OAC-1664061
OAC-1664018
OAC-1664119
2017-2021

ACI-1148453
ACI-1148090
2012-2017

Advancing the capability for collaborative discovery through data and model sharing: The HydroShare example.

Access these slides in HydroShare by searching for "OACWebinar"

David Tarboton, Ray Idaszak, Jeffery S Horsburgh, Daniel P Ames, Jonathan L Goodall, Alva Couch, Richard Hooper, Shaowen Wang, Martyn Clark, Pabitra Dash, Hong Yi, Christina Bandaragoda, Anthony Castronova, Tian Gan, Zhiyu Li, Mohamed Morsy, Maurier Ramirez, Jeffrey Sadler, Dandong Yin, Yan Liu.

HydroShare is operated by the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI) with ongoing development through a collaborative project among Utah State University, Brigham Young University, CyberGIS Center University of Illinois, Tufts, University of Virginia, and RENCI University of North Carolina.

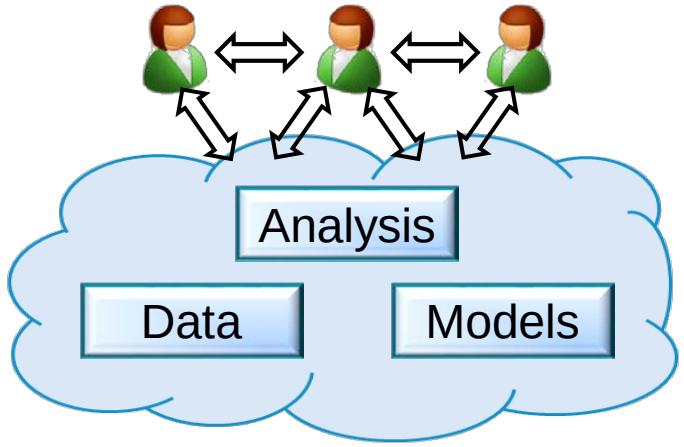
HYDROSHARE

http://www.hydroshare.org

CUAHSI
universities allied for water research

Vision

Part of an ecosystem of cyberinfrastructure elements that make up an integrated cyberinfrastructure for collaboration and computation that integrates data storage, data organization, discovery, analysis and modeling through web applications (web apps) and that allows researchers to employ services beyond their desktop to make data storage and manipulation more reliable and scalable, while improving ability to collaborate and reproduce results.

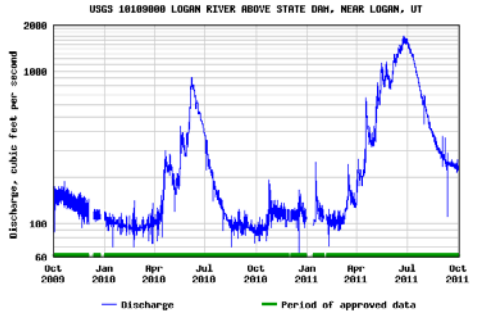


- Don’t need your own software and platform to use
- Reduce installation, library and platform dependencies
- Data access and size, faster computation
- Re-use
- Reproducibility
- Transparency
- Trust
- Collaboration

Motivation: Collaborative research

Advancing Hydrologic Understanding

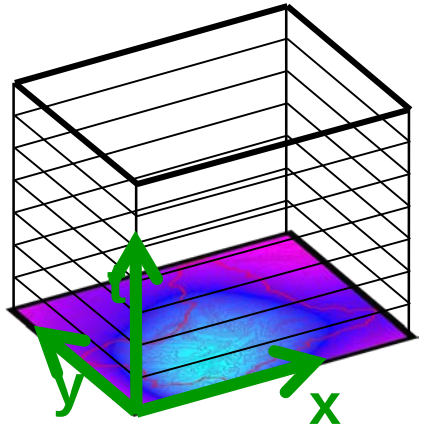
- requires integration of information from multiple sources
- using diverse types of data and models
- may be data and computationally intensive
- requires collaboration and working as a team/community
- publication of data and models for transparency, reproducibility, and trust (open data)

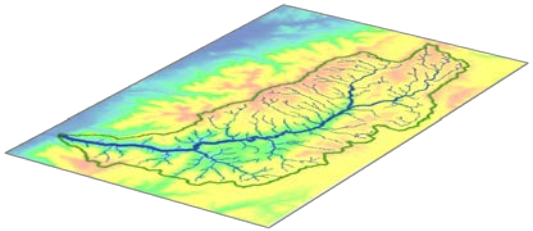


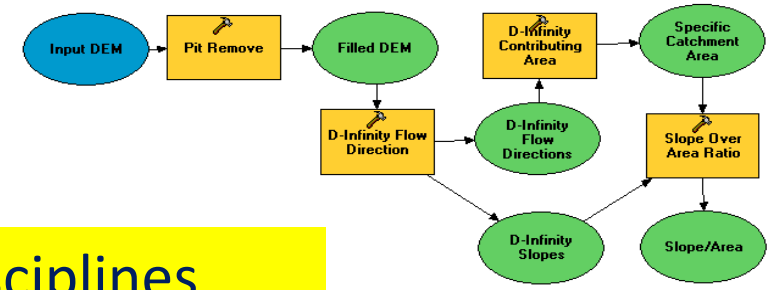
Resources

Data and models

Social Objects







This applies for many NSF disciplines

Grand Challenge

Better hydrologic forecasting that quantifies effects and consequences of land surface change on hydrologic processes and conditions

by enabling access to and organizing data for integrated analysis and modeling

We want to be able to better forecast, plan for and mitigate the effects of floods.

We want to ensure sufficient water resources in times of shortage.

Example from HydroShare: Data-driven methods model flood severity using crowd-sourced and environmental data.

Journal of Hydrology 559 (2018) 43–55

Contents lists available at ScienceDirect

Journal of Hydrology

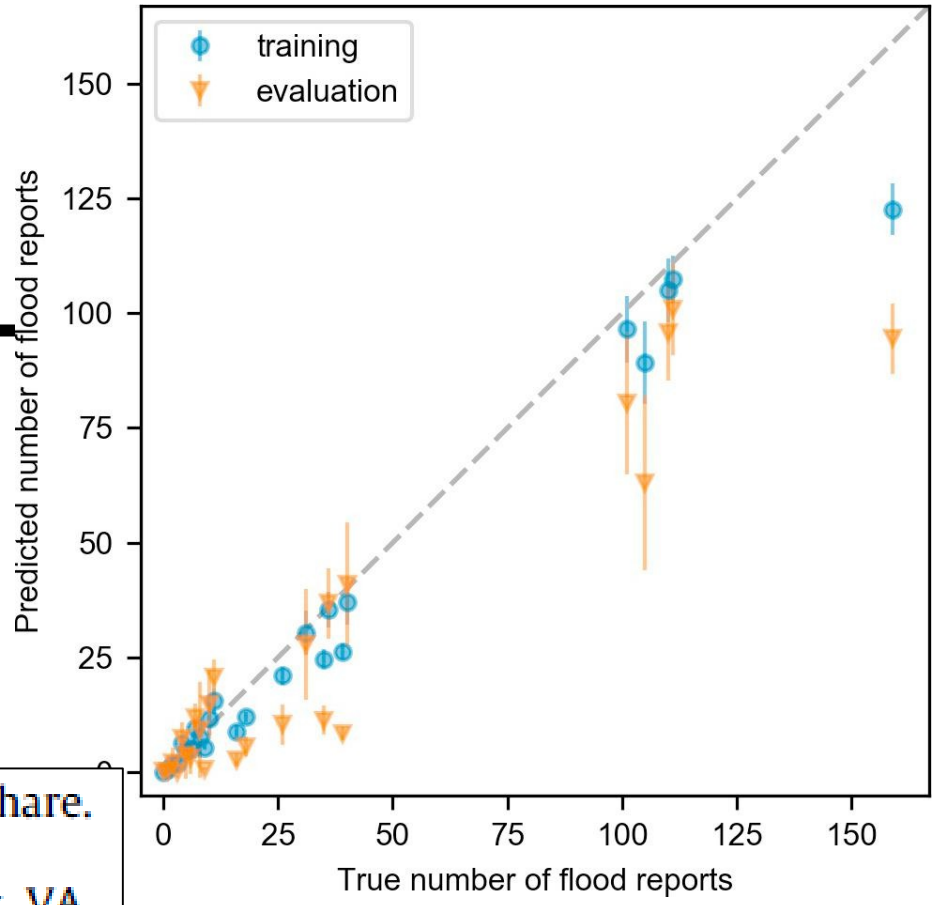
journal homepage: www.elsevier.com/locate/jhydrol

Research papers

Modeling urban coastal flood severity from crowd-sourced flood reports using Poisson regression and Random Forest

J.M. Sadler [a], J.L. Goodall [a,*], M.M. Morsy [a,b], K. Spencer [c]

[a] Dept. of Civil and Environmental Engineering, Univ. of Virginia, 351 McCormick Rd., P.O. Box 400742, Charlottesville, VA 22904, United States
[b] Irrigation and Hydraulics Dept., Cairo University, P.O. Box 12211, Giza 12614, Egypt
[c] Deputy Resilience Officer, City Manager's Office of Resilience, City of Norfolk 501 Boush St., Norfolk, VA 23510, United States



Sadler, J., 2018a. Input data for flood severity modeling in Norfolk, VA. HydroShare. https://doi.org/10.4211/hs.ff8be5aea3224c15b262bfddd5fb6033.

Sadler, J., 2018b. Output from data-driven model of flood severity in Norfolk, VA. HydroShare. https://doi.org/10.4211/hs.54df00b15c02458685fa3b622f2ecc7b.

Sadler, J., 2018c. Data-driven model script for flood severity modeling in Norfolk, VA. HydroShare. https://doi.org/10.4211/hs.712cd2ce8f604c8f824d6836ee3fcb53.

Data from 2017 US Hurricanes

HYDROSHARE MY RESOURCES DISCOVER COLLABORATE APPS HELP ABOUT

Hurricane Harvey 2017 Collection

Authors:
Owners:
Resource typ
Created:
Last updated

Abstrac

HYDROSHARE MY RESOURCES DISCOVER COLLABORATE APPS HELP ABOUT

Hurricane Irma 2017 Collection

Authors:
Owners:
Resource type:
Created:
Last updated:

HYDROSHARE MY RESOURCES DISCOVER COLLABORATE APPS HELP ABOUT

Hurricane Maria 2017 Collection

Authors:
Owners:
Resource typ
Created:
Last updated

HYDROSHARE MY RESOURCES DISCOVER COLLABORATE APPS HELP ABOUT

Find Groups My Groups

CUAHSI 2017 Hurricane Data Community

To share data from Hurricanes Harvey, Irma and Maria that impacted the US and Caribbean region in 2017.

Following Hurricanes Harvey, Irma and Maria that had significant impacts to parts of the US and islands in the Caribbean there has been much activity to assemble, document and archive data from these events. This data is intended to support research to improve our understanding of and capability to prepare for and respond to such extreme events in the future. This group has been created as a community within

ne who joins

akes them

Look in HydroShare for keywords harvey2017, irma2017, maria2017

Submerged I-10 in Houston,Tx

I-10, Houston, Texas, 77079

Portions of the Interstate 10 remains flooded in the wake of Hurricane Harvey after it dumped up to 50 inches of rain in Houston, Texas, on Aug. 29, 2017. (Photo: Marcus Yam / Los Angeles Times via Getty Images

Example: Support for CSDMS Landlab Earth Surface Modeling Toolkit community.

CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

LANDLAB

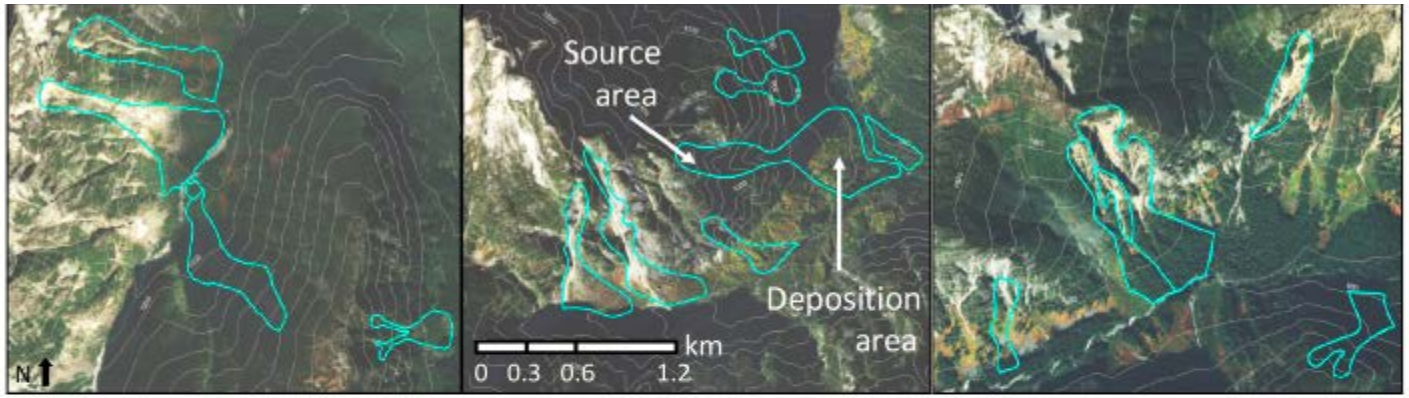
Developers, Researchers & Students

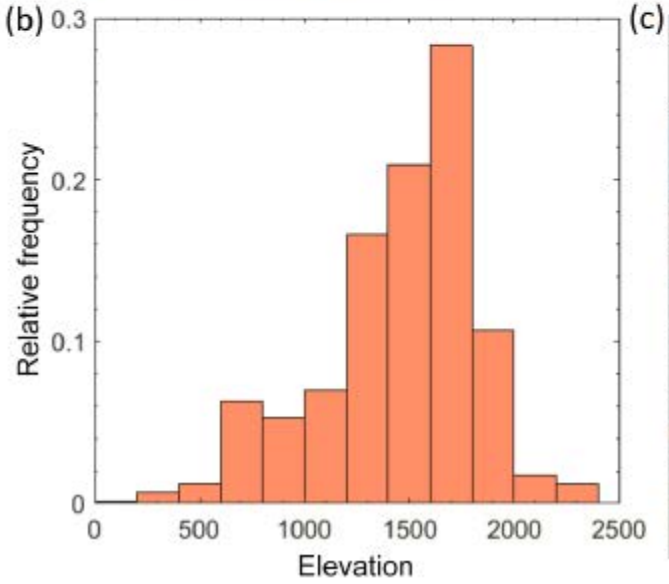
- 330 Users in Landlab **HydroShare Group**
- 6 National/International Conference Workshops running on **HydroShare JupyterHub App**
- 10+ university classroom lectures interacting with **HydroShare JupyterHub App**
- PhD Dissertation and Journal Articles

A hydroclimatological approach to predicting regional landslide probability using Landlab

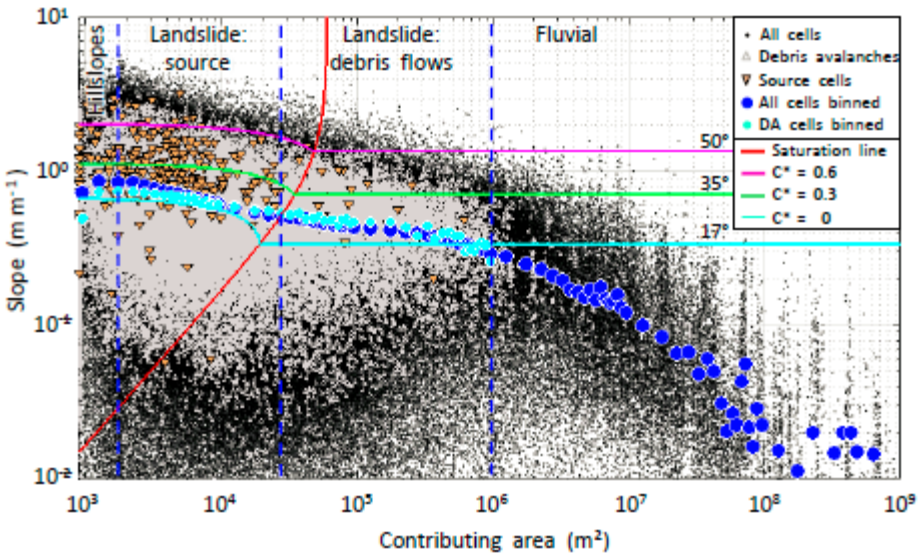
Earth Surf. Dynam., 6, 49–75, 2018
https://doi.org/10.5194/esurf-6-49-2018

Ronda Strauch[1], Erkan Istanbulluoglu[1], Sai Siddhartha Nudurupati[1], Christina Bandaragoda[1], Nicole M. Gasparini[2], and Gregory E. Tucker[3,4]





Debris avalanches mapped within NOCA

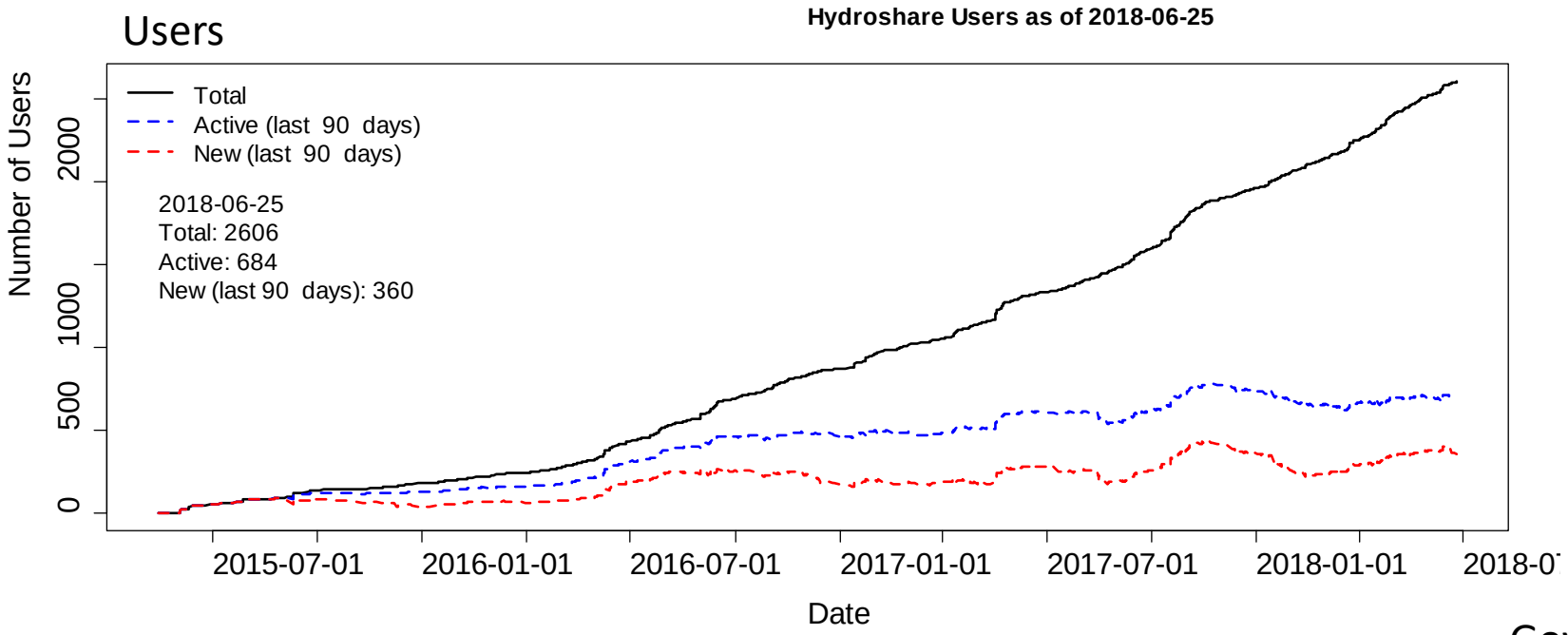


NOCA Data, HydroShare, https://doi.org/10.4211/hs.a5b52c0e1493401a815f4e77b09d352b

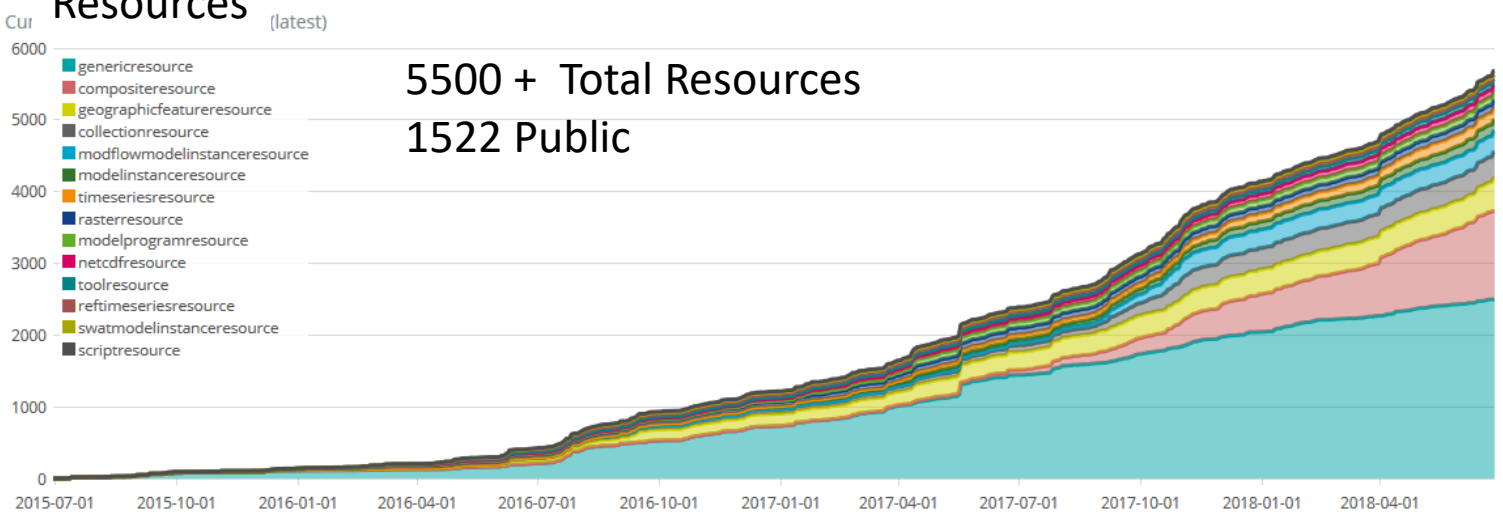
Landlab: Model code and Users Manual, HydroShare, https://doi.org/10.4211/hs.27d34fc967be4ee6bc1f1ae92657bf2b

Audience and User base

Users



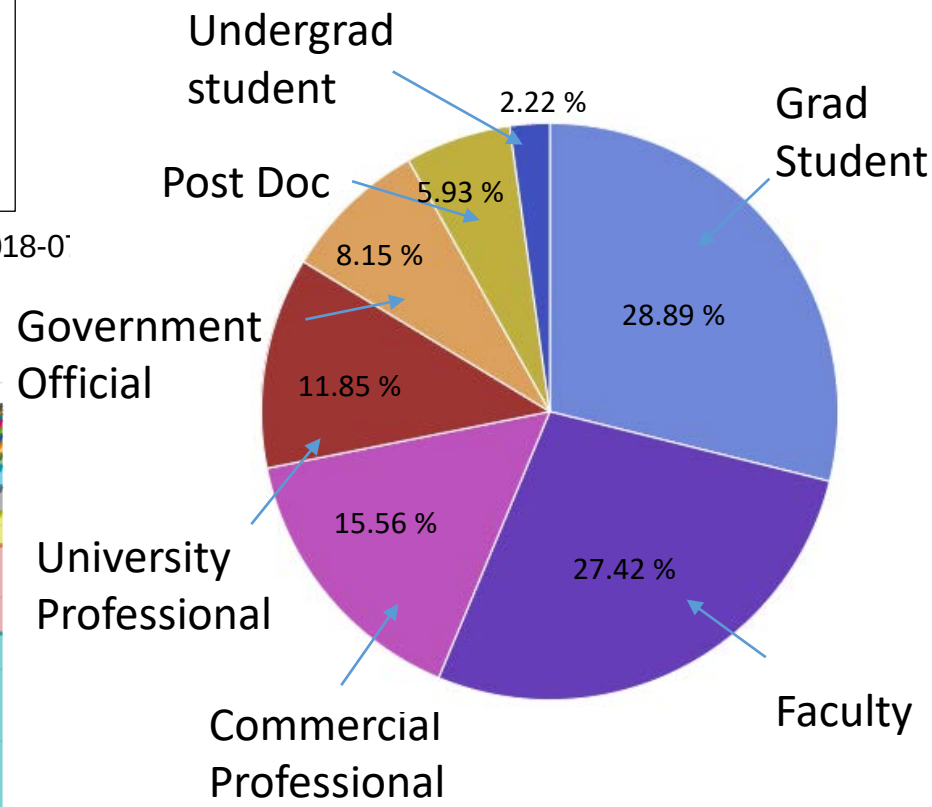
Resources



5500 + Total Resources

1522 Public

Primary audience is US Hydrologic Research community (NSF funding) but open to international use and use by water resource professionals, educators and citizen scientists



For users who have indicated type in their profile

Statistics as of 6/25/18 , see https://help.hydroshare.org/about-hydroshare/usage-metrics/

CyberInfrastructure Challenges

- The data deluge
  - Large datasets, data heterogeneity, Inadequate metadata
- Data Organization and Model Input preparation
- Reproducibility
- Software installation and configuration
  - Platform dependencies, Library dependencies, Licensing
- Computational resources
  - Memory, disk and processing

Data Management

"All of the primary datasets collected as part of this project will be made freely and publicly available…"

- iUTAH Proposal Data Management Plan

Many of us put statements like this in our Data Management Plan, but how do we really accomplish this?

From Jeff Horsburgh

Ideal Investigator Data Workflow

- Easily create a digital instance of a dataset or model
- Quickly share it with colleagues (perhaps privately at first)
- Add value through collaboration, annotation, and iteration
- Describe with metadata
- Eventually…share publicly or formally Publish

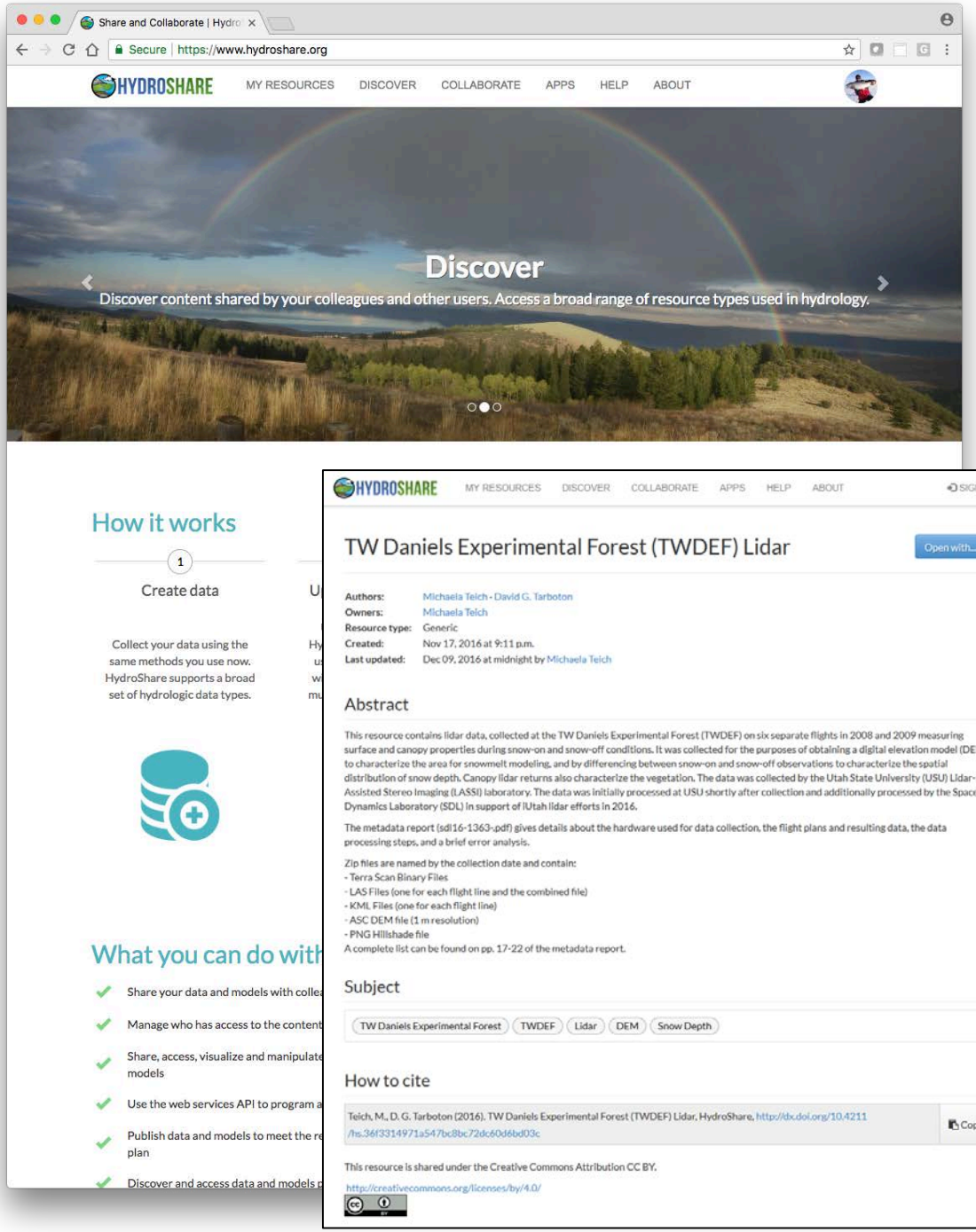
This is still not as easy as it should be!

From Jeff Horsburgh

HYDROSHARE

http://www.hydroshare.org

- Web-based Hydrologic Information System operated by the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI)
- Gives you a way to share datasets, models, and other research products
- Has capabilities for collaboration
- Has Links to computational resources
- Provides permanent publication of data and models with citable digital object identifiers that can link to literature



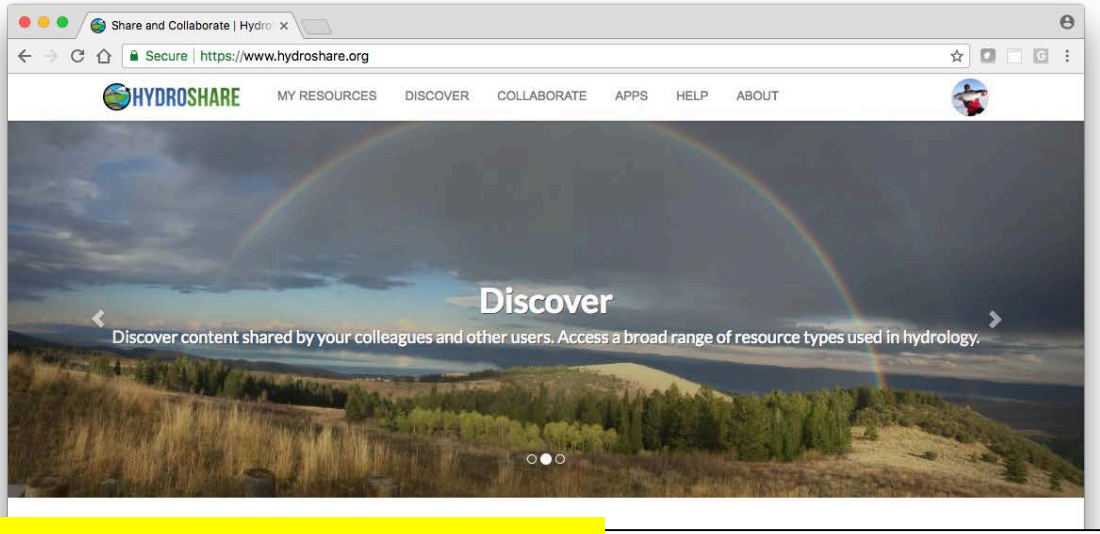
HYDROSHARE

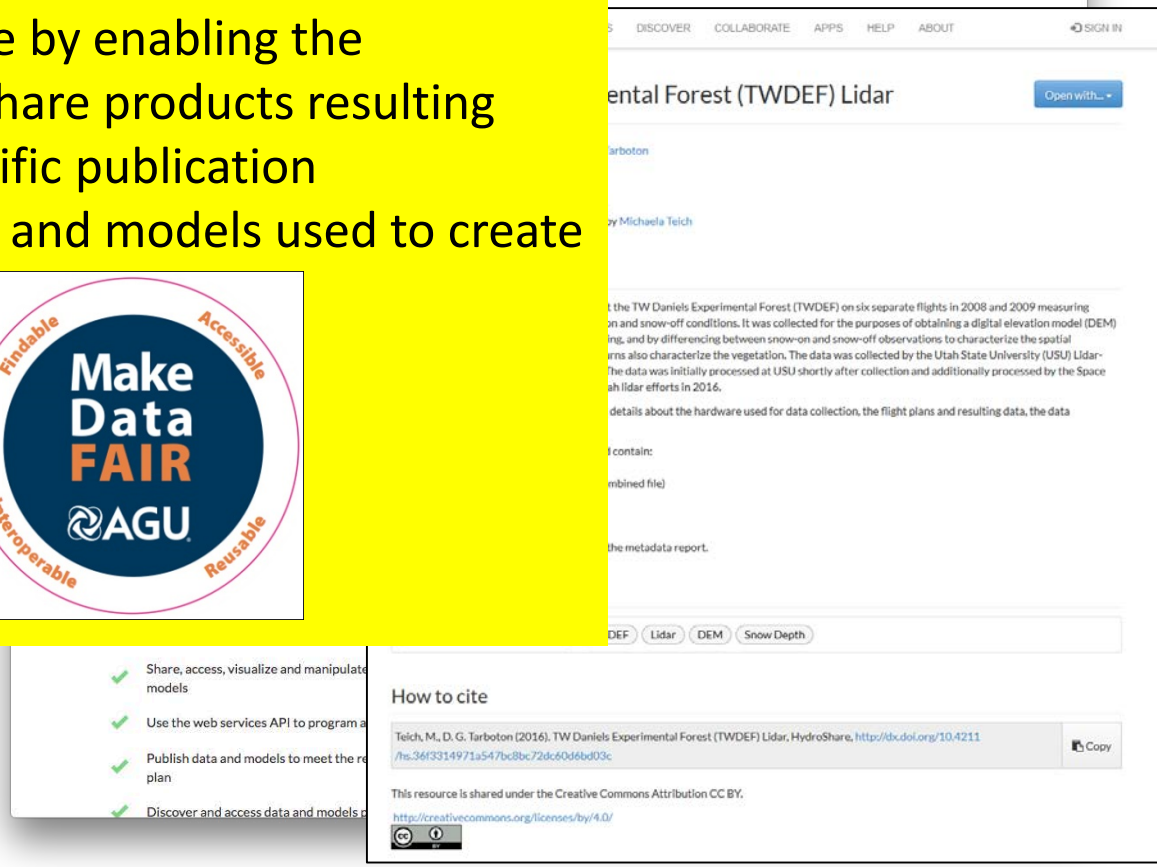
http://www.hydroshare.org

- Web-based Hydrologic Information System operated by the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI)
- Gives you a way to s
  research products
- Has capabilities for c
- Has Links to comput
- Provides permanent
  citable digital object

A system to advance hydrologic science by enabling the community to more easily and freely share products resulting from their research, not just the scientific publication summarizing a study, but also the data and models used to create the scientific publication.

- **F**indable
- **A**ccessible
- **I**nteroperable
- **R**eusable





HydroShare is a platform for sharing Hydrologic Resources and Collaborating

- File Storage

DropBox-ish Functionality

- Meta Data Descriptions
- Data Access API
- Web Apps
- Social Functions
- DOI Data Publication

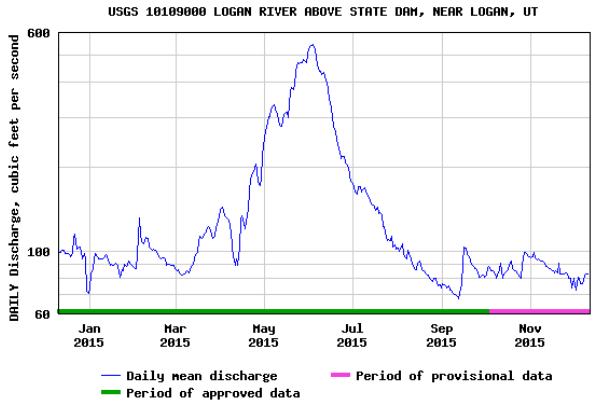
Value Added Functionality

dropbox.com

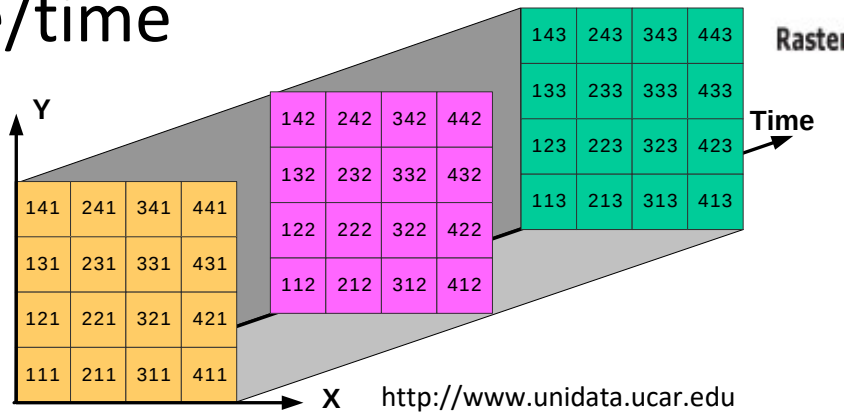
From Dan Ames

Data and models used by hydrologists are diverse…

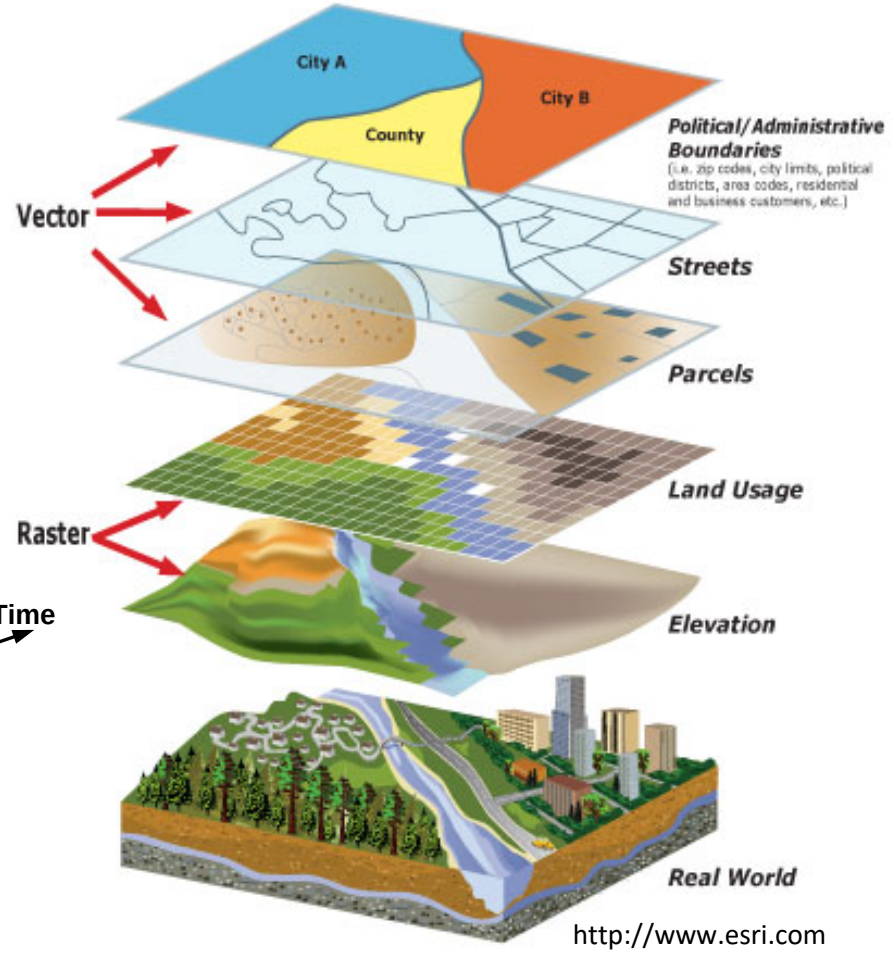
- Time series
- Geographic rasters
- Geographic features
- Multidimensional space/time
- Model programs
- Model instances
- …



http://www.usgs.gov



http://www.unidata.ucar.edu

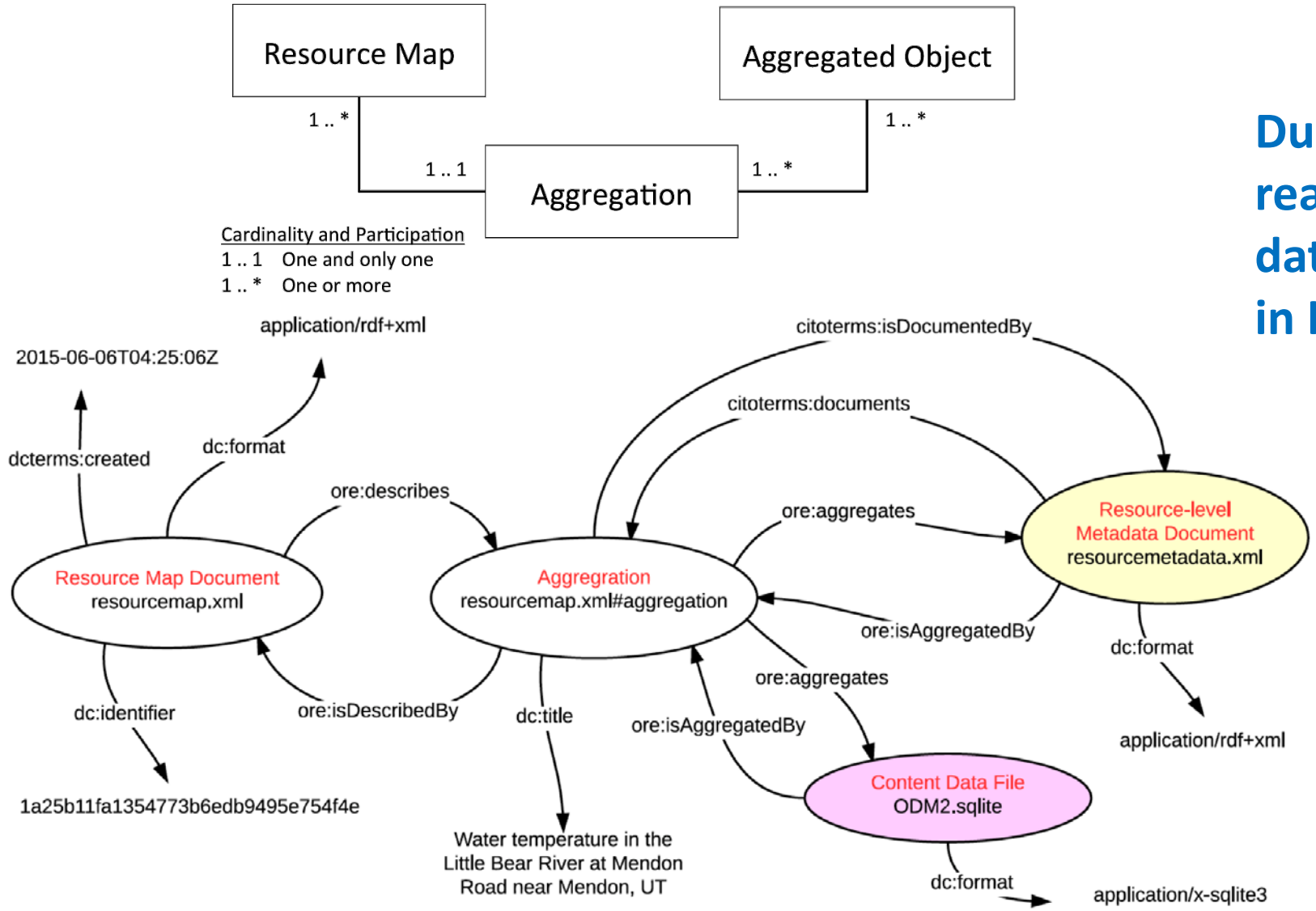


http://www.esri.com

HydroShare can hold data in a wide variety of formats

From Jeff Horsburgh

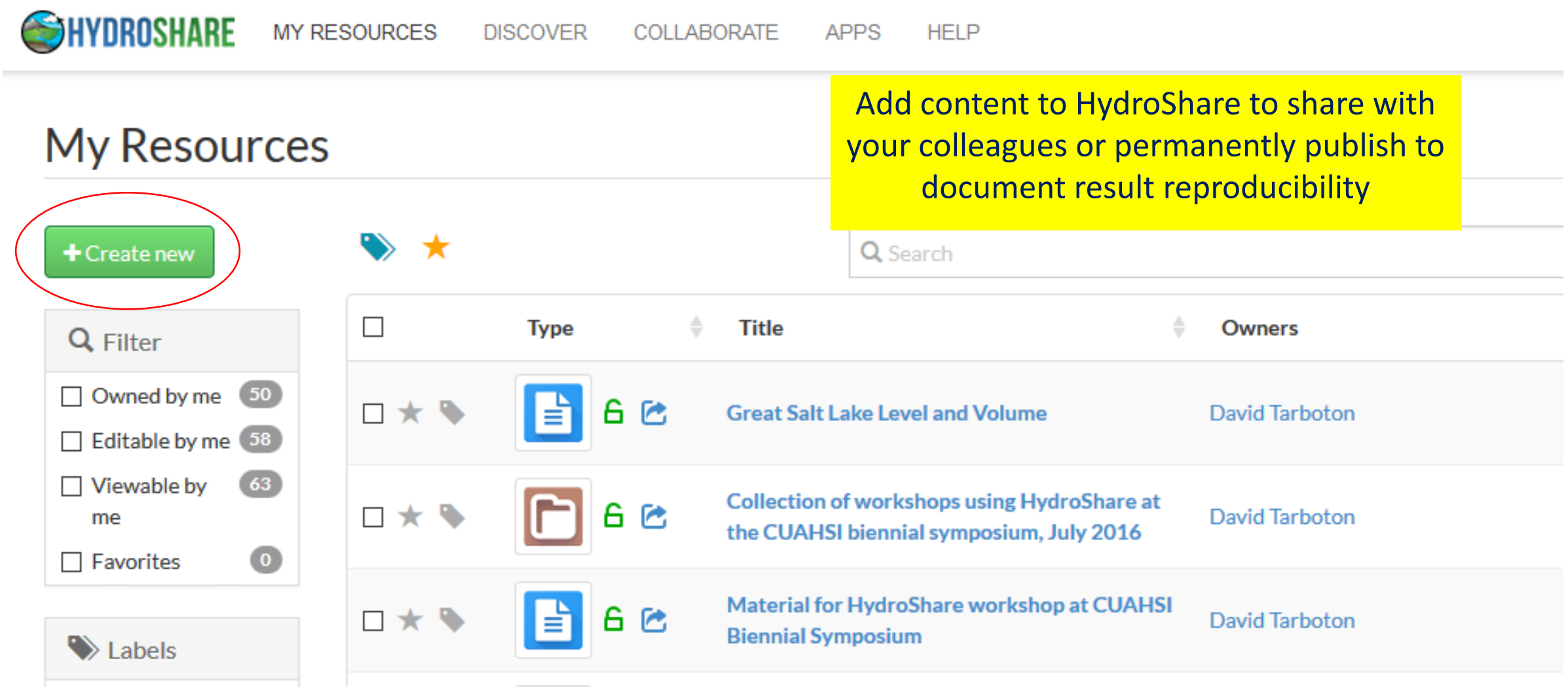
OAI-ORE standard based Resource Data Model



Dublin Core machine readable metadata and data model to make data in HydroShare FAIR

Horsburgh, J. S., M. M. Morsy, A. M. Castronova, J. L. Goodall, T. Gan, H. Yi, M. J. Stealey and D. G. Tarboton, (2016), "HydroShare: Sharing Diverse Environmental Data Types and Models as Social Objects with Application to the Hydrology Domain," JAWRA Journal of the American Water Resources Association, 52(4): 873-889, http://dx.doi.org/10.1111/1752-1688.12363.

Collaborative data sharing



Resources (data and models) in HydroShare are objects of collaboration (social objects)

TW Daniels Experimental Forest (TWDEF) Lidar

Open with...

Authors: Michaela Teich · David G. Tarboton
Owners: Michaela Teich
Resource type: Generic
Created: Nov. 17, 2016, 9:11 p.m.
Last updated: Dec. 9, 2016, midnight by Michaela Teich

Abstract

This resource contains lidar data, collected at the TW Daniels Experimental Forest (TWDEF) on six separate flights in 2008 and 2009 measuring surface and canopy properties during snow-on and snow-off conditions. It was collected for the purposes of obtaining a digital elevation model (DEM) to characterize the area for snowmelt modeling, and by differencing between snow-on and snow-off observations to characterize the spatial distribution of snow depth. Canopy lidar returns also characterize the vegetation. The data was collected by the Utah State University (USU) Lidar-Assisted Stereo Imaging (LASSI) laboratory. The data was initially processed at USU shortly after collection and additionally processed by the Space Dynamics Laboratory (SDL) in support of iUtah lidar efforts in 2016.

The metadata report (sdl16-1363-.pdf) gives details about the hardware used for data collection, the flight plans and resulting data, the data processing steps, and a brief error analysis.

Zip files are named by the collection date and contain:
- Terra Scan Binary Files
- LAS Files (one for each flight line and the combined file)
- KML Files (one for each flight line)
- ASC DEM file (1 m resolution)
- PNG Hillshade file

A complete list can be found on pp. 17-22 of the metadata report.

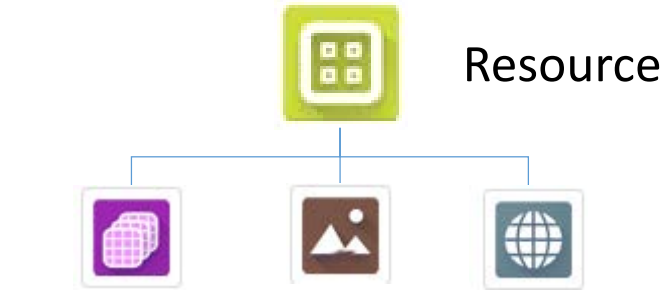
How to cite

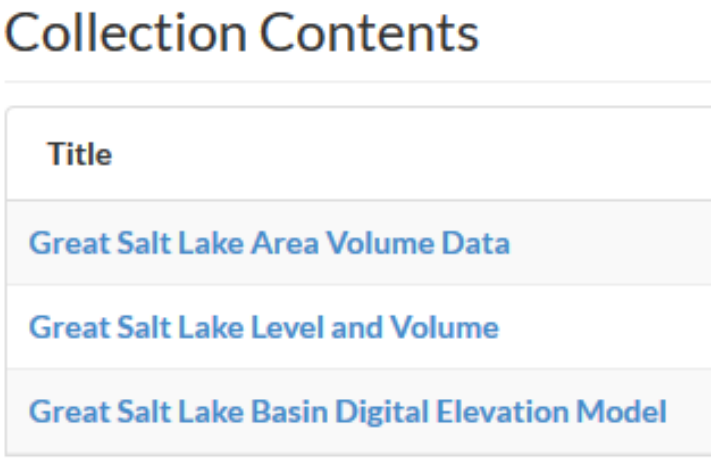
Teich, M., D. G. Tarboton (2016). TW Daniels Experimental Forest (TWDEF) Lidar, HydroShare, http://dx.doi.org/10.4211/hs.36f3314971a547bc8bc72dc60d6bd03c

For each resource you can
- Manage who has access
  - To edit
  - To view
- Comment or rate
- Obtain unique identifier
- Describe with metadata
- Organize into collections
- Permanently publish with DOI
- Version
- Open with compatible web app

Resource Organization Concepts

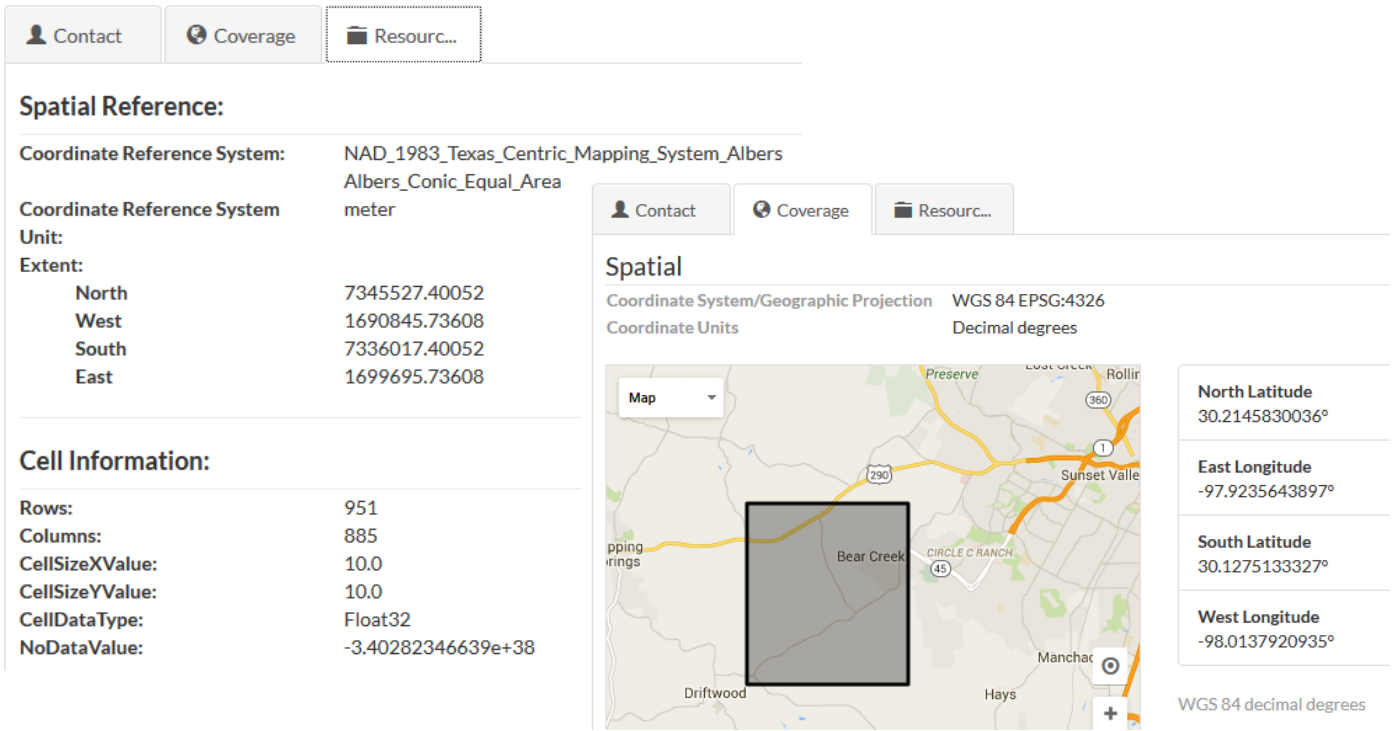
- A resource can hold multiple aggregations
  - Each being a different type of data
  - Managed as one discoverable resource
  - One set of access controls (Owners, Editors etc.)
  - One unique identifier
  - One set of resource level metadata
- A collection can hold multiple resources
- Collections and their members may each be discovered separately
- Unique keyword tags form informal collections
  (e.g. “OACwebinar”)



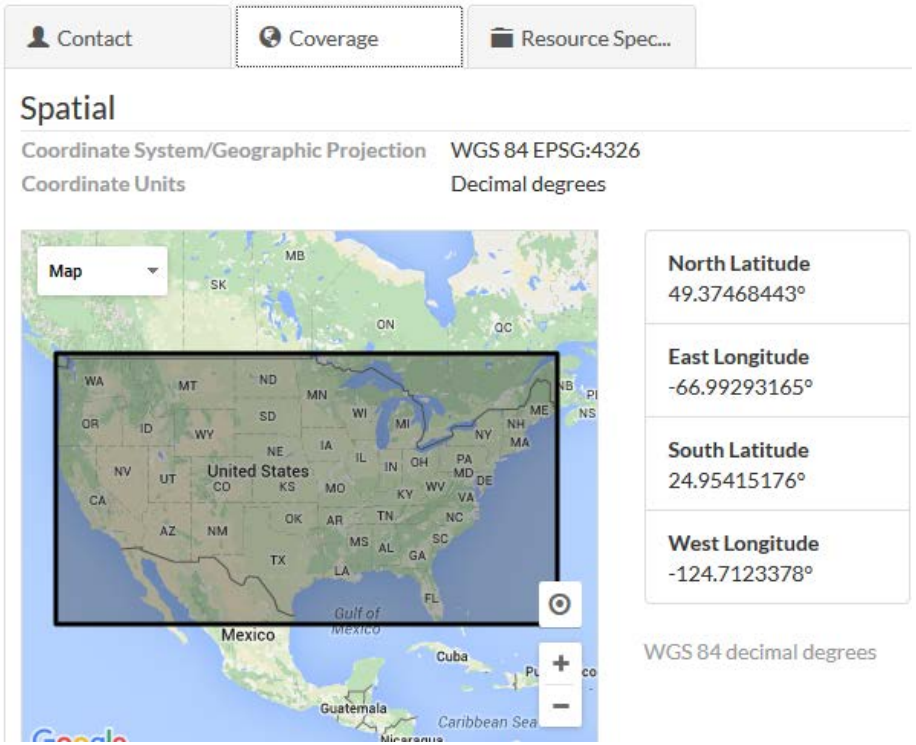


Automatic and simple metadata gathering eases some of the pain of metadata entry

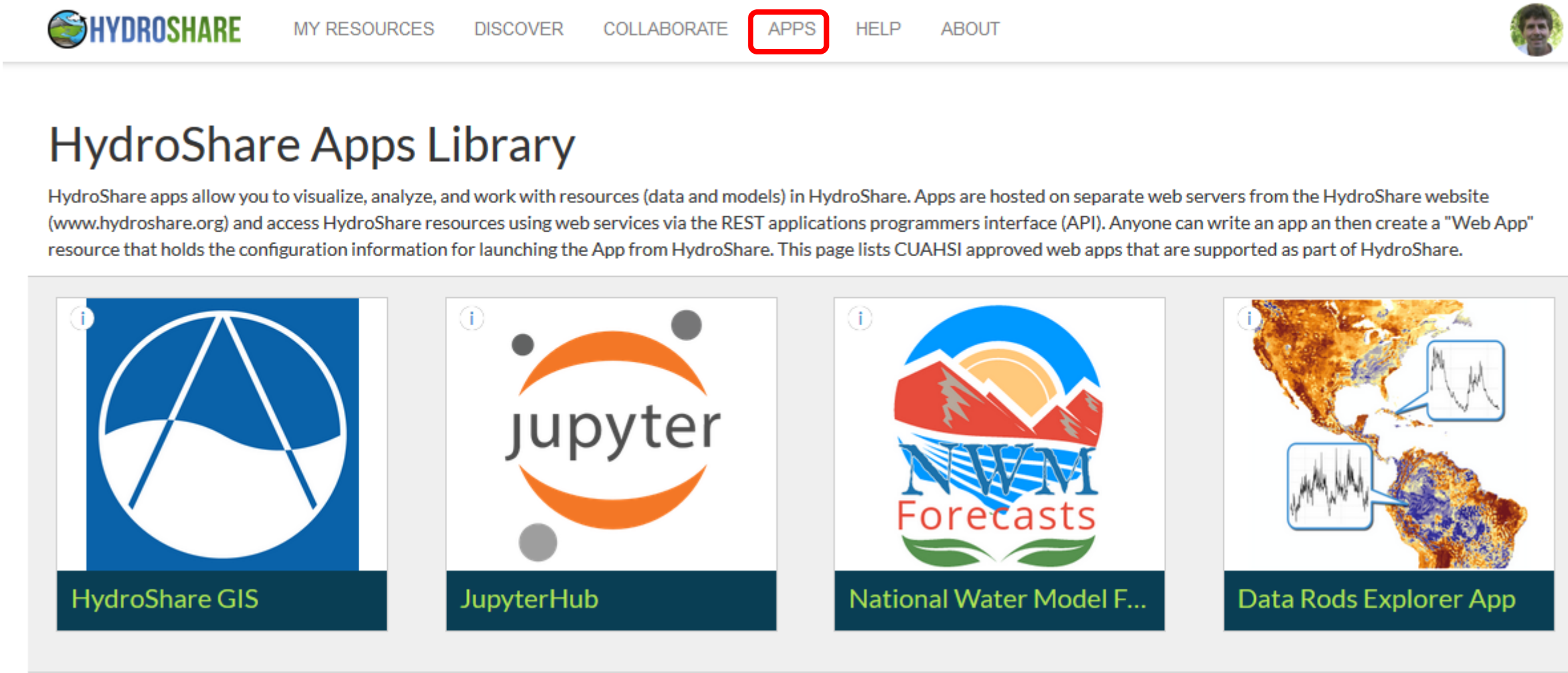
For geographic raster WGS 84 Coverage information automatically harvested from GeoTIFF coordinate system information



For multidimensional netCDF data with CF convention metadata the HydroShare metadata can be fully and automatically completed



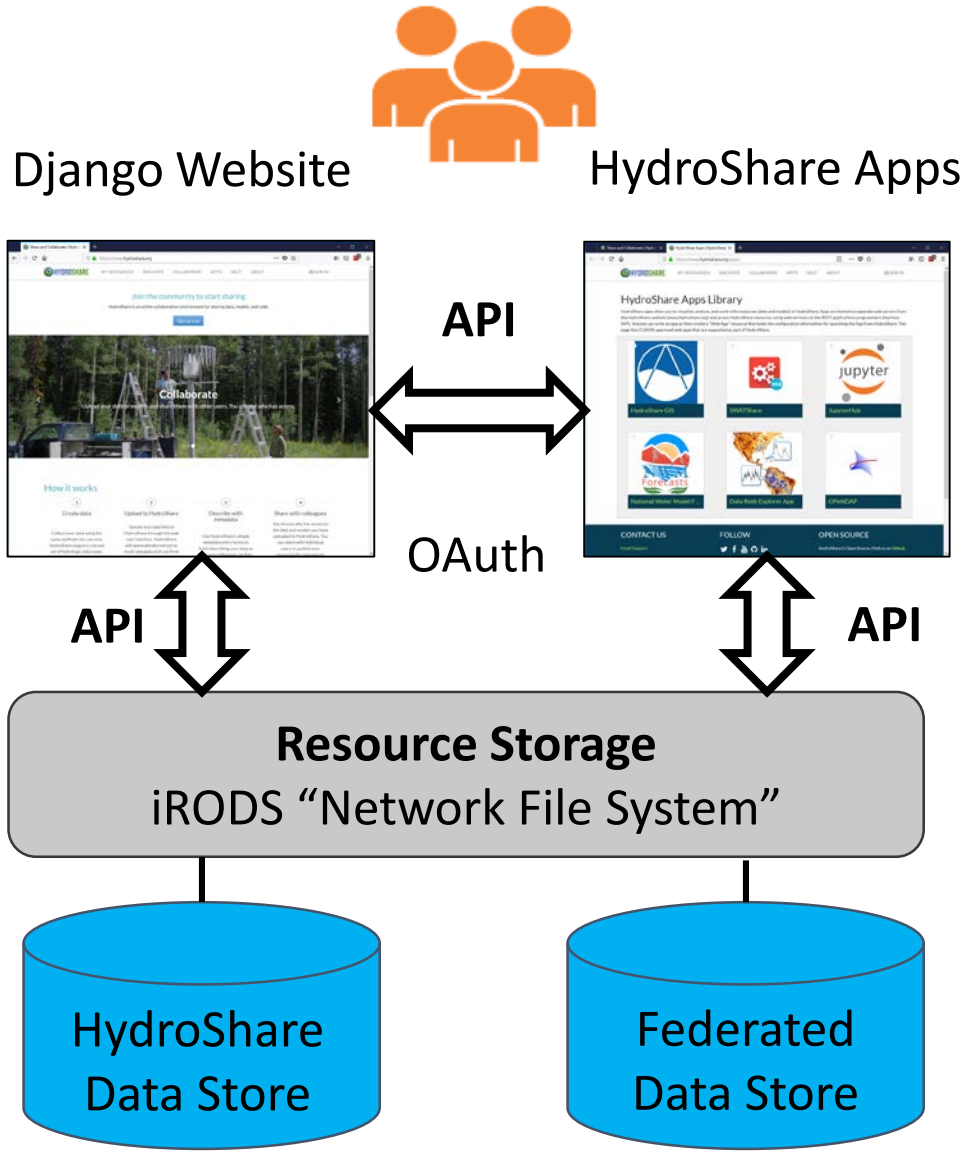
Apps act on resources to support web based visualization and analysis http://www.hydroshare.org/apps



Conceptual Architecture

Resource exploration

- Organize and annotate your content
- Manage access



Distributed file storage

Actions on Resources

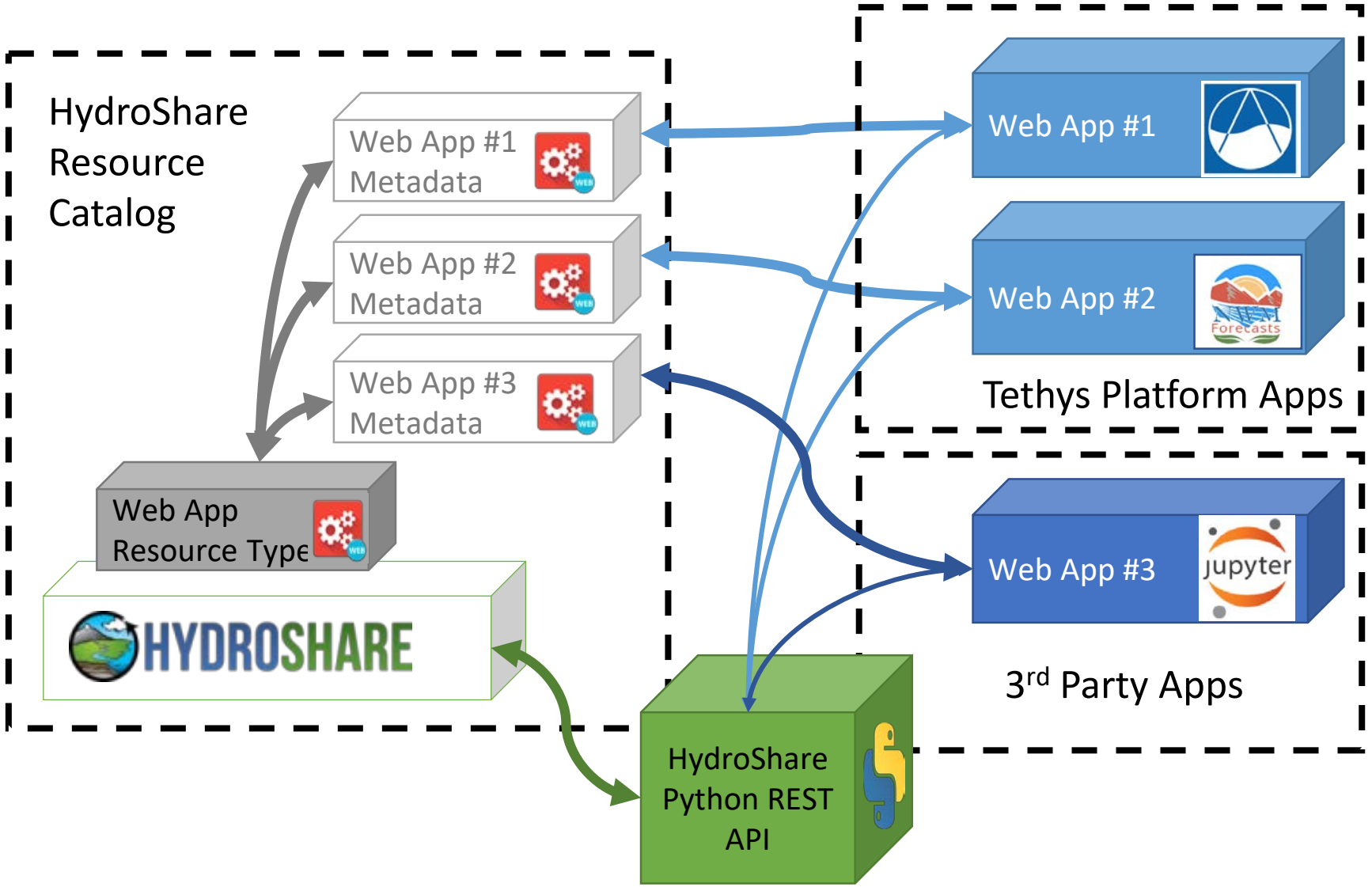
- Web software to operate on content you have access to (Apps)
- Extensibility

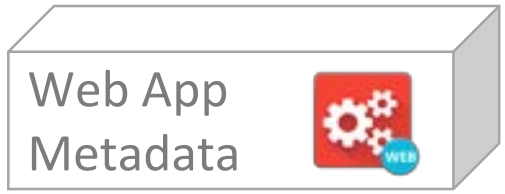
Anyone can set up a server/app platform (software service) to operate on HydroShare resources through iRODS and API

- SWATShare (Hubzero)
- JupyterHub
- Unidata – THREDDS
- NWM Viewer
- Tethys Apps

HydroShare Web App Linkage

Anybody can create a web app on any web server and configure a web app resource for it to be launched from HydroShare





Predefined URL Launch Parameters:

Resource ID: ${HS_RES_ID}

Resource Type: ${HS_RES_TYPE}

HydroShare username: ${HS_USR_NAME}

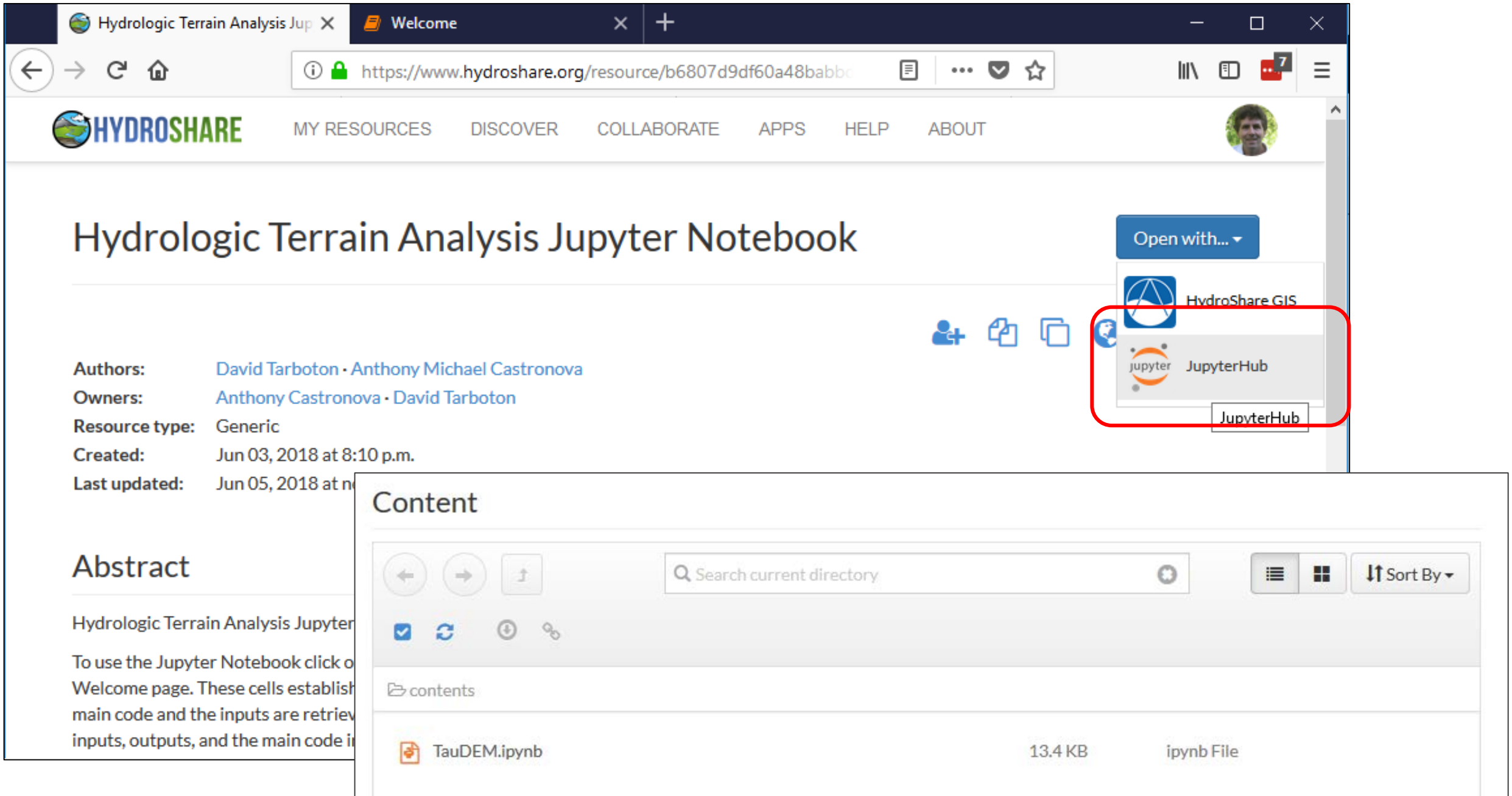
Examples:

https://apps.hydroshare.org/apps/hydroshare-gis/?res_id=${HS_RES_ID}

https://mygeohub.org/.../?res_id=${HS_RES_ID}&usr=${HS_USR_NAME}&src=hs

http://hyrax.hydroshare.org/opendap/${HS_RES_ID}/data/contents/

JupyterHub App



JupyterHub App Analysis

CUAHSI

TauDEM (autosaved)

Logout | Control Panel | Welcome dtarb

File Edit View Insert Cell Kernel Widgets Help | Not Trusted | Python 3

Run | Markdown

Hydrologic Terrain Analysis Using TauDEM

The purpose of this notebook is to introduce
Digital Elevation Models (TauDEM) softwa
for watershed delineation and extraction and

This notebook is intended as a brief introduc
functions required to delineate a stream netw
documentation on the use of each TauDEM f
and construct other analyses to meet your ne

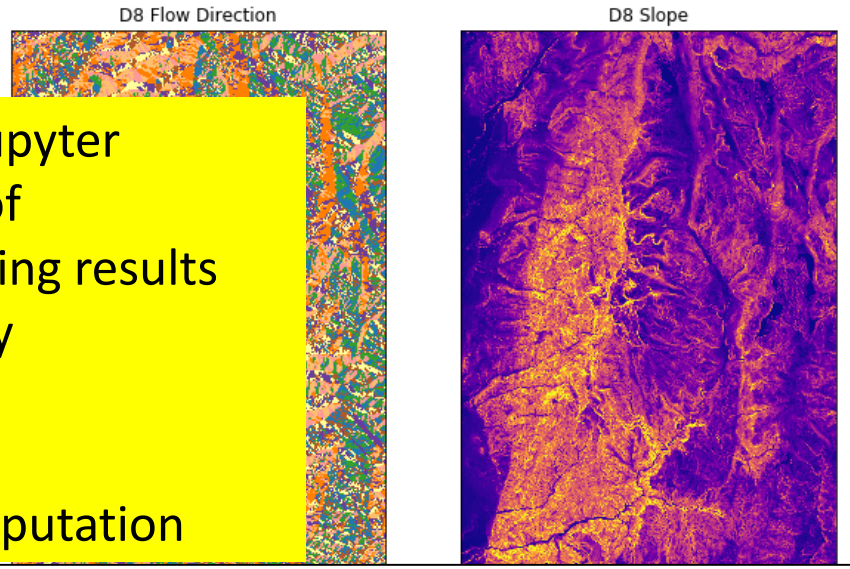
The notebook is organized into the following

1- Preparation, libraries and

2- Digital Elevation Model an

3- Save the Results back into

```
In [7]: grid.plot(raster=['demp.tif', 'demsd8.tif'],
                  title=['D8 Flow Direction', 'D8 Slope'],
                  cm=['Paired','plasma'],
                  cm_scale=[(None,None), (0,1)])
```



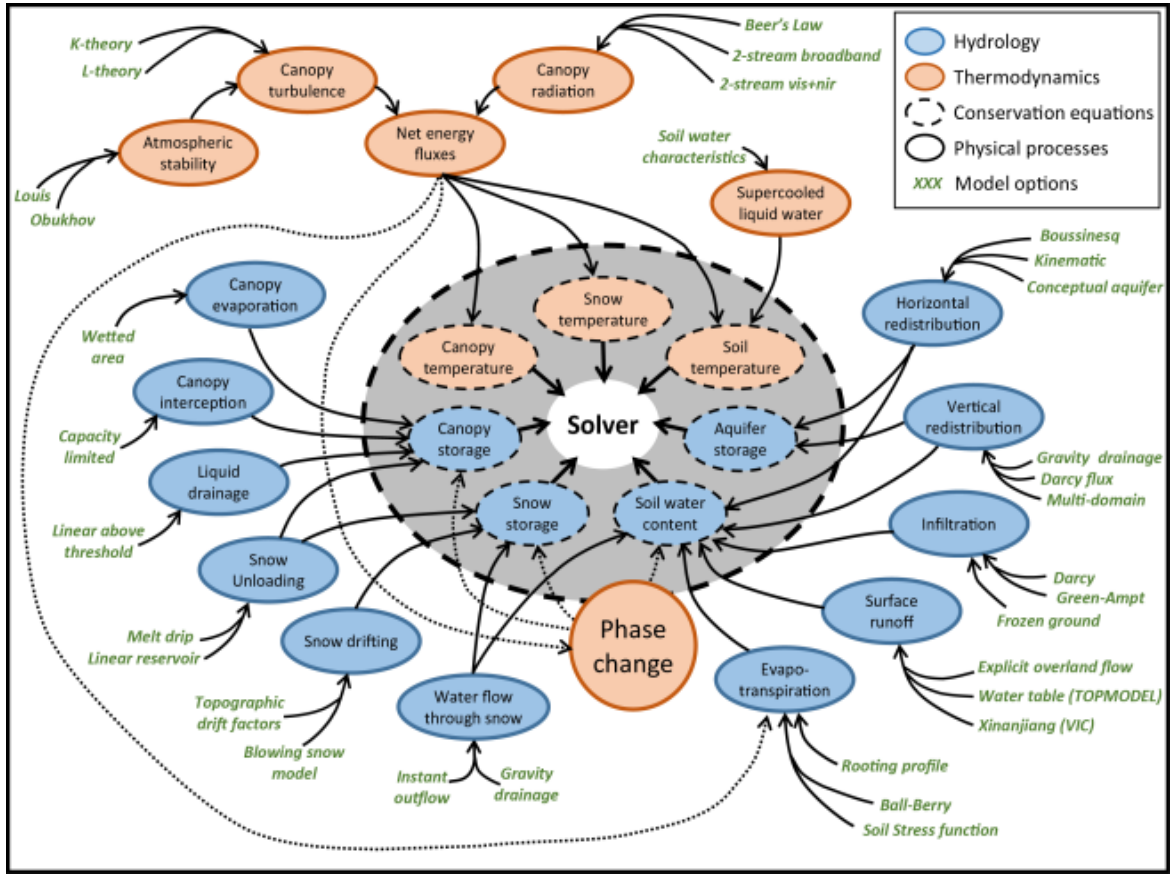
Write and execute code in a Jupyter Notebook, acting on content of HydroShare resources and saving results back to HydroShare Repository

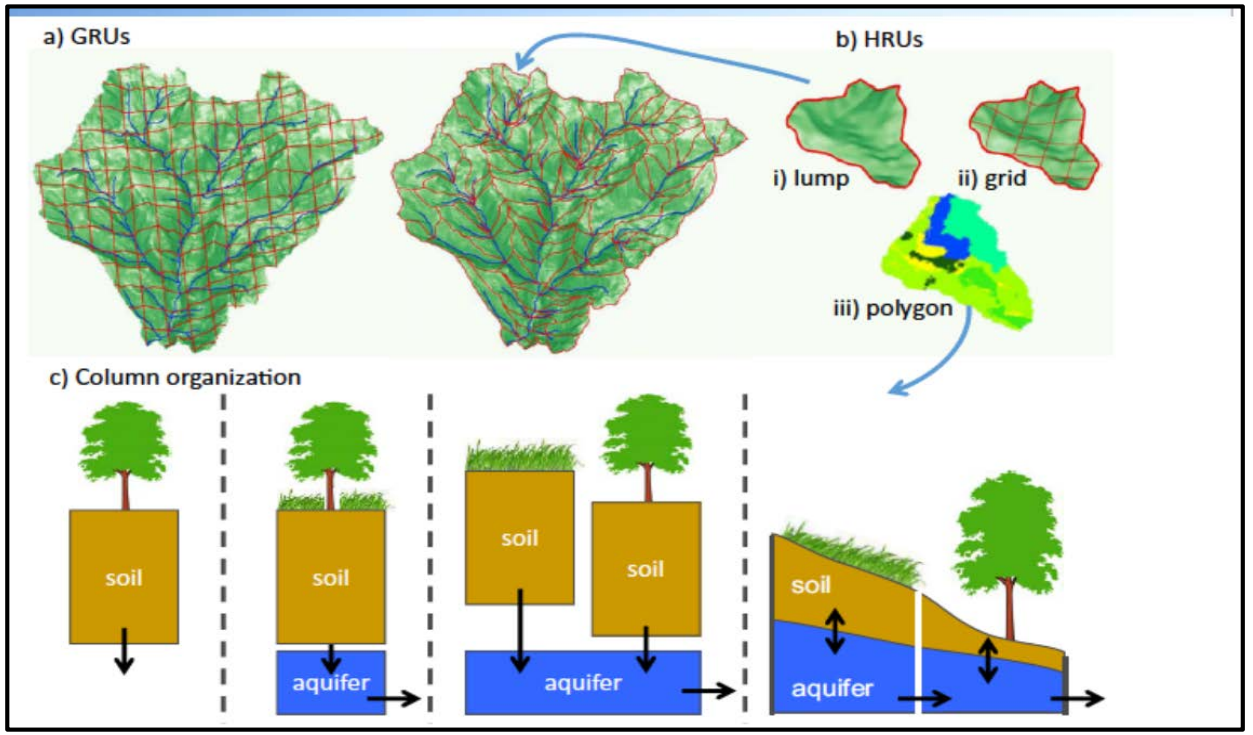
- Reproducibility
- Collaboration
- Access to enhanced computation

```
In [11]: # Find the files that are not folders.  (The initial folders are already there)
files = !find . -maxdepth 1 -type f
print(files)
hs.addContentToExistingResource(resid, files)
```

```
['./demfel.tif', './demsd8.tif', './demp.tif', './demad8o.tif', './demsrc.tif', './demtree.dat', '
./demcoord.dat', './demnet.shp', './demnet.shx', './demnet.dbf', './demnet.prj', './demw.tif', './
demord3.tif']
Successfully Added Content Files
```

The Structure for Unifying Multiple Modeling Alternatives (SUMMA)





Enable systematic evaluation of multiple working hypotheses on model representations of physical processes, encourage hydrologic modeling best practices, and elevate the state of practice of hydrologic modeling science.

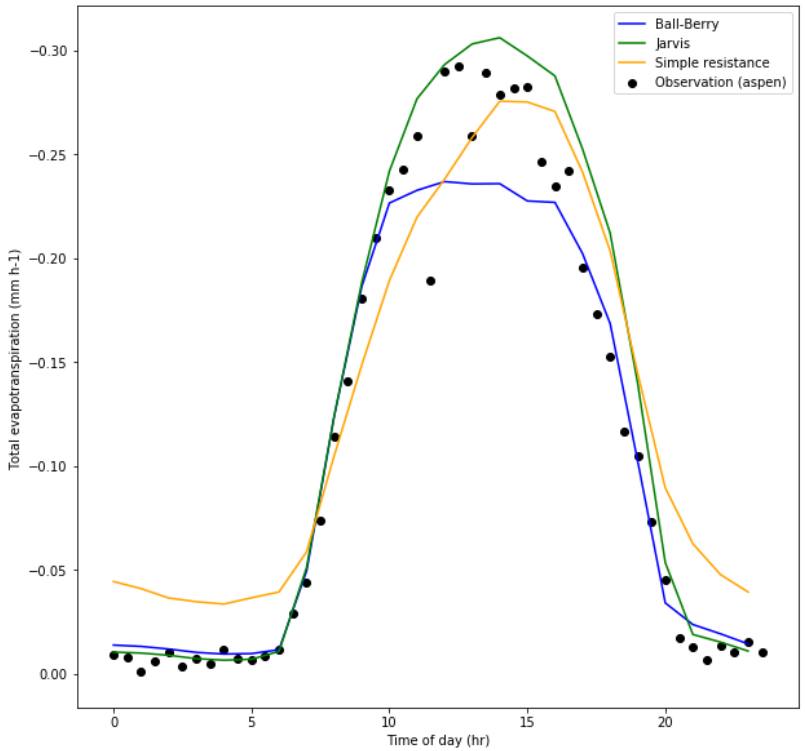
Clark, M.P., Nijssen, B., Lundquist, J.D., Kavetski, D., Rupp, D.E., Woods, R.A., Freer, J.E., Gutmann, E.D., Wood, A.W., Brekke, L.D. and Arnold, J.R., 2015. A unified approach for process-based hydrologic modeling: 1. Modeling concept. *Water Resources Research*, *51*(4), pp.2498-2514.

JupyterHub SUMMA implementation used to replicate a study in published paper where three different Evapotranspiration parameterizations are used to explore their impact on the modeled Evapotranspiration in comparison to observed Evapotranspiration rates.

Name	Selection	description
simulStart	'2007-07-01 00:00'	(01) simulation start time -- must be in single quotes
simulFinsh	'2007-08-20 00:00'	(02) simulation end time -- must be in single quotes
soilCatTbl	ROSETTA	(03) soil-category dateset
vegeParTbl	USGS	(04) vegetation category dataset
soilStress	NoahType	(05) choice of function for the soil moisture control on stomatal resistance
stomResist	**simpleResistance Ballbery Jarvis**	**(06) choice of function for stomatal resistance**
num_method	itertive	(07) choice of numerical method
fDerivMeth	analytic	(08) method used to calculate flux derivatives
LAI_method	specified	(09) method used to determine LAI and SAI
f_Richards	mixdform	(10) form of Richard's equation
groundwatr	noXplict	(11) choice of groundwater parameterization
hc_profile	constant	(12) choice of hydraulic conductivity profile
bcUpprTdyn	nrg_flux	(13) type of upper boundary condition for thermodynamics
bcLowrTdyn	zeroFlux	(14) type of lower boundary condition for thermodynamics
bcUpprSoiH	liq_flux	(15) type of upper boundary condition for soil hydrology
bcLowrSoiH	drainage	(16) type of lower boundary condition for soil hydrology
veg_traits	CM_QJRMS1988	(17) choice of parameterization for vegetation roughness length and displacement height
canopyEmis	difTrans	(18) choice of parameterization for canopy emissivity
snowIncept	lightSnow	(19) choice of parameterization for snow interception
windPrfile	logBelowCanopy	(20) choice of wind profile through the canopy
astability	louisinv	(21) choice of stability function
canopySrad	BeersLaw	(22) choice of canopy shortwave radiation method
alb_method	varDecay	(23) choice of albedo representation
compaction	anderson	(24) choice of compaction routine
snowLayers	CLM_2010	(25) choice of method to combine and sub-divide snow layers
thCondSnow	jrdn1991	(26) choice of thermal conductivity representation for snow
thCondSoil	mixConstit	(27) choice of thermal conductivity representation for soil
spatial_gw	localColumn	(28) choice of method for the spatial representation of groundwater
subRouting	timeDlay	(29) choice of method for sub-grid routing

4.5) Plotting output of three different stomatal resistance parameterizations and observation data

In [36]:
```
# create plot with three different stomatal resistance parameterizations
ET_Combine_Graph = ET_Combine.plot(color=['blue', 'green', 'orange'])
# invert y axis
ET_Combine_Graph.invert_yaxis()
# plot scatter with x='xvals', y='Observation (aspen)'
ET_Combine_Graph.scatter(xvals, df_gp_hr['Observation (aspen)'], color='black')
# add x, y label
ET_Combine_Graph.set(xlabel='Time of day (hr)', ylabel='Total evapotranspiration (mm h-1) ')
# show up the legend
ET_Combine_Graph.legend()
jtplot.figsize(x=10, y=10)
```



JupyterHub SUMMA implementation used to replicate a study in published paper where three different Evapotranspiration parameterizations are used to explore their impact on the modeled Evapotranspiration in comparison to observed Evapotranspiration rates.

4.6) Validation between the observation and simulation data.

In [37]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error
from math import sqrt
from pysumma.Validation import validation
```

In [38]:
```
# defind simulation data
BallBerry_simulation = ET_Combine ['Ball-Berry']
Jarvis_simulation = ET_Combine ['Jarvis']
Simple_resistance_simulation = ET_Combine ['Simple resistance']
```

In [39]:
```
# defind observation data
obs = df_gp_hr.groupby('level_0').mean()
observation_data = obs['Observation (aspen)']
```

In [40]:
```
# analyze validtation between BallBerry simulation and observation data.
validation.analysis(observation_data, BallBerry_simulation)
```

```
Mean Absolute Error: 0.014720
Mean Squared Error: 0.000434
Root Mean Squared Error: 0.020833
```

In [41]:
```
# analyze validtation between Jarvis simulation and observation data.
validation.analysis(observation_data, Jarvis_simulation)
```

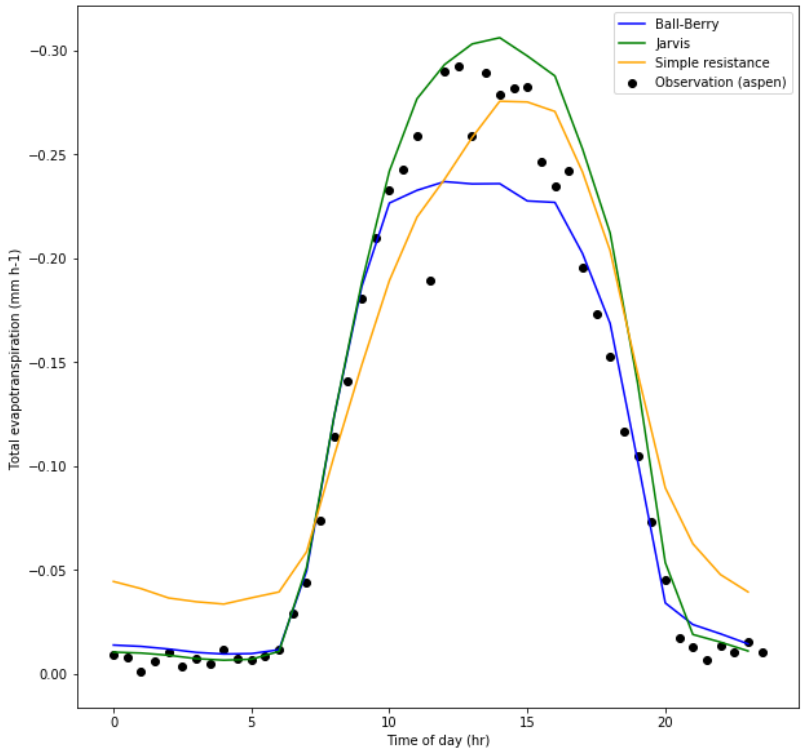
```
Mean Absolute Error: 0.019703
Mean Squared Error: 0.000915
Root Mean Squared Error: 0.030249
```

In [42]:
```
# analyze validtation between Simple resistance simulation and observation data.
validation.analysis(observation_data, Simple_resistance_simulation)
```

```
Mean Absolute Error: 0.033234
Mean Squared Error: 0.001449
Root Mean Squared Error: 0.038060
```

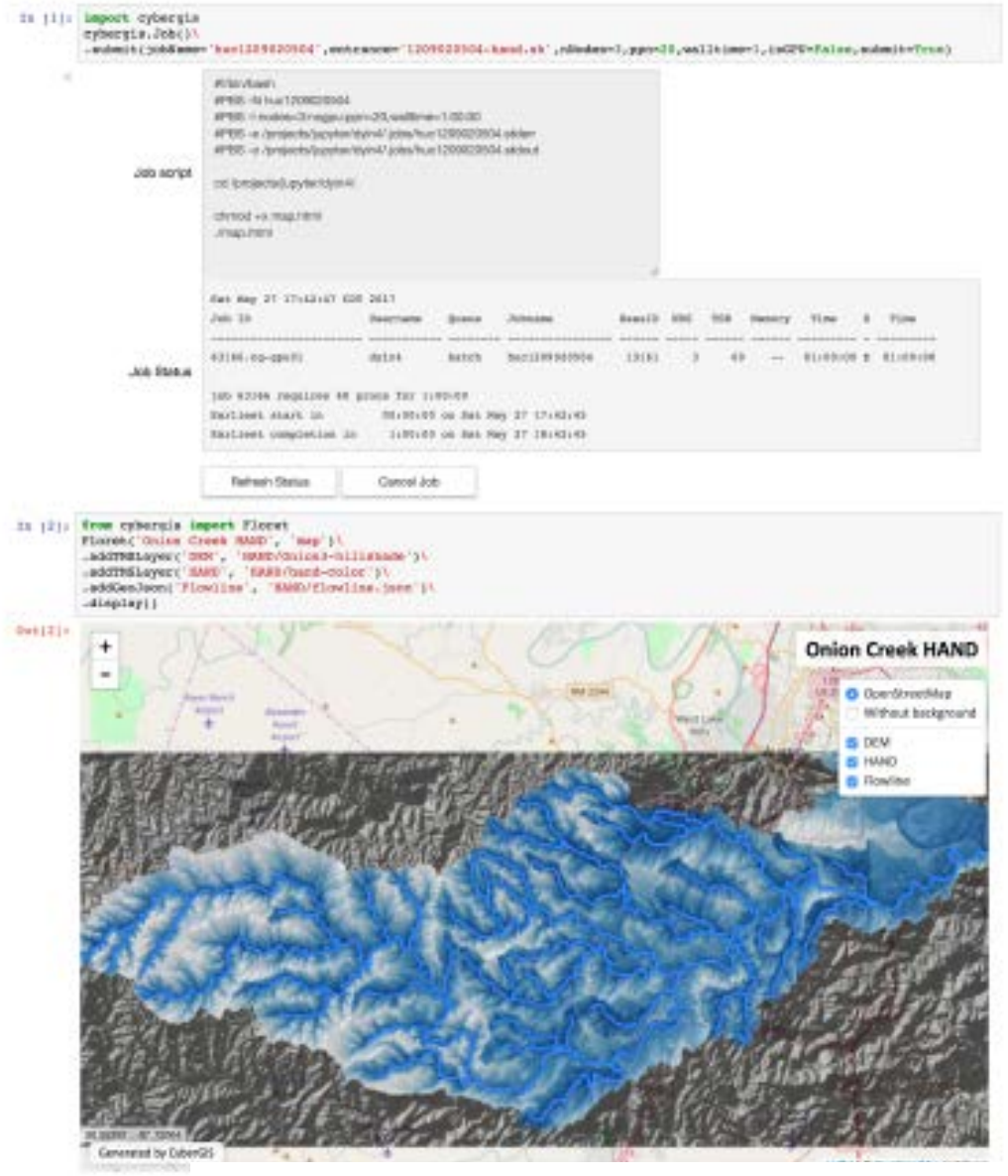
4.5) Plotting output of three different stomatal resistance parameterizations and observation data

In [36]:
```
# create plot with three different stomatal resistance parameterizations
ET_Combine_Graph = ET_Combine.plot(color=['blue', 'green', 'orange'])
# invert y axis
ET_Combine_Graph.invert_yaxis()
# plot scatter with x='xvals', y='Observation (aspen)'
ET_Combine_Graph.scatter(xvals, df_gp_hr['Observation (aspen)'], color='black')
# add x, y label
ET_Combine_Graph.set(xlabel='Time of day (hr)', ylabel='Total evapotranspiration (mm h-1) ')
# show up the legend
ET_Combine_Graph.legend()
jtplot.figsize(x=10, y=10)
```

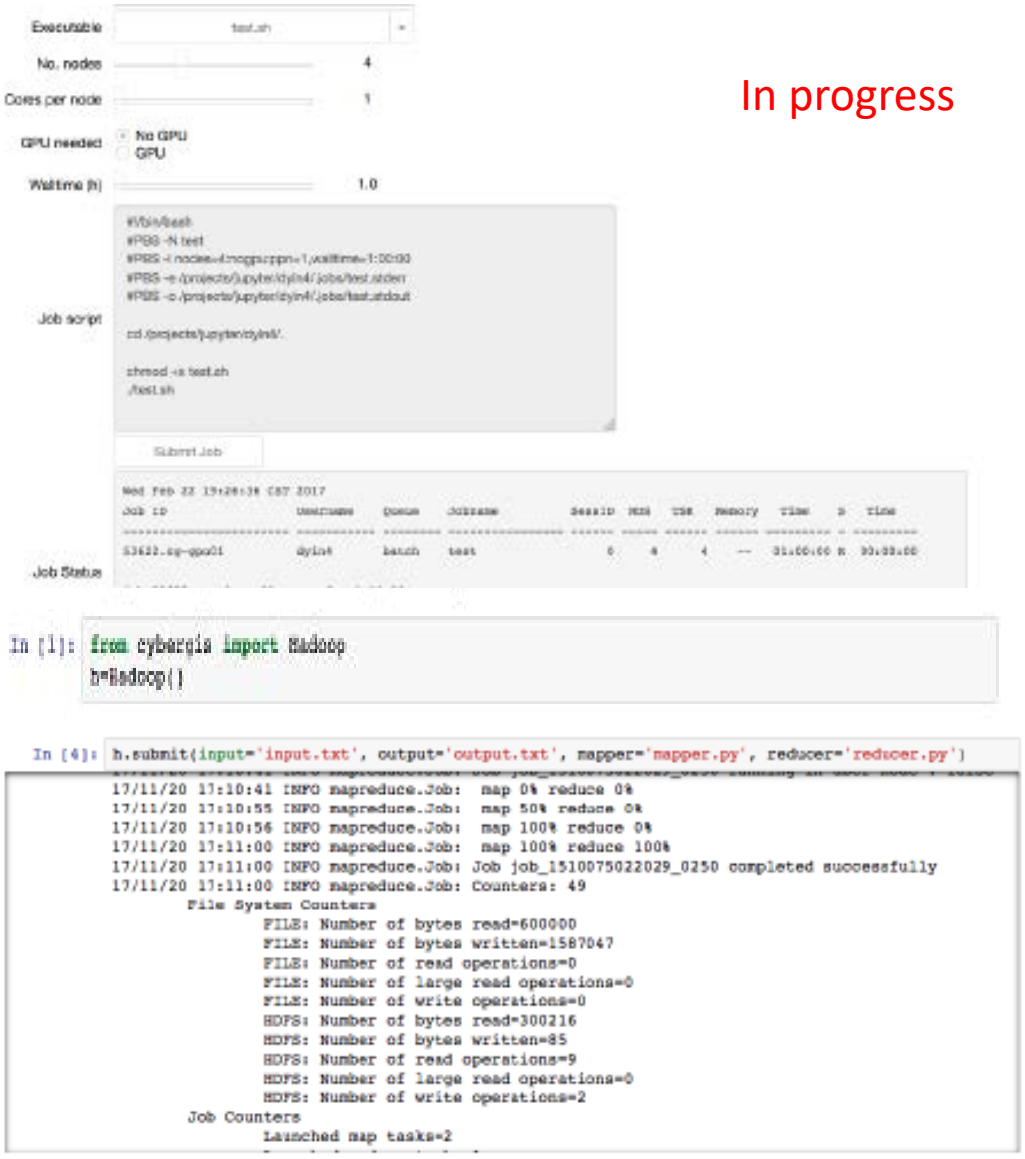


CyberGIS-Jupyter

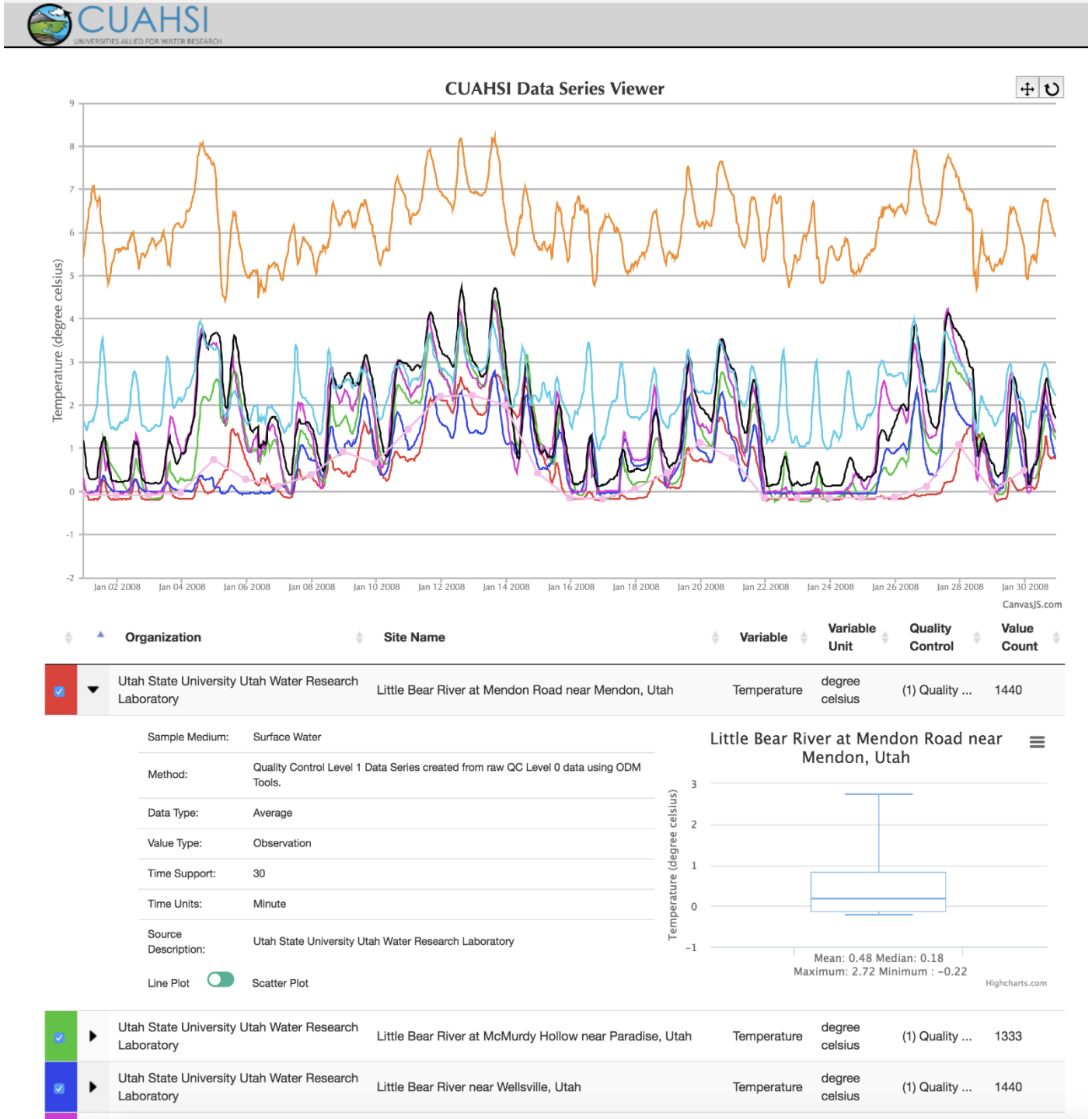
An enhanced JupyterHub platform to ease linkages to geospatial data analytics and execution of HPC-enabled models



In progress



Yin, D., Liu, Y., Padmanabhan, A., Terstriep, J., Rush, J. and Wang, S., 2017, July. A CyberGIS-Jupyter Framework for Geospatial Analytics at Scale. In Proceedings of the Practice and Experience in Advanced Research Computing 2017 on Sustainability, Success and Impact (p. 18). ACM.



CUAHSI Data Series Viewer

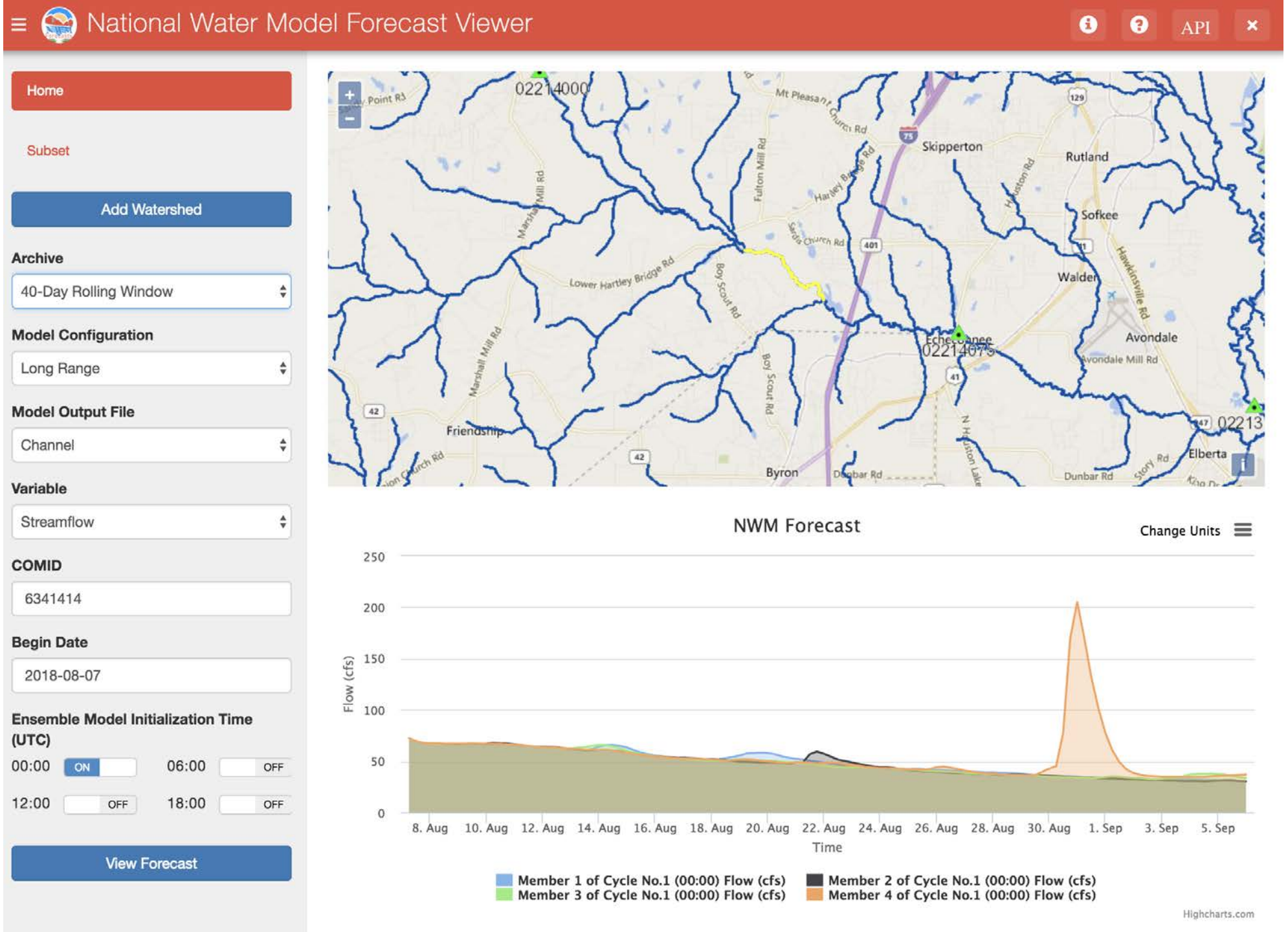
Display one or more time series and metadata from time series resources.

Apps that facilitate and ease access to community value datasets

Not all data for which HydroShare facilitates access will be formal resources

- National Water Model Data (NWM forecast viewer and Data Explorer apps)
- NASA Modis Snow Cover (Snow inspector app)
- NASA NLDAS data (Data Rods Explorer app)
- GRACE Satellite total water storage from gravity (GRACE App)

Enhancing access to community data products



- View a time series forecast for any stream segment, model variable, and forecast period.
- Download a NetCDF file of a subset of forecasts for any polygon provided.
- Access data via web API – with auth token.

Snow Inspector

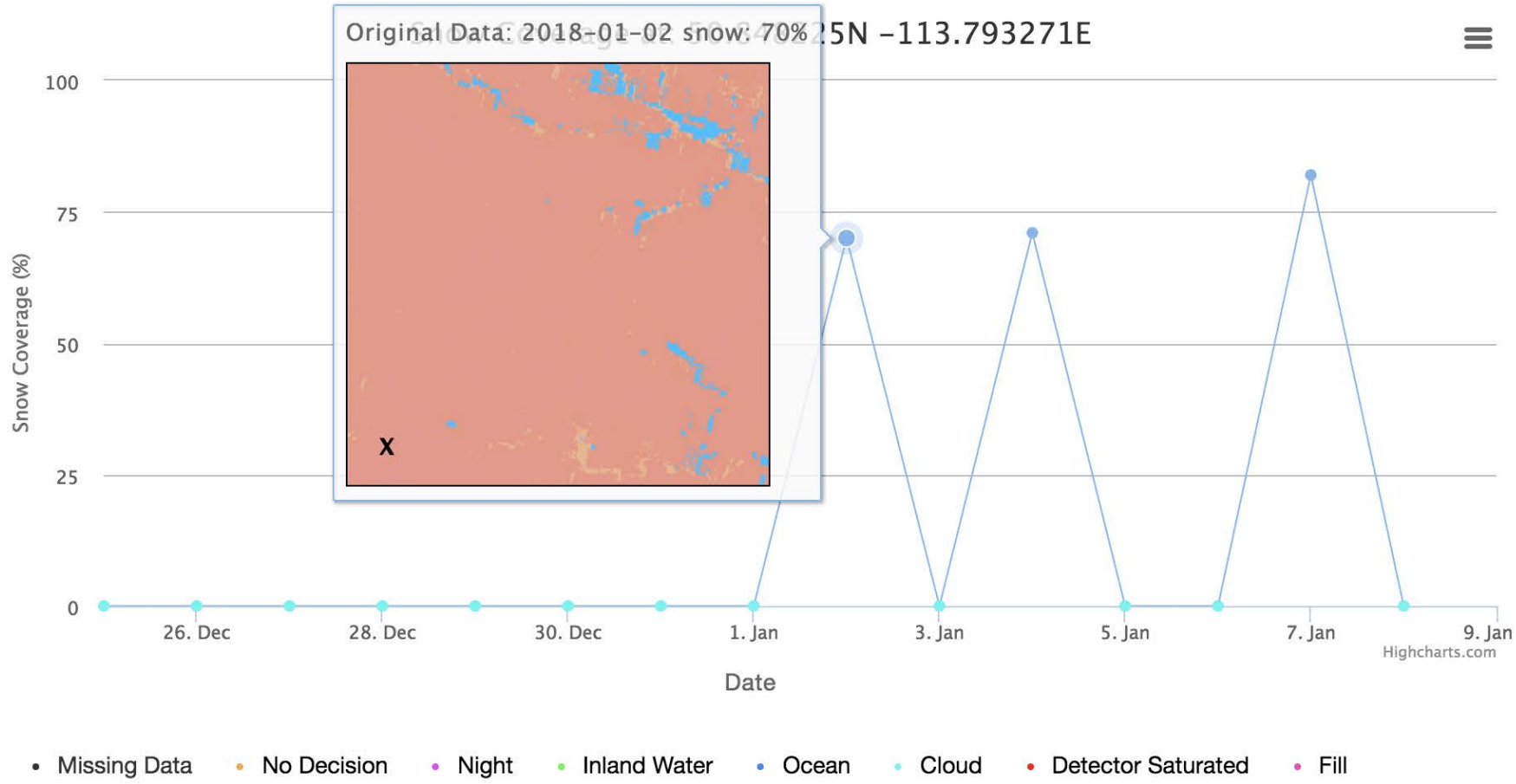
Change Dates, Location & Layer

'2	72	70	69	69
'2	67	70	69	69
'2	70	70	69	69
'2	70	70	69	69
'2	70	69	69	69
'0	70	69	69	71
'0	70	69	69	71
'6	73	73	71	71

Estimated data value per cell

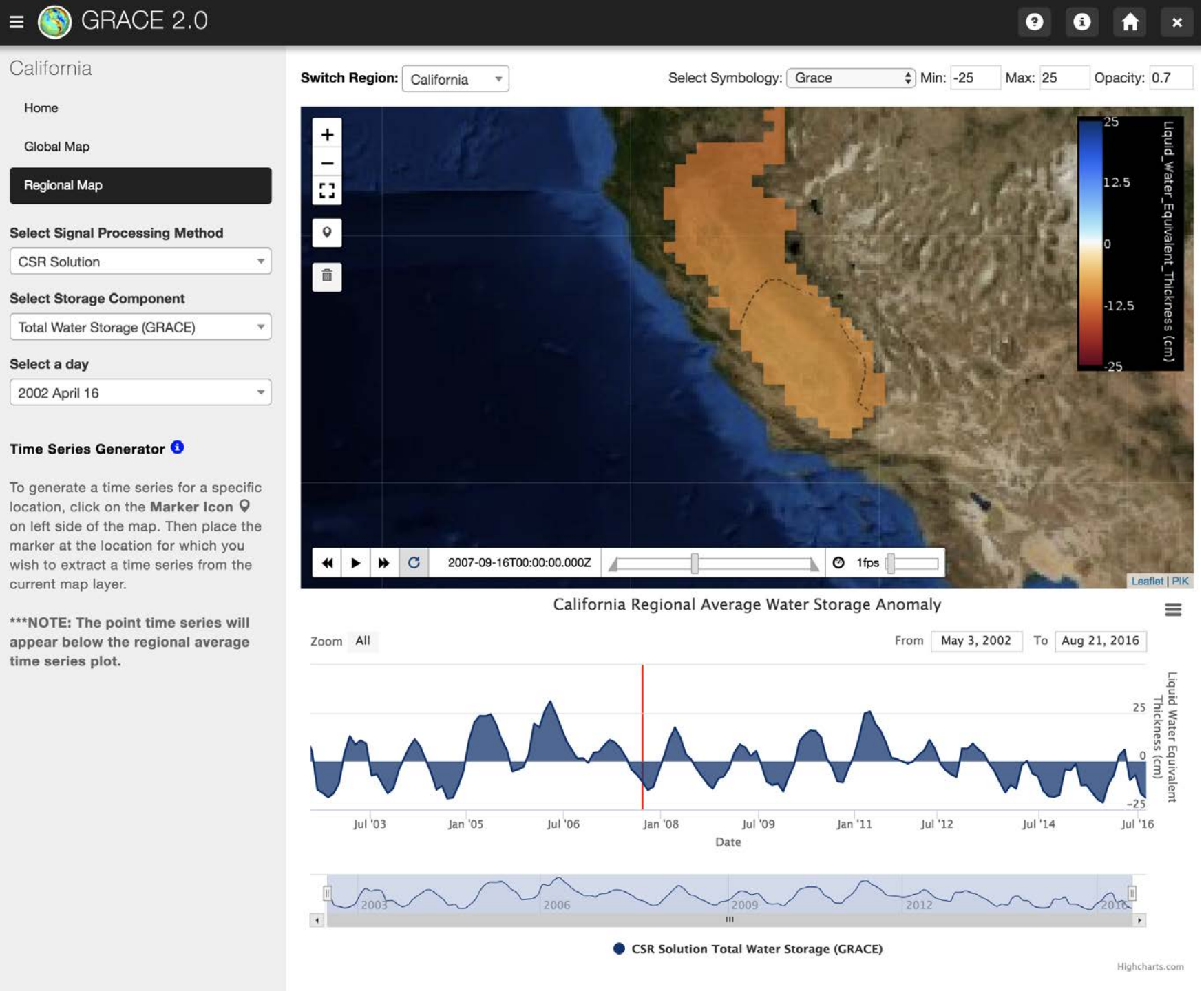
Layer Selected: Snow Cover

Graph For: *50.848225 -113.793271* time period: 2017-12-25 - 2018-01-09



View a time series of percent snow cover for any location on the globe based on the MODIS snow cover product.

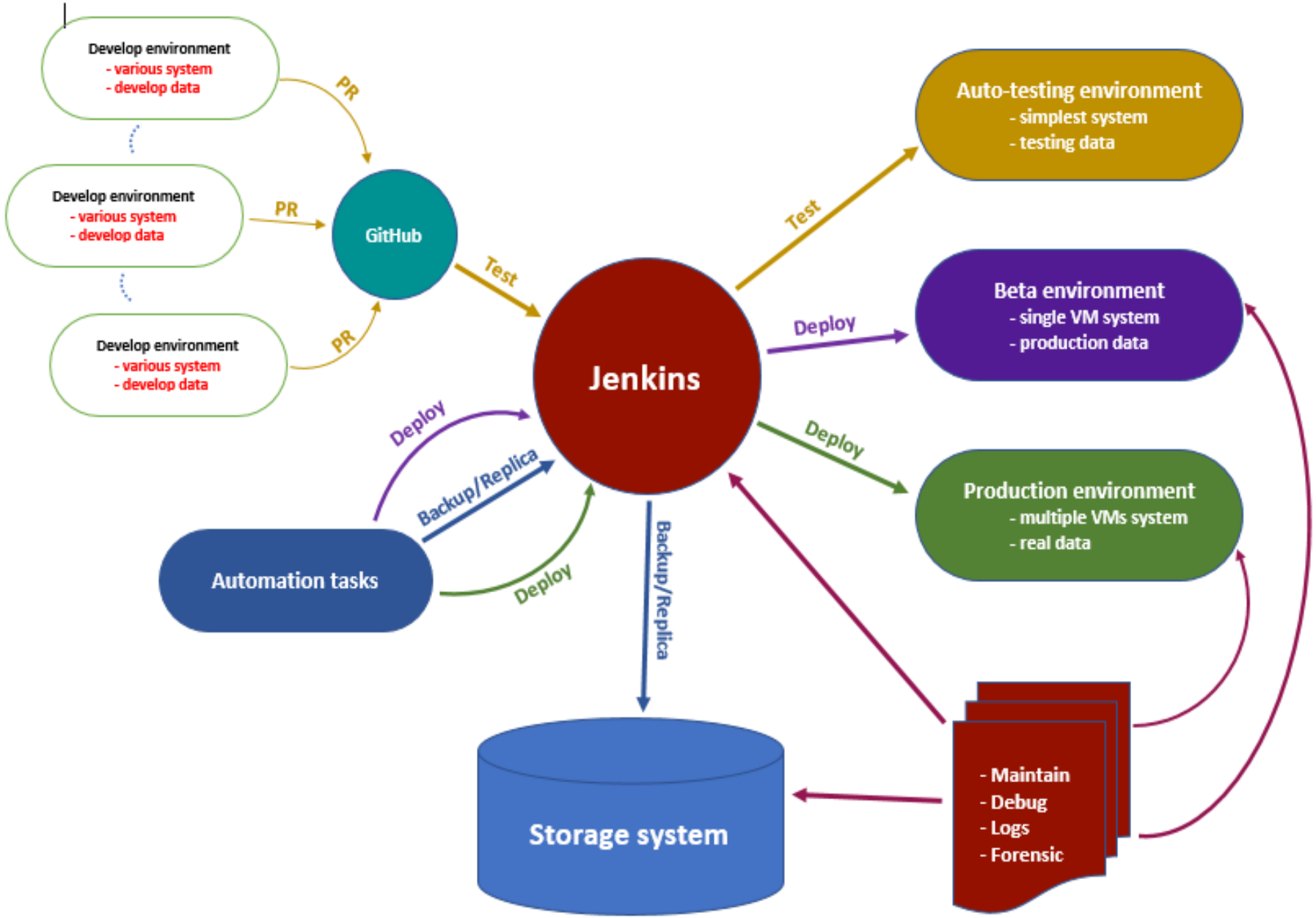
Back | Upload to HydroShare | Get WaterML



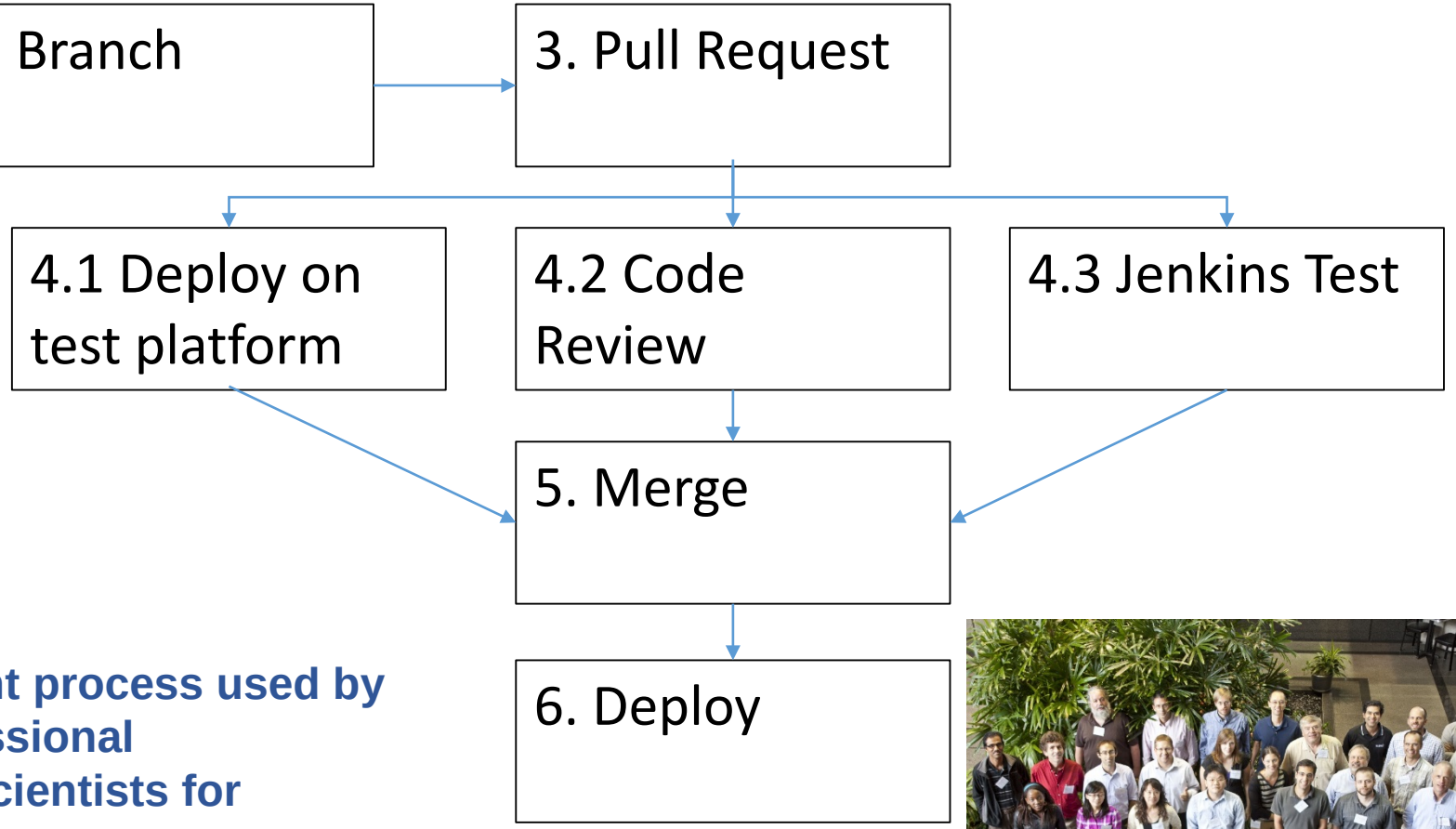
NASA GRACE Groundwater App

View global GRACE satellite results including surface water, groundwater, soil moisture. Extract time series and animate data over selected time periods and locations using THREDDS.

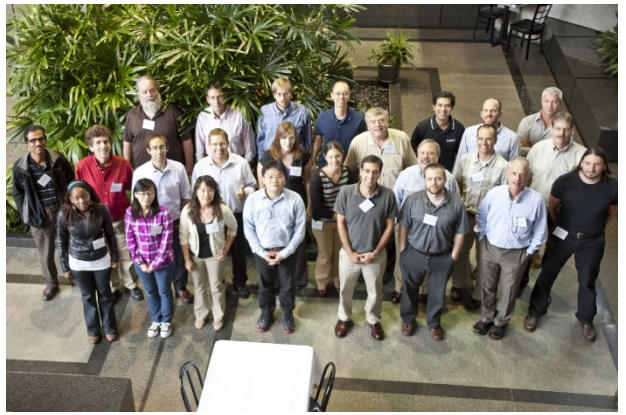
HydroShare Infrastructure



Software Engineering Process



Collaborative open development process used by multidisciplinary team of professional programmers and hydrologic scientists for HydroShare development.



HydroShare User Experience Redesign

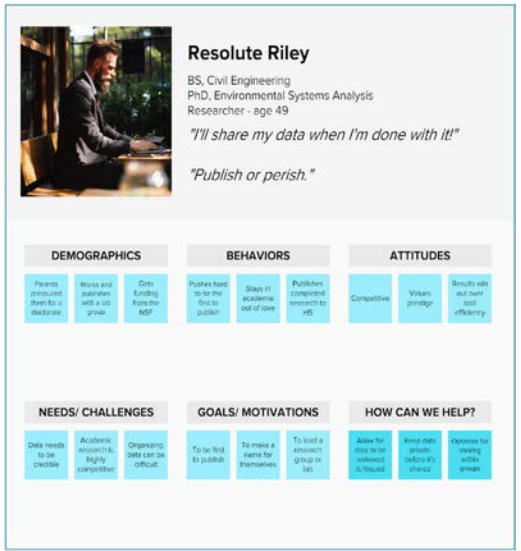
Olin College of Engineering

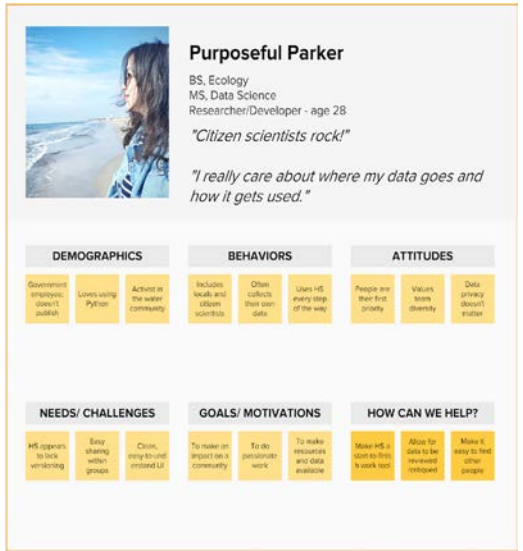
Leveraging user-oriented design practices to inform future design decisions to the HydroShare interface

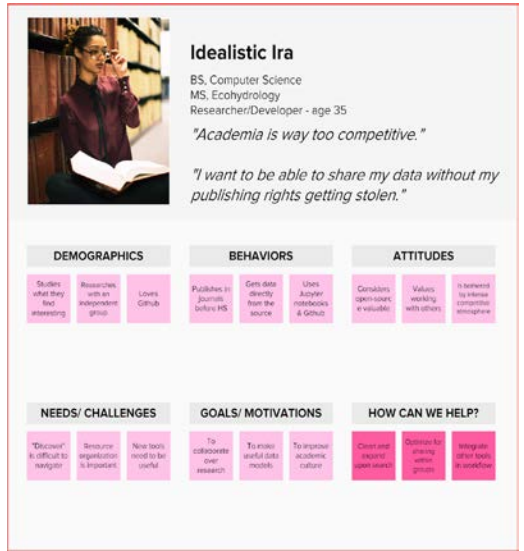
Design practices:

- Talking to users
- Co-design
- Design frameworks e.g. personas, journey maps, etc.
- Wireframing

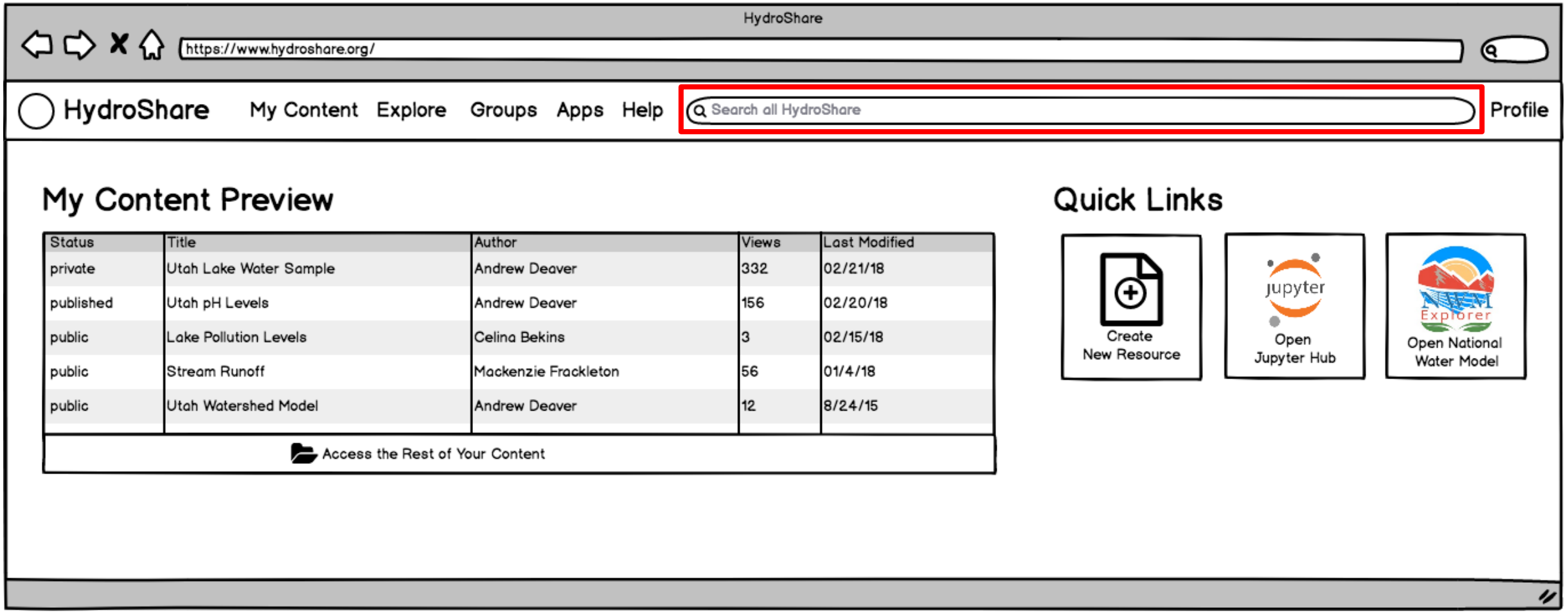
Keenan, Patrick, Andrew, Mackenzie, & Celina







Example: Recommendation for Dashboard and “Search all of HydroShare”



Olin College of Engineering

Full Final Report:
https://www.hydroshare.org/resource/9e888ababe6648ad95d07b6ec5ed7cb0/

Summary

HydroShare is a web based collaboration environment to enable more rapid advances in hydrologic understanding through collaborative data sharing, analysis and modeling

- Sharing and publication of data (DOI)
- Social discovery and added value
- Model sharing

Collaboration, Reproducibility, Credit, Transparency

- Model input data preparation
- Model execution
- Visualization and analysis (best of practice tools)

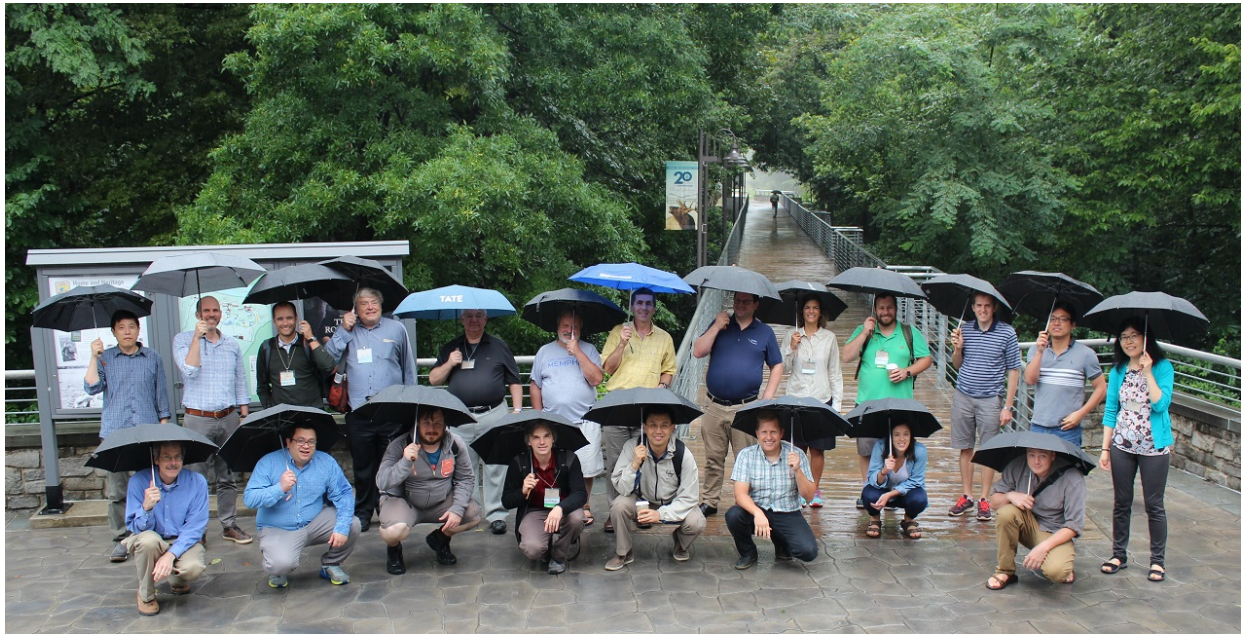
Server/Cloud Computation

- Platform independence
- Big data
- Reproducibility
- Reduce needs for software installation and configuration

OAC-1664061
OAC-1664018
OAC-1664119
2017-2021

Thanks to the HydroShare team!

HydroShare is operated by CUAHSI with ongoing development through a collaborative project among Utah State University, RENCI University of North Carolina, CyberGIS Center University of Illinois, Tufts, University of Virginia, Brigham Young University, National Center for Atmospheric Research and the University of Washington.



To learn more

- Publications https://help.hydroshare.org/about-hydroshare/publish/
- Online Help https://help.hydroshare.org/

HYDROSHARE

http://www.hydroshare.org

CUAHSI
universities allied for water research