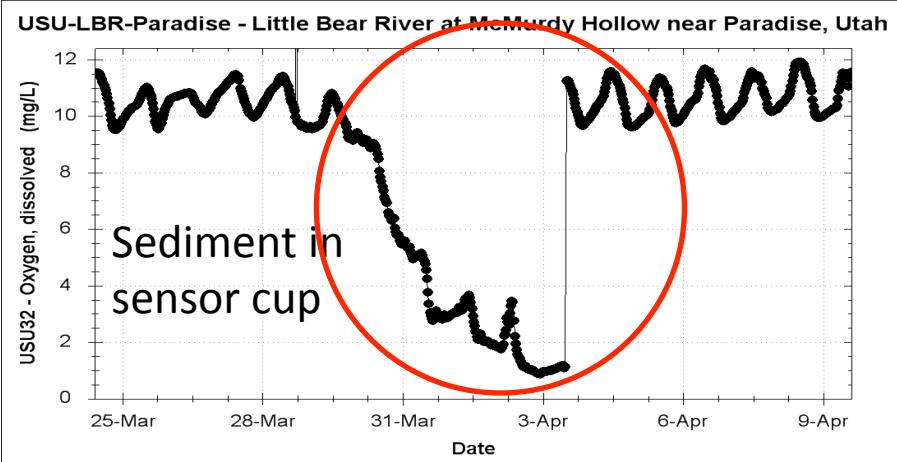
ODM Tools Python Dockable Windows



ValueID	DataValue	Val...	LocalDateTime	UT...	DateTimeUTC	Sit...	Va...	Of...	O
8607706	4.00045970149		2008-07-02 07:30:00	-7.0	2008-07-02 14:30:00	1	32		
8615287	4.25681459701		2008-07-01 07:30:00	-7.0	2008-07-01 14:30:00	1	32		
8616334	4.23571177612		2008-07-02 05:30:00	-7.0	2008-07-02 12:30:00	1	32		
8619129	4.33288192537		2008-07-02 01:30:00	-7.0	2008-07-02 08:30:00	1	32		
8619782	4.4006091194		2008-07-02 03:00:00	-7.0	2008-07-02 10:00:00	1	32		
8619818	4.4100449403		2008-07-01 05:00:00	-7.0	2008-07-01 12:00:00	1	32		
8620012	4.36762985075		2008-07-02 03:30:00	-7.0	2008-07-02 10:30:00	1	32		
8620220	3.83081343284		2008-07-02 08:00:00	-7.0	2008-07-02 15:00:00	1	32		
8622377	3.89308523881		2008-07-02 06:30:00	-7.0	2008-07-02 13:30:00	1	32		
8622441	4.49635820896		2008-07-01 04:30:00	-7.0	2008-07-01 11:30:00	1	32		
8625349	4.58550746269		2008-07-02 00:30:00	-7.0	2008-07-02 07:30:00	1	32		
8625395	4.59515373134		2008-07-02 00:00:00	-7.0	2008-07-02 07:00:00	1	32		
8625705	4.2038311791		2008-06-25 06:30:00	-7.0	2008-06-25 13:30:00	1	32		
8626475	4.62864941791		2008-07-03 04:30:00	-7.0	2008-07-03 11:30:00	1	32		
8627214	4.66996268657		2008-07-03 04:00:00	-7.0	2008-07-03 11:00:00	1	32		
8627341	4.66188076119		2008-07-03 02:00:00	-7.0	2008-07-03 09:00:00	1	32		
8628198	4.28373167164		2008-07-01 05:30:00	-7.0	2008-07-01 12:30:00	1	32		
8630093	4.78889435821		2008-07-02 10:00:00	-7.0	2008-07-02 17:00:00	1	32		
8630222	4.37667031343		2008-07-02 04:30:00	-7.0	2008-07-02 11:30:00	1	32		
8634141	4.93983449254		2008-06-30 07:30:00	-7.0	2008-06-30 14:30:00	1	32		
8634276	4.48706534328		2008-06-25 05:00:00	-7.0	2008-06-25 12:00:00	1	32		

Series Selector								
<input type="radio"/> All	<input type="radio"/> Simple Filter	<input type="radio"/> Advanced Filter						
<input type="checkbox"/>	SeriesID	SiteID	SiteCode	SiteName	Variable...	VariableCode	VariableName	Speciation
<input type="checkbox"/>	12	1	USU-LBR-Mendon	Little Bear River at Me...	13	USU13	Gage height	Not Applicable
<input type="checkbox"/>	13	1	USU-LBR-Mendon	Little Bear River at Me...	13	USU13	Gage height	Not Applicable
<input type="checkbox"/>	14	1	USU-LBR-Mendon	Little Bear River at Me...	13	USU13	Gage height	Not Applicable
<input checked="" type="checkbox"/>	15	1	USU-LBR-Mendon	Little Bear River at Me...	32	USU32	Oxygen, dissolved	Not Applicable
<input type="checkbox"/>	16	1	USU-LBR-Mendon	Little Bear River at Me...	32	USU32	Oxygen, dissolved	Not Applicable
<input type="checkbox"/>	17	1	USU-LBR-Mendon	Little Bear River at Me...	33	USU33	Oxygen, dissolved per...	Not Applicable
<input type="checkbox"/>	18	1	USU-LBR-Mendon	Little Bear River at Me...	34	USU34	Specific conductance	Not Applicable

Sensor Data Quality Control



ODM Tools Python Sensor Data Quality Control

The screenshot displays the ODM Tools Python application interface, which integrates data visualization, editing tools, and scripting capabilities.

Data Editing Tools: Located in the top menu bar under "Edit Functions".

Dynamic Data Editing Display: A line graph titled "Little Bear River at Paradise, Utah Gage height" showing water level fluctuations over time from December 2007 to April 2008. A red box highlights the graph area.

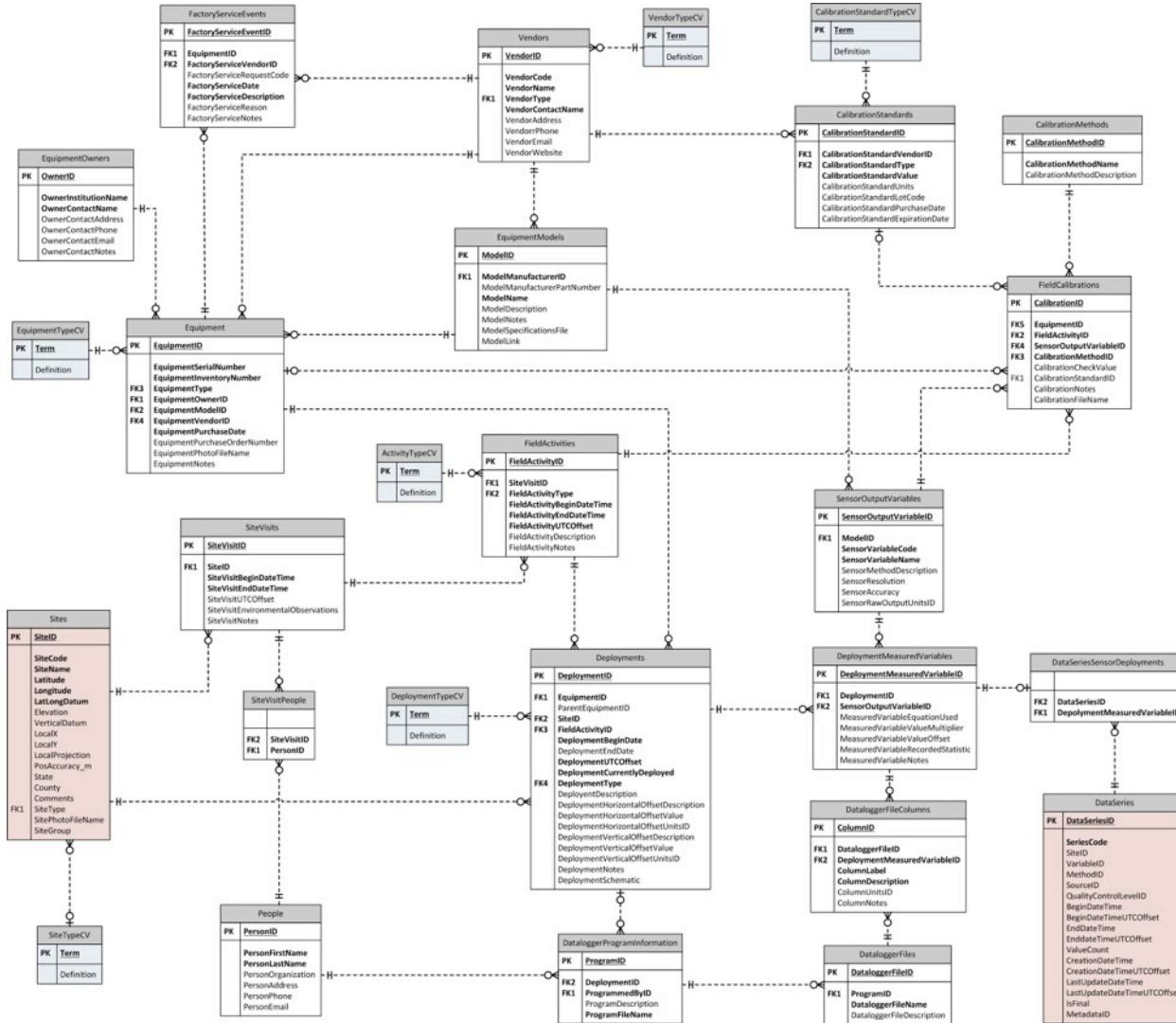
Python Code Console: A window showing a Python script for editing a data series. The script uses the `EditService` class to filter values greater than 8 for series ID 171. A red box highlights the code.

Python Script Editor: A window showing a partial Python script for testing. It imports `EditService`, connects to a database, and filters a series by value. A red box highlights the editor area.

Series Selector: A table listing sensor series details, including SiteID, SiteName, VariableCode, and VariableName.

SeriesID	SiteID	SiteCode	SiteName	VariableCode	VariableName	Speciation	VariableUnitsName	SampleM
165	11	USU-LBR-Confluence	Little Bear River below...	36	USU36	Temperature	Not Applicable	96
166	11	USU-LBR-Confluence	Little Bear River below...	39	USU39	Phosphorus, total as P	P	199
167	11	USU-LBR-Confluence	Little Bear River below...	40	USU40	Phosphorus, total as ...	P	199
168	11	USU-LBR-Confluence	Little Bear River below...	41	USU41	Solids, total Suspended	Not Applicable	199
169	12	10105900	Little Bear River at Pa...	42	USU42	Gage height	Not Applicable	48
170	12	10105900	Little Bear River at Pa...	43	USU43	Discharge	Not Applicable	35
171	12	10105900	Little Bear River at Pa...	42	USU42	Gage height	Not Applicable	48

Equipment Management



- Track physical infrastructure: sensors, data loggers, batteries, etc.
- Track events: deployments, calibrations, site visits, factory servicings, etc.
- Connects to ODM where streaming data is stored
- Web interface

Equipment Details

|
[View full equipment details](#)
[Edit Description](#)[Delete](#)

Equipment Description

Equipment ID: 9999999999

Serial Number: 9999999999

Model Name: DTS-12

Description: Forest Technology Systems DTS-12 Digital Turbidity Sensor

Purchase Date: 1/20/2013

Notes: Measures water turbidity and water temperature.

Link: <http://www.ftsenvironmental.com/products/sensors/dts12/>

Owner Institution: Utah State University

Owner Contact: Michelle Baker

Owner Address: 5305 Old Main Hill, Logan, UT 84322-5305

Owner Phone: 1.435.797.7131

Email: michelle.baker@usu.edu

Manufacturer

Vendor Name: Forest Technology Systems

Contact Name: Someguy Thatworksthhere

Address: 1123 Fir Avenue, Suite C., Blaine, WA, 98230

Phone: 1.800.548.4264

Email: sales@ftshydrology.com

Web Address: <http://www.ftsenvironmental.com/>

Vendor

Vendor Name: Forest Technology Systems

Contact Name: Someguy Thatworksthhere

Address: 1123 Fir Avenue, Suite C., Blaine, WA, 98230

Phone: 1.800.548.4264

Email: sales@ftshydrology.com

Web Address: <http://www.ftsenvironmental.com/>

[View Deployment History](#)[View Factory Service History](#)[View Calibration History](#)

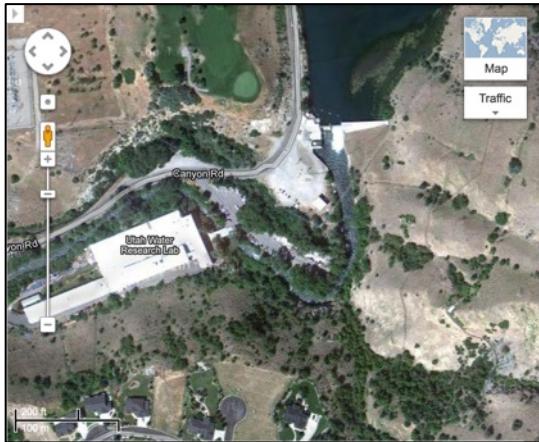


Site Visit Details | [View full site visit details](#)

[Edit Description](#)

[Delete](#)

[View Full Site Visit History for this Site](#)



Site Visit Location

Site Code: USU-LR-UWRL

Site Name: Logan River at the Utah Water Research Laboratory

Latitude: 43

Longitude: -111

Elevation: 4355 m

Site Visit Description

Crew: Jeff Horsburgh, Amber Jones

Begin Date Time: 2/22/2013 1:00 PM MST

End Date Time: 2/22/2013 2:00 PM MST

Environmental Observations: The weather was sunny. The river was low. Water was clear.

Site Visit Notes: None.

Field Activities Performed (click the activity type to view details)

Activity Type	Begin Date/Time	End Date/Time	Description	Notes
Calibration	2/22/2013 1:00 PM MST	2/22/2013 1:10 PM MST	Sensor Calibration	None
Deployment	2/22/2013 1:30 PM MST	2/22/2013 2:00 PM MST	Sensor Deployment	None

[Sites](#)[Manage Sites](#)[Site Visits](#)[Manage Visits](#)[Equipment](#)[Manage equipment](#)[Reports](#)[Generate Reports](#)

Calendar | Click on activities to view details



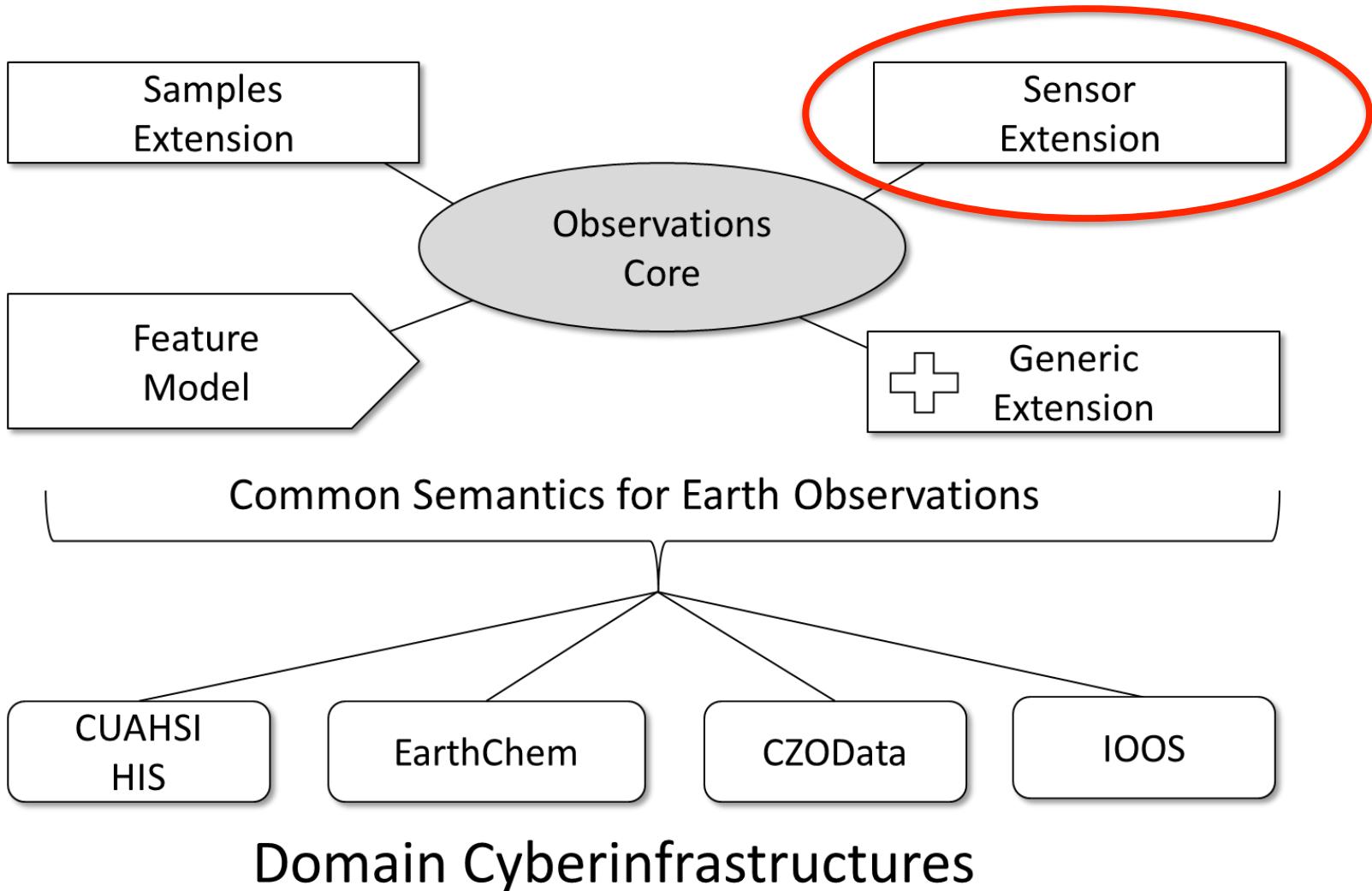
February ▼

2013 ▼

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
			Logan River Site1			
	Red Butte Creek Site3	Logan River Site2	Red Butte Creek Site1			
			Provo River Site1	Logan River Site3		
	Red Butte Creek Site2		Provo River Site1			

Display: Site Visits Factory Service Events

ODM2



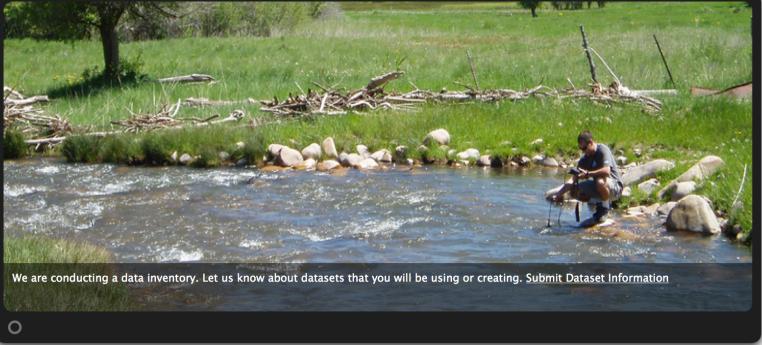
How can we enable and increase collaborative research and sharing of data and models through the innovative use of cyberinfrastructure?

iUTAH Modeling and Data Federation

data.iutahepscor.org

iUTAH EPSCoR innovative Urban Transitions and Aridregion Hydro-sustainability

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We are conducting a data inventory. Let us know about datasets that you will be using or creating. Submit Dataset Information

The iUTAH Modeling and Data Federation is an online system for sharing data, models, and other digital resources. Activities of the iUTAH Cyberinfrastructure Team (CI Team) are focused on developing hardware and software systems and tools that improve iUTAH participants' capacity for data collection, organization, management, sharing, synthesis to higher-level products, and integration with models.

Announcements

Data Inventory: As an initial step in developing the iUTAH Modeling and Data Federation, we are conducting a survey of existing and planned datasets. [Click here](#) to submit dataset information to the iUTAH data inventory or view the list of datasets that have been submitted.

Model Inventory: We are collecting information about models from a variety of disciplines that may be of interest to your iUTAH-related research. [Click here](#) to submit model information to the iUTAH data inventory or view the list of models that have been submitted.

[iUTAH Homepage](#) [Data Inventory](#) [About](#)
[Utah EPSCoR](#) [Model Inventory](#) [Hardware Development](#)
[CI-WATER EPSCoR](#) [Year 1 Scope of Work](#) [Software Development](#)

This project is funded through EPS - 1208732. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



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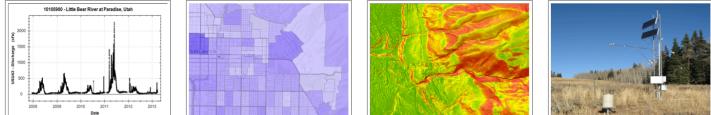
Software Development

UTAH Modeling and Data Federation

The beginnings of the iUTAH Modeling and Data Federation have been implemented at <http://data.iutahepscor.org>. This website will continue to be fleshed out as we develop new functionality over the next couple of years.

Data and Model Inventories

The iUTAH research teams will be developing new datasets and models to support iUTAH's research goals. However, there will also be extensive reuse of existing data resources and models from many different sources. The CI Team is developing tools that will help facilitate the process of identifying existing datasets and models that may be useful to the iUTAH efforts. For example, we are compiling a database of metadata describing existing and planned data resources. iUTAH participants can access an online metadata submission form via <http://data.iutahepscor.org> to submit metadata describing datasets that they know about. Users can also view details of datasets that have been submitted by others. The database of metadata that we compile will enable us to both prioritize efforts for providing access to specific datasets through the iUTAH Modeling and Data Federation and will serve as an initial corpus of data that we can use to develop data discovery and access services needed by iUTAH partners.



Sensor Data Management

One of the immediate goals of the iUTAH CI team is to support management of the streaming sensor data from the iUTAH aquatic and terrestrial monitoring sites that will be installed as the GAMUT network is built. The CI Team is assisting in the planning for telemetry connections to each of the iUTAH monitoring sites as well as implementing tools that will facilitate the automated loading of the streaming sensor data into relational databases where they can be more easily managed by the iUTAH watershed technicians and ultimately shared on the Internet. Much of the required sensor data management functionality is being implemented using existing tools from the CUAHSI Hydrologic Information System.



Extended Data Models

Model and Data Inventories

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Submit Dataset Information

Please complete this form with information about datasets that you will either be creating as part of the iUTAH project or from existing data sources. Required fields are indicated with a red star.

If you find would rather submit metadata about many datasets all at once, please download the [Microsoft Excel Template](#) and fill it out then email it to jeff.horsburgh@usu.edu or amber.jones@usu.edu and we will upload your file in bulk.

Data Inventory Submission

General Information About the Dataset

Dataset Title *

Please provide a descriptive title for the dataset.

Abstract *

Please provide a descriptive abstract.

Purpose

What is the purpose of the data? Why were they created?

Existing * Is the data existing or is this data that will be created by iUTAH?

Collection

iUTAH EPSCoR Modeling and Data Federation
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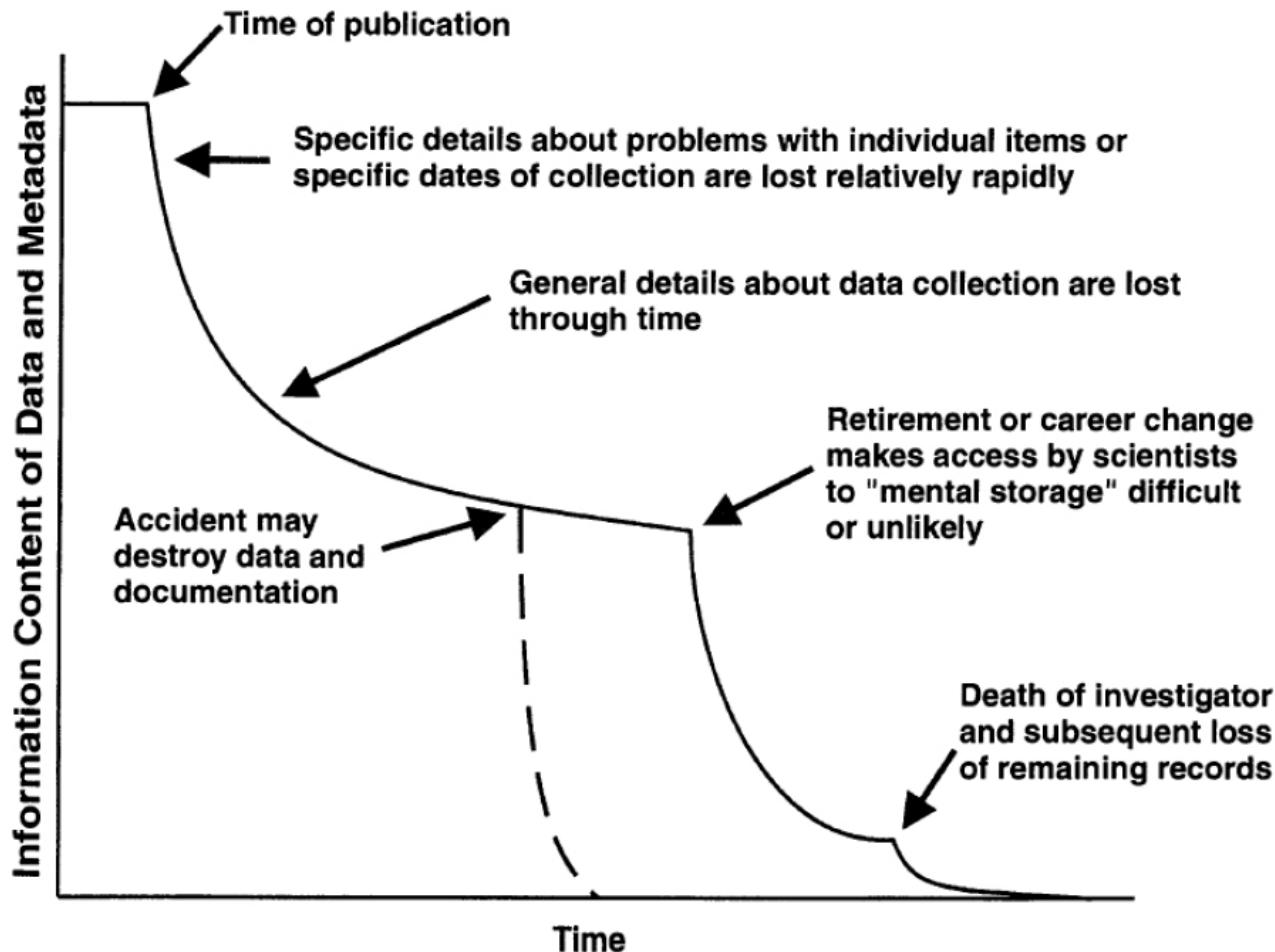
Submitted Datasets

Dataset Title	Abstract	Submitter
Little Bear River, UT Continuous Water Quality Data	The Utah Water Research Laboratory uses in situ sensors to monitor water quality and streamflow at several sites in the Little Bear River. These data have been collected from 2005 to present.	Amber Jones
Utah Division of Water Rights Water Use Records	The Utah Division of Water Rights maintains records of water diversion from surface and underground sources.	Amber Jones
Airborne Thermal Infrared Remote Sensing Bear River Basin, ID/WY/UT	In 2006, Pacifircorp and Trout Unlimited contracted with Watershed Sciences, Inc. to provide thermal infrared (TIR) and true color digital imagery of selected streams in the Bear River basin in Idaho, Wyoming, and Utah (Figure 1). Surveyed streams included the Bear River from Cutler Reservoir upstream to Cokeville, WY, Cub River, Thomas Fork/Salt Creek, and Smiths Fork/Hobble Creek. The data were successfully acquired from July 24–29, 2006, during the mid-afternoon hours (1:30 to 5:00 PM).	Jeff Horsburgh
State of Utah Geographic Information Database's (SGID) High Resolution Orthophotography	The Utah AGRC contracted Aero-Graphics to collect high resolution orthophotography of the Wasatch Front. Data collection occurred between March 28 and June 1 of 2012. Coverage includes 110 square miles of 12.5cm (~5 inch) resolution 4-band aerial photography imagery.	Amber Jones
Little Bear River, UT Meteorological Data	The Utah Water Research Laboratory operates four weather stations within the Little Bear River watershed. These stations have been collecting data from 2007 to present.	Amber Jones

UTAH EPSCoR This project is funded through EPS - 1208732. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Information Entropy



Example of the normal degradation in information content associated with data and metadata over time (“information entropy”).

Michener, W.K. (2006). Meta-information concepts for ecological data management, Ecological Informatics, 1(1), 3-7, <http://dx.doi.org/10.1016/j.ecoinf.2005.08.004>.

Information Content of Data and Metadata

What if instead?

Curated data
published in a data
repository

Data synthesized
and leads to
another publication

Paper using data is
published

Data annotated by
additional users

Time

Support for Sharing and Collaboration

- Collaboration
 - Datasets as shared “social objects”
 - Formation of collaborations
 - Social networking features
- Requirements
 - What data resources are available? (metadata catalog)
 - How do I get them? (search interface)
 - How can I share what I have? (data repository)

Accessing Agency and National Data Networks

- Challenges
 - Multiple sources, websites, systems
 - Multiple data formats, schemas, semantics
 - Building consistent metadata to support data discovery
 - Prioritizing where to allocate our resources
- Solutions
 - Partnerships!!!

Collaborative Data Sharing

cloudshare.iutahhepscor.org

The image shows two side-by-side browser windows. The left window displays the iUTAH cloud share login page at <https://cloudshare.iutahhepscor.org>. It features a logo with three white clouds above the text "iUTAH cloud share". Below the logo are two input fields labeled "Email" and "Password", and a "Log in" button. There is also a "remember" checkbox. The right window shows the file list for the user "Jeff" at <https://cloudshare.iutahhepscor.org/?app=files&dir=/>. The interface includes a header with "Files | iUTAH cloud share (Jeff)", a search bar, and navigation buttons for "iUTAH" and "New". The file list table has columns for Name, Size, and Modified. A single folder named "Data" is listed, with a size of 10.2 and a modified date of last month.

iUTAH cloud share – powered by ownCloud
This service provided by the
iUTAH Model & Data Federation

ownCloud

<http://owncloud.org/>

Data Publication in National Networks

- Collaboration with:
 - CUAHSI Data Center
 - HydroShare
 - NSF DataONE Network
- Focus: publishing data products in a way that they can be cited and easily accessed



HydroShare: Collaborative Sharing of Data and Models

- Collaboration environment and social media website
 - Social objects – data, models, digital content
 - HydroShare aims to change the way we do science
 - We are working to make collaboration easier
 - Sharing data
 - Sharing models and other research products
 - Providing new communication and social media capabilities
- 5 Year, \$5 Million collaboration among USU, RENCI, BYU, Purdue, U. Texas, San Diego Supercomputer Center, Tufts, U. of North Carolina Chapel Hill, U. of South Carolina



Support:
OCI 1148453



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

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RECENT ACTIVITY
LITTLE BEAR RIVER ODM
 Database 6/6/2012

LITTLE BEAR RIVER SHEETS
 6/6/2012

LITTLE BEAR RIVER EXCEL
 File 6/6/2012

WATERSHED DELINEATION
 Workflow 6/6/2012
MORE...**ALL ACTIVITY | ONLY MY ACTIVITY****ABSTRACT**

Time series of water quality sensor date in the Little Bear River, Utah, USA.

KEYWORDS

Temperature, Dissolved Oxygen, pH, Specific Conductance, Turbidity

ANNOUNCEMENTS**What's New at HydroShare**

Click [here](#) to visit the HydroShare blog to learn more about recent updates and new HydroShare features.

What's New at HydroShare

Click [here](#) to visit the HydroShare blog to learn more about recent updates and new HydroShare features.

**Jeff Horsburgh**
 Utah State University
jeff.horsburgh@usu.edu
RESOURCES YOU MAY LIKE**LITTLE BEAR RIVER SWAT MODEL**

Shared by: David Tarboton

**LITTLE BEAR RIVER DEM**

Shared by: David Tarboton

**LITTLE BEAR RIVER DEM**

Shared by: David Tarboton

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Type	Title	Date	Abstract
	Little Bear River ODM Database	6/6/2012	
	Little Bear River Sites	6/6/2012	
	Watershed Delineation Worflow	6/6/2012	
	Little Bear River SWAT Model	6/6/2012	
	Little Bear River DEM	6/6/2012	
	Little Bear River Excel File	6/6/2012	
	Little Bear River Word .doc	6/6/2012	

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LITTLE BEAR RIVER MONITORING SITES | Resource Details

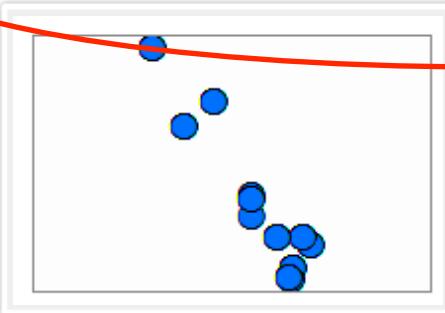
OPEN

SHARE

EXPORT

EDIT

DELETE



Resource Type: ESRI Shapefile



Created by: Jeff Horsburgh

Created: 6/10/2012

Keywords: observations catalog, data cart, little bear river, utah, CUAHSI, Water, Utah State University, Continuous Monitoring, Water Quality, Streamflow.

Size: 250 KB

Extent: Left: -111.95 Right: -111.79 Top: 41.73



Resource Description

Abstract: Utah State University is conducting continuous monitoring within the Little Bear River watershed of northern Utah, USA to investigate the use of surrogate measures such as turbidity in creating high frequency load estimates for constituents that cannot be measured continuously. This shapefile contains location of USU's continuous monitoring sites.

Citation: Horsburgh, J. S., D. K. Stevens, D. G. Tarboton, N. O. Mesner, A. Spackman Jones, and S. Gurrero, (2009), Monitoring data collected within the Little Bear River Experimental Watershed, Utah, USA, Utah State University.

COMMENTS



Jeff Horsburgh 11.11.12
This shapefile is really helpful if you want to know where my monitoring sites are located.



Jeff Horsburgh 11.21.12
Have you thought about re-writing the script so that it can access data using web services instead?

SIMILAR RESOURCES



LITTLE BEAR RIVER SITES
Shared by: Jeff Horsburgh



LITTLE BEAR RIVER ODM DATABASE
Shared by: Jeff Horsburgh



LITTLE BEAR RIVER DEM
Shared by: David Tarboton

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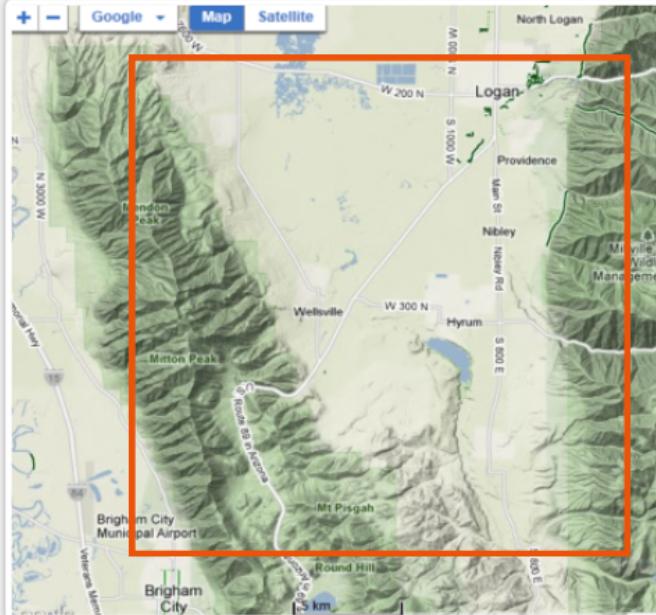
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Discover Resources[COLLABORATE](#)
Share with colleagues[SUPPORT](#)
Get Help**EXPLORE** | Discover and access resources published by others**KEYWORD:** Little Bear River[Search](#)[Hide Filters](#)

Resource Type: Geospatial dataset

Date: 1.1.2012 – 6.12.2012

Sort by: [Relevance](#) [Title](#) [Owner](#) [Rating](#) [Date](#)

- | | |
|--|-----------|
|  Title: Little Bear River Sites | 6.6.2012 |
| Shared by: Jeff Horsburgh | |
|  Title: Little Bear River DEM | 6.10.2012 |
| Shared by: David Tarboton | |
|  Title: National Land Cover Dataset | 6.10.2012 |
| Shared by: United States Geological Survey | |
|  Title: National Elevation Dataset | 6.10.2012 |
| Shared by: United States Geological Survey | |

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CREATE GROUP +

SEARCH GROUPS:

🔍

Groups You Created | Results



Name: Little Bear River Research Group

Description: This group is studying water quality in the Little Bear River, Utah, USA.

Created by: Jeff Horsburgh



Name: CUAHSI

Description: This group shares resources related to hydrologic science.

Created by: Rick Hooper



Name: Little Bear River Research Group

Description: This group is studying water quality in the Little Bear River, Utah, USA.

Created by: Jeff Horsburgh

GROUPS YOU MIGHT BE INTERESTED IN

Name: USU Hydrology Group

Created by: David Tarboton

[View Group](#)

Name: Little Bear River Junkies

Created by: Jeff Horsburgh

[View Group](#)

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Next Steps

- Accessing agency and national datasets
 - Developing tools for automatically accessing data
 - Partnerships with data providers
- Supporting data discovery and access across iUTAH and external data sources
 - Mediating across sources, formats, semantics
- Enhanced tools for collaboration and sharing of models and data
- Data publication within national networks
 - publishing data products in a way that they can be cited and easily accessed

iUTAH



EPSCoR

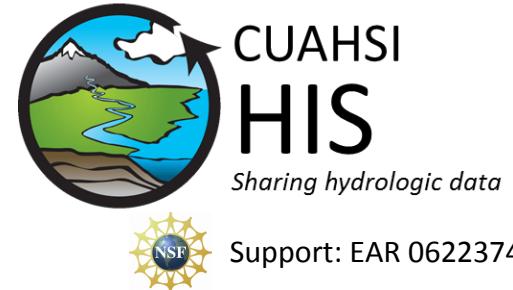


Support: EPS 1208732

Questions?

Jeff Horsburgh

jeff.horsburgh@usu.edu



Support: EAR 0622374