

# Utah Meeting Notes

(Recorded by Kevin Dressler)

## 08/23/04 – HIS Workshop

### *Review of HIS*

2-year project to develop an RFP for the Center for Hydrologic Information (like hydrologic synthesis centers) and perform preliminary research and prototyping for HIS

Years 3 and onwards all funds would be competitive  
Center for Hydrologic Information  
Hydroinformatics Thematic Centers

### Partners for CUAHSI HIS Proposal

SDSC  
Cal Berkeley  
Utah State  
Texas Austin  
CUAHSI  
Drexel  
Columbia  
Alabama  
South Carolina  
Virginia Tech  
Colorado State  
Duke  
Illinois

### Environmental Cyberinfrastructure

Special emphasis on environmental sciences fostered by Margaret Leinen  
CUAHSI HIS is one of several projects

### HIS

Analysis, Modeling, hypothesis testing  
Geospatial Data  
Will Facilitate Model Integration (e.g. Mesoscale, SVAT, Groundwater, Coupled Ocean-Atmosphere)

1. Assemble data from many sources
2. Integrate Data into a coherent structure
3. Do science

## Digital Watershed

An implementation of the CUAHSI Hydrologic Information Data Model for a particular hydrologic unit region

\*\*\*Internet Class Associated with the digital Watershed concept

HIS (Hydrologic Information System): <http://cuahsi.sdsc.edu/HIS>

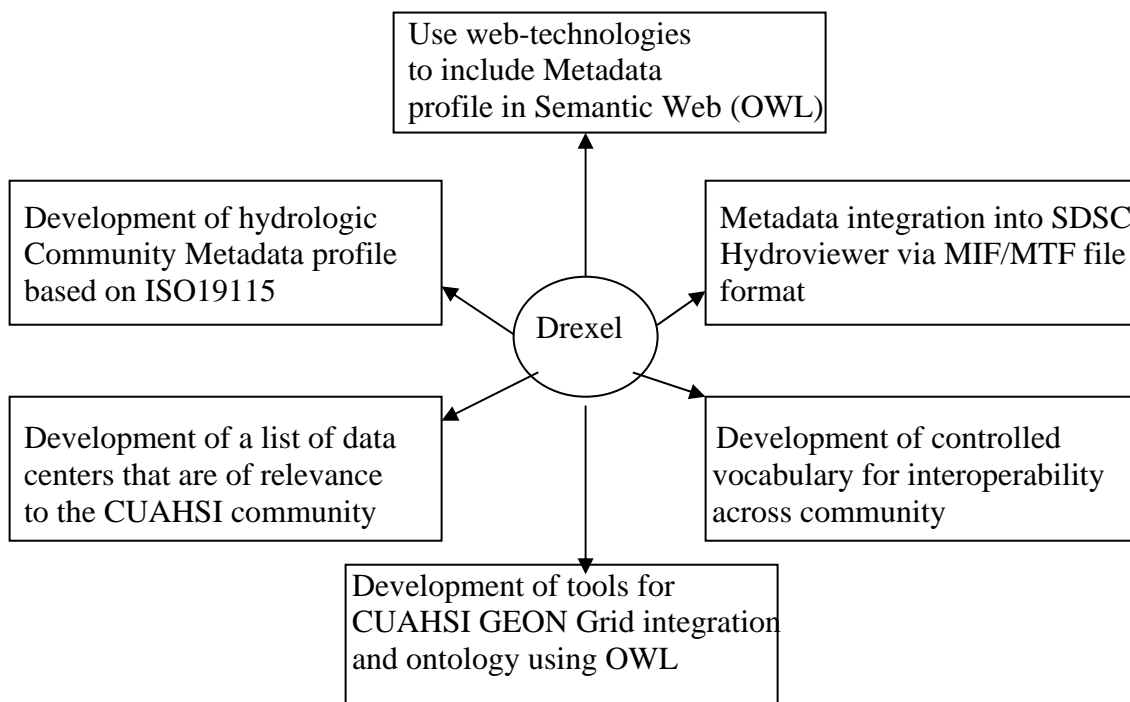
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There has been NO mention of UNIDATA in the prospectuses

### Five HIS PI's

1. John Helly (SDSC) – Data Storage
2. Michael Piaseki (Drexel) – Metadata
  - Defines metadata standards for hydrologic data and analysis
  - Standards are drawn from ISO (International Standard Organization)
  - Customized for hydrology in XML (Extended Markup Language)

### Objectives



Will give hydrologic community a description set for HO's

**Ontology:** allows you to describe data and put between data sets; relationship among entities

3. David Maidment (University of Texas)

- Overall project coordination
- Defining hydrologic data model
- Building digital watersheds

Why do we need a hydrologic data model?

- Start with big pile of files
- Need to assemble data into a coherent picture of a water environment
- Need to capture commonalities in a standard form, facilitating comparison among different regions
- Simplifies construction of an integrated hydrologic database

Good Data Model

- Data model should be simple and general
- Fundamental concepts
- Must be able to be applied to a wide range of topics and groups

Existing Data Models

- Net CDF (part of UNIDATA) – developed in the atmospheric sciences and describes sampled values in an n-dimensional function space
- Arc Hydro – developed for representation of water resources in ArcGIS (geospatial and monitoring data)
- HDF, Grib, SHEF, DSS, WDM, .....etc

4. Praveen Kumar (Illinois) – The Modelshed Framework

Limitations of existing GIS data models

- 2D map data representation
- Static data (no time-series)
- Difficulty relating spatially continuous raster data to spatially discrete (vector) data

Modelshed

- A volumetric spatial model (GeoVolume) unit, registered in 3D by a GIS, with which time-varying data, model fluxes, spatial relationships and descriptive metadata are associated
- What can a modelshed do?
  - i. Store data for applications
  - ii. Generalized 4D model
  - iii. Addresses issues of scale heterogeneity and resolution
  - iv. Builds on existing data models (e.g. Arc Hydro) to leverage existing data structures and tool
  - v. Establish new relationships

vi. Models environmental fluxes

- Vertical layering system
  - i. Indexing vertical data by layers associated with existing database features
  - ii. Area link connect otherwise unrelated spatial coverages and zones to allow interaction
  - iii. Modelshed types may establish orthogonal links to neighboring X and Y Modelsheds

## 5. CUAHSI Program Office

Coordination of HIS and other CUAHSI components

Tom Torgeson (NSF)

\*\*\*Data files should start when the sample is collected

Two Standards

1. Data collection standards (HO responsibility)
2. Data archiving standards (HIS responsibility)

Landscape characterization for Observatory Design

- Pfafstetter Basins (9 units divided into 99, divided into 999)

EDNA (Elevation Derivative for National Applications) – USGS

- Elevation derivative database
- Derived from 1-arc second NED
- Albers
- Composed of multiple raster and vector layers
- Controlled database for hydrologic modeling community
- Useful for environmental and hydrologic modelers
- Applications
  1. Estimation of average annual streamflows
  2. Modeling of perennial/intermittent/ephemeral nature of streams
    - Developed spatial delineations for Hydro-Climatic Data Network (HCDN) gauges
    - HCDN watershed characterization to support modeling efforts
    - Leverage existing flow accumulation parameters
  3. Watershed tools for Lake Michigan monitoring and assessment
    - Watershed characteristics tool (can delineate basins)

Roger Bales (on measurement needs)

- Real-time scientific use

Example: Combine data from embedded sensor network, remote sensing and stand-alone instruments from multiple sources for:

- Streamflow forecasting
- Precipitation estimation
- Salinity levels

Near real-time data important for research-applications partnerships

- Data processing by HO teams
- Long-term datasets (capture data from multiple sources)
- Multiple types of user interfaces
  - Expert user
  - Knowledgeable user
  - HO staff for data processing
  - Applications user
  - HO staff for management data

\*\*\*Each HO needs a full-time data manager to interface with HIS, if selected

Educational component

- Suggested to use DLESE and/or NSDL model

**08/24/04**

Jay Famiglietti – Neuse Prototype Team

- Three cross-cutting themes
  1. Forcing, feedbacks, and coupling
  2. Scaling
  3. Prediction and limits to predictability
- Four basic properties to a catchment
  1. Mass in each store
  2. Residence time within stores
  3. Fluxes between stores
  4. Flowpaths among stores
- Core data
  - Data released immediately, ASAP dependent on the particular variable and its QA/QC

- Monitoring data (e.g. precip., soil moisture, land and atmosphere characteristics)
- Monitor the variables in the context of the 4 basic properties (e.g. nitrogen cycle)
- HO's provide unparalleled infrastructure to develop/test remote sensing estimates of water storage and flux quantities
  - Examples
    1. Snow
    2. Soil moisture
    3. Surface energy budget terms
    4. Canopy cover
    5. Flood inundation/coverage
- Observatories are not “experimental watersheds”
  - Human activities affect stores, flows and fluxes
  - Should study these attributes
    - e.g. timing, amount and location of water withdrawals from aquifers and streams
    - Do through surveys for specific sub-watersheds and observatory-wide

David Maidment

- UNIDATA
  - e.g. precipitable water, wind vectors, wind speed, NEXRAD to more than 100 universities
- HMF (Hydrologic Measurement Framework)
  - Make sure measuring devices are the same across observatories
  - Instrumentation marketplace
  - Peer-reviewed methods (web handbook)
  - Foundation for instrumentation library
  - Training courses on cutting edge technologies

Doug James (NSF Hydrologic Science Program Officer)

- Observatories need to be visible, concrete and appreciated
- Need to convince people we are dedicated to address/solve water needs
- Need coherent data collection and readily available
- Need a major change of how we do our research (i.e basin approach as opposed to individual study approach)
- Four major components (storages, fluxes, pathways, and residence times)
  - How these are also interconnected (many arrows pointing to many boxes)
- This is a growth process. Recognize that it is a step by step learning

- Adaptive perspective, flexible growth plan
- Focus on management (make sure things are working and adequately monitored)
- NSF Proposal Criteria (Usual)
  - Criterion 1: Intellectual Contribution
  - Criterion 2: Information has to serve people (has to help them)
    - We have engaged a diverse group of people academically, culturally, demographically
  - 20 specific criteria in Doug's memo on the CUAHSI website (<http://www.cuahsi.org>)

**08/25/04**

## Breakout groups

1. Hydrologic Extremes
2. Evaluation Criteria

### *1. Hydrologic Extremes*

- What is an extreme? (flooding, drought, nutrient storm pulse, mass wasting)
- How can we capture changing land use and the effect that extreme events have on it?
  - What effect does this change have on the response to extreme events?
- Extreme events as a matter of scale
  - Extreme events on a small scale (~ 1 km) occur by an extremely intense rainfall over a small area, on average
  - Extremes on a large scale occur by a very small intensity rainfall over an extensive area, on average
- Rain-on-snow (can the HO's capture this?)
  - Most cannot
- Jeff Dozier – need a pre-event capability to measure extreme events
  - e.g. development of better interpolation for rain-on-snow

### *2. Evaluation Criteria*

Doug James

- \*\*\*Not just who and what we have in existing data, but what we are going to do with it

- \*\*\*Look to fill in USGS and others' gaps to look at critical science questions
- \*\*\*Manager of the facility.....who do we pick?
  - Manager must have demonstrated expertise of efficiency and effectiveness on large scale projects/initiatives so that the HO runs smoothly

Each HO must do the 4 fundamental principles and the hypotheses should come from the investigators

James Kirchner – UC Berkeley

- The most important issues is whether an HO will yield viable success quickly on important hypotheses and issues
- Need a central location for people to interact in a real way (foster multidisciplinary activity)

Are federal, state, local and management agencies viewing the project as essential to their strategies?

How do we measure the science hypotheses proposed against the benefit to the general public?

Transferability to other basins, un-gauged areas

Beth Boyer (UC Berkeley, transitioning from Cornell)

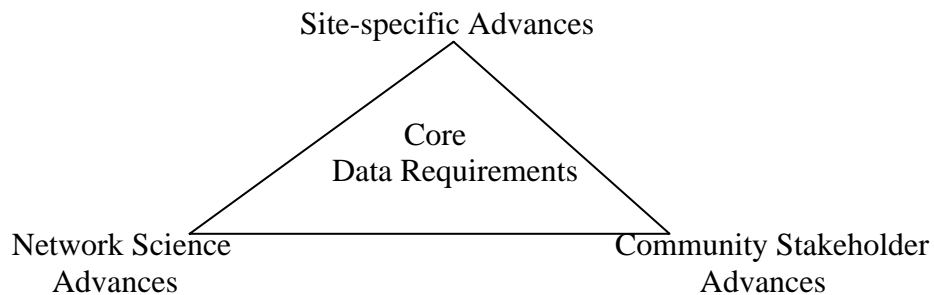
- Core services that assess the availability and access of the HO to outside users (show a plan to make it accessible)

\*\*\*How do we weigh the utility to the hydrologic community and to the other ones (e.g. atmospheric, ecology)?

- Direct addressing of NEON and how we would overlap.....what would it look like?

\*\*\*e.g. collect the data ecologists can use, make meteorological stations common to all groups

- Maybe not the groups in particular, but the environmental community as a whole



HIS is theoretically providing federal data such as USGS, NWS, etc

- This service needs to be better defined before proposals are written

Andrew Miller (UMBC)

- Need a staffing and management definition (a defined template delineating responsibility)

**Closing Remarks by Doug James**

- Focus on how to make your HO the best
- Do NOT do something that will be easily outdated OR non-network available or compatible
- Should bring scientists from all research disciplines
  - Integrated hydrology/ecology/environmental engineering.....you name it
  
- Mesoscale processes and why they are the drivers
- Think of a watershed smaller than 100, 000 km<sup>2</sup>
- Human interaction with the watershed
- Give thought to the “firehose” of data
  - i.e. consolidate it and fill critical gaps (e.g. USGS, NWS, .....
  
- \*\*\*\*Biggest Single key is good manager and management team
- \*\*\*Think urban and think smaller than the majority of the 24 basins presented at this workshop