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

ACI-1148453
ACI-1148090
2012-2017

Hydroshare: An online hydrologic information system for sharing data and models in support of hydrologic research

Access these slides in HydroShare by searching for "GeoEDF"

David Tarboton, Ray Idaszak, Jeffery S Horsburgh, Daniel P Ames, Jonathan L Goodall, Alva Couch, Pabitra Dash, Hong Yi, Christina Bandaragoda, Anthony Castronova, Bart Nijssen, Richard Hooper, Shaowen Wang, Maurier Ramirez, Jeffrey Sadler, Mohamed Morsy, Scott Black, Dandong Yin.

HydroShare is operated by 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

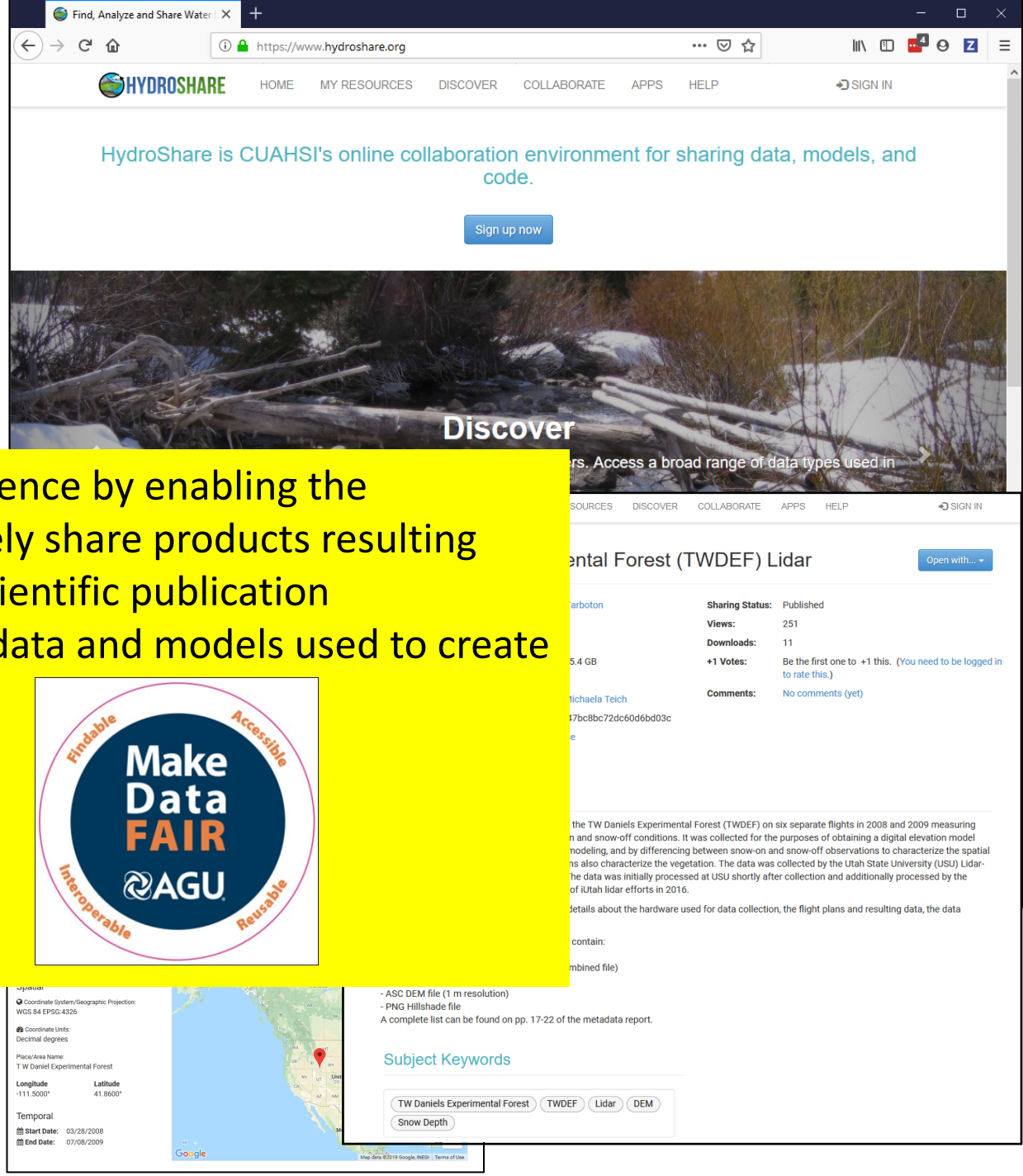
HYDROSHARE

http://www.hydroshare.org

- Domain-specific data and model repository operated by the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI)
- Gives users a way to
  research products
- Has capabilities for c
- Has links to computa
- Provides permanent
  with citable digital o
  literature
- Gateway for web bas
  modeling functionali
  compatibility, dependency and capacity limitations
- Capability to reproduce workflows in a JupyterHub environment

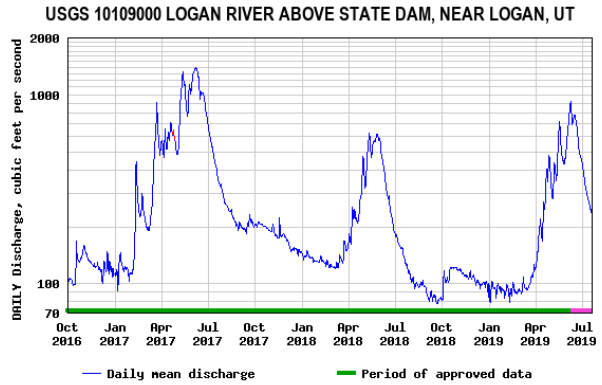
A system to advance hydrologic science by enabling the community to more easily and freely share products resulting from their research, not just the scientific publication summarizing a study, but also the data and models used to create the scientific publication.

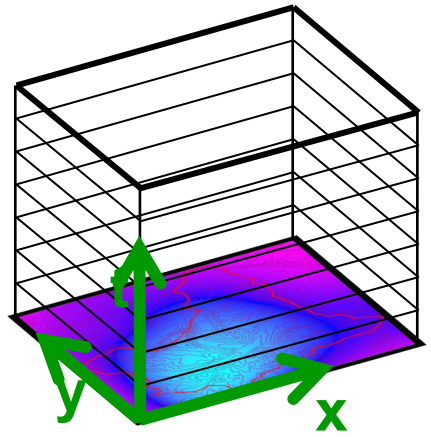
- **F**indable
- **A**ccessible
- **I**nteroperable
- **R**eusable

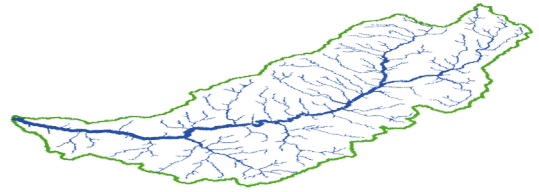


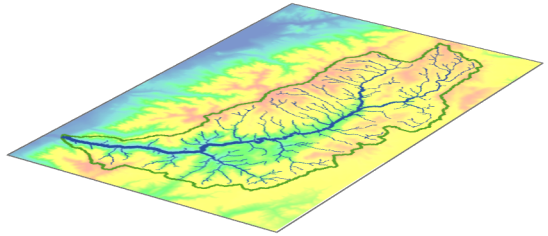
Principles

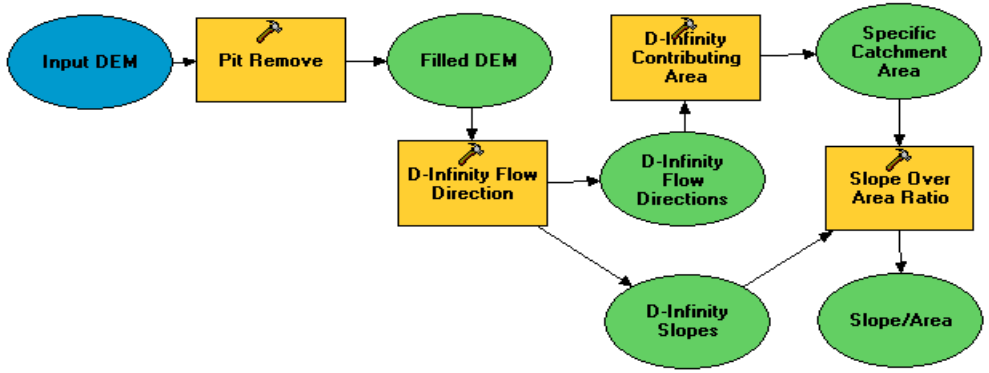
- Data and models are first-class products of research and should be shared
- Data and models become **social objects**
- In HydroShare data and models are stored in and comprise “Resources”





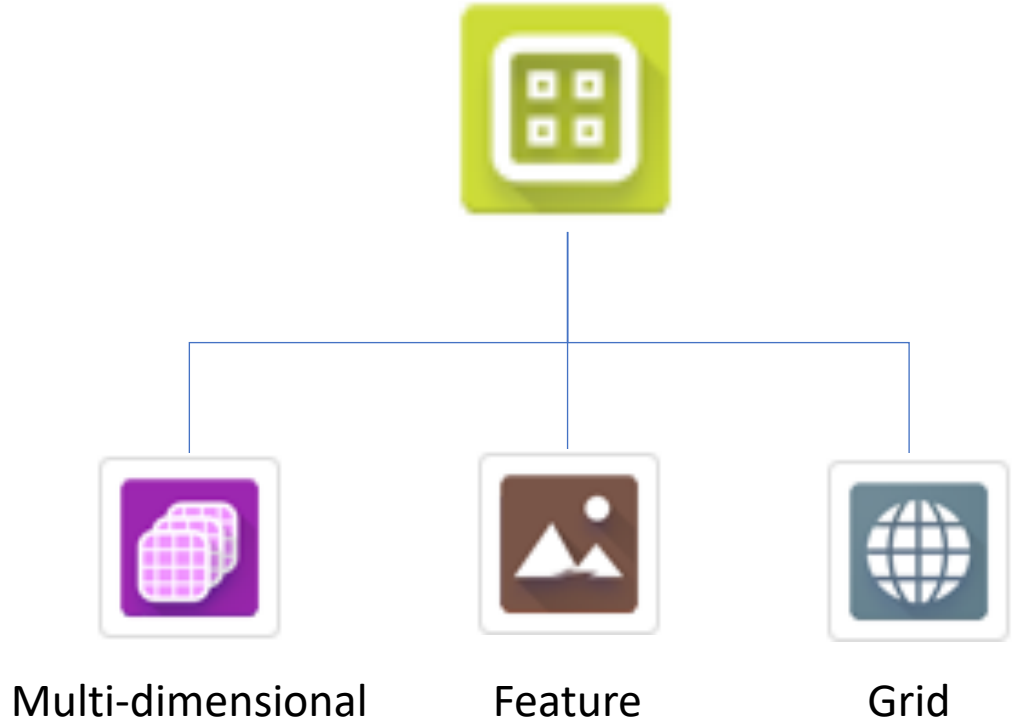






HydroShare OAI-ORE standard based Resource Data Model

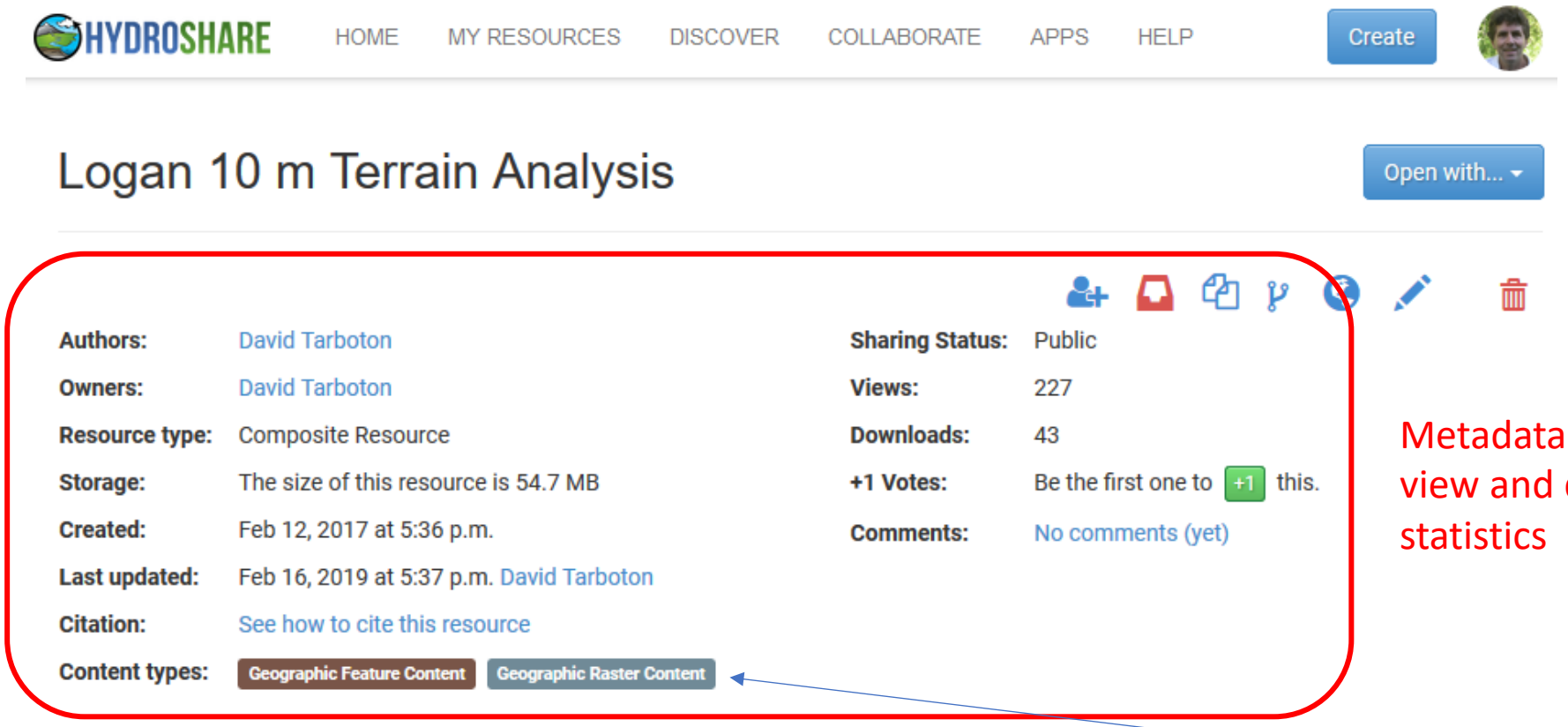
- A resource can hold multiple content aggregations
  - Managed as one discoverable resource
  - One set of access controls (Owners, Editors etc.)
  - One unique identifier
  - One set of resource level metadata
- A content aggregation
  - Can hold one or multiple files that comprise a single logical object
  - Each being a different type of data
  - One set of aggregation level metadata



Schema.org + Dublin Core machine readable metadata 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.

Resource Landing Page



Metadata header with view and download statistics

Content types

Conceptual HydroShare Architecture

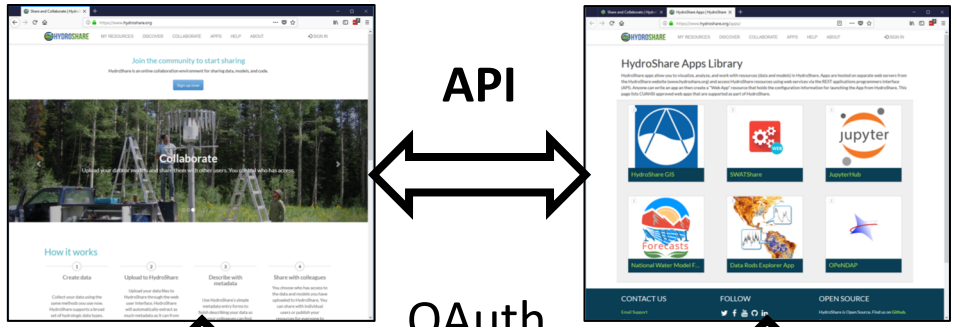
Exploration and Content Management

Django Website

Actions on and working with Resources

Apps

Collaboration, Reproducibility, Credit, Transparency, Trust



Storage

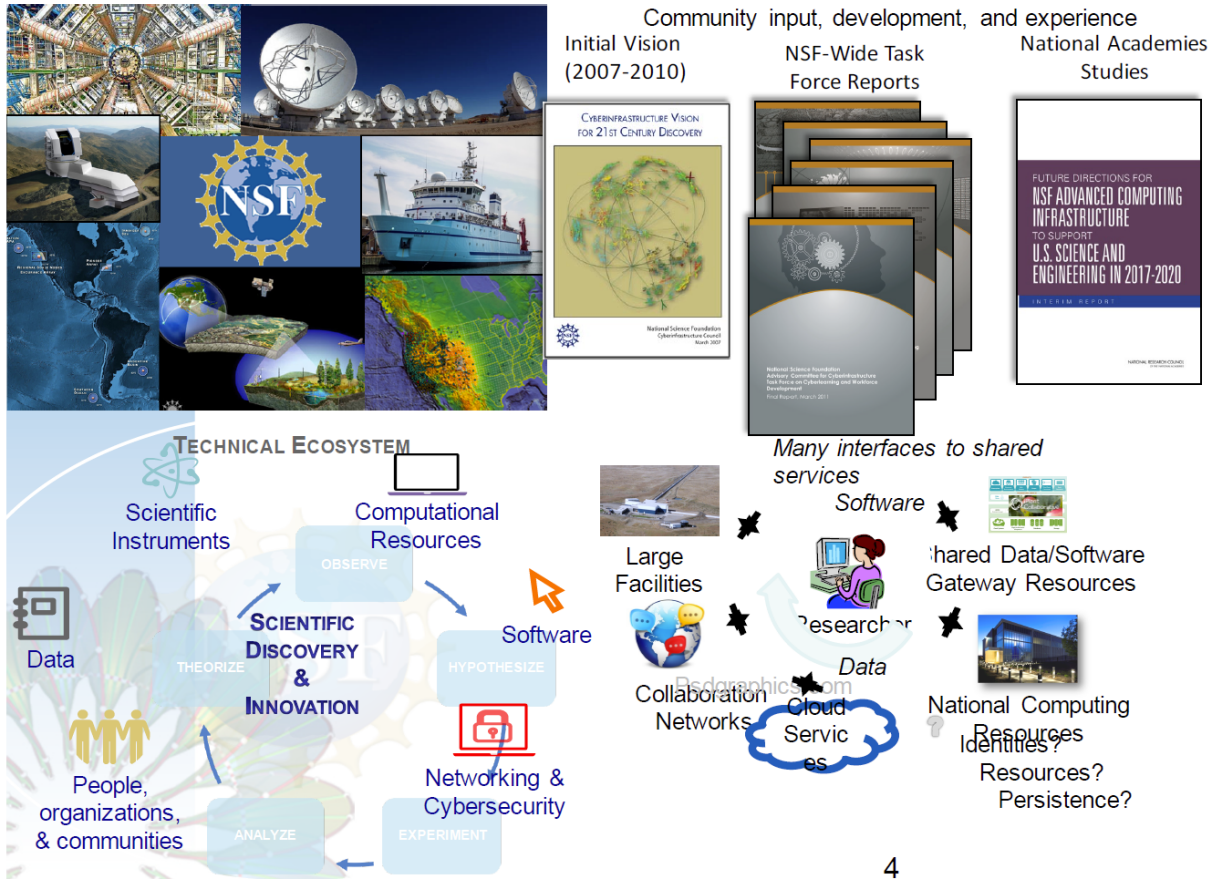
Server/Cloud Computation

- Platform independence
- Big (ish) data
- Reproducibility
- Reduce needs for software installation and configuration
- Scalable Analytics
- Extensibility
  - Anyone can set up a server/app platform (software service) to launch from ("Open with") HydroShare and operate on content through API

Moving towards fully web based hydrologic innovation environment

Interoperability and Software Ecosystems

- A foundation of the web
- No one system can do it all
- Applications programming interfaces (APIs)
- Unique Identifiers that enable linked data (web URI's)
- A cyberinfrastructure ecosystem of many interfaces to shared services
- Personal Cyberinfrastructure
  - Individually managed set of CI tools you assemble and learn to use to do your work



NSF vision for a cyberinfrastructure of many interfaces to shared services [Rajiv Ramnath, NSF Division of Advanced Cyberinfrastructure https://doi.org/10.6084/m9.figshare.4676173]

Connecting GeoEDF with HydroShare

- Modeling and Analysis Tools. “Open With”
- Resource storage interoperability. OAI-ORE + Bagit Resource Data Model

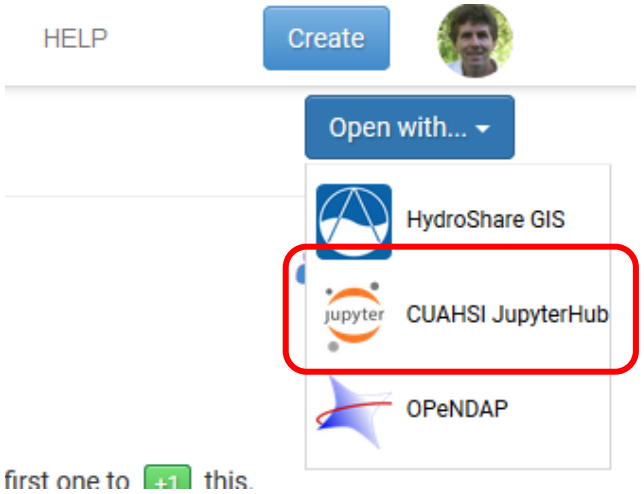
I think we should

- Develop capability to connect GeoEDF tools (e.g. connector tools) with HydroShare using Open With
- Explore convergence of the resource storage data model

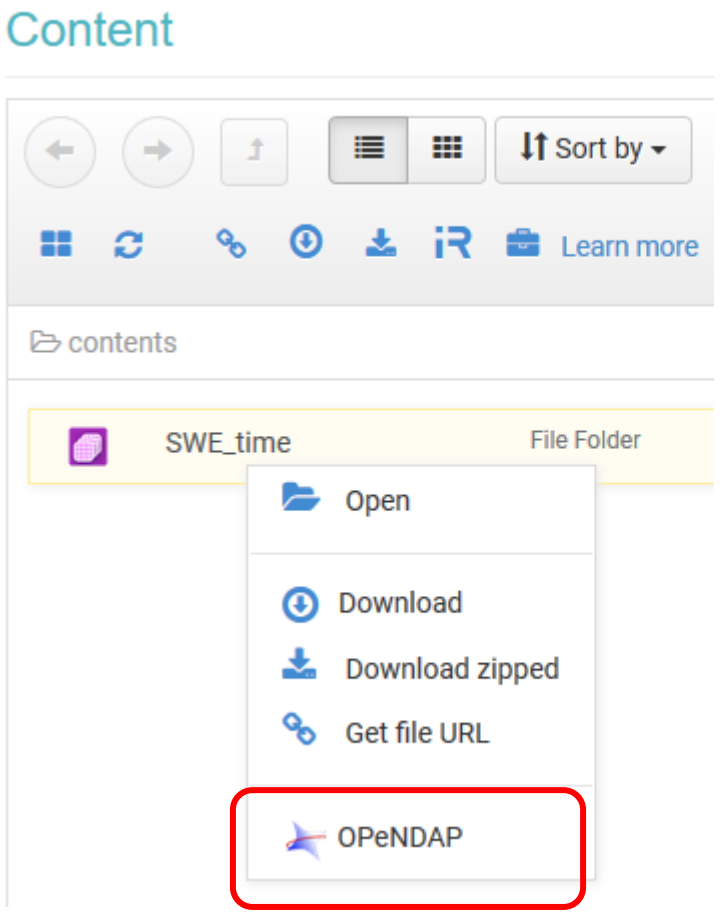
Seamless interoperability for users through coordinated loosely coupled underlying CI architecture

“Open With”

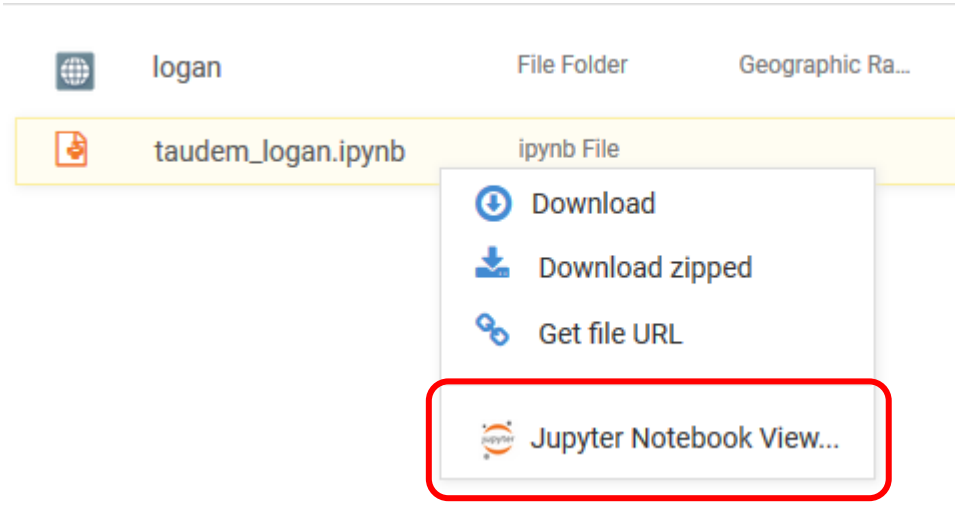
Resource Level



Content aggregation level

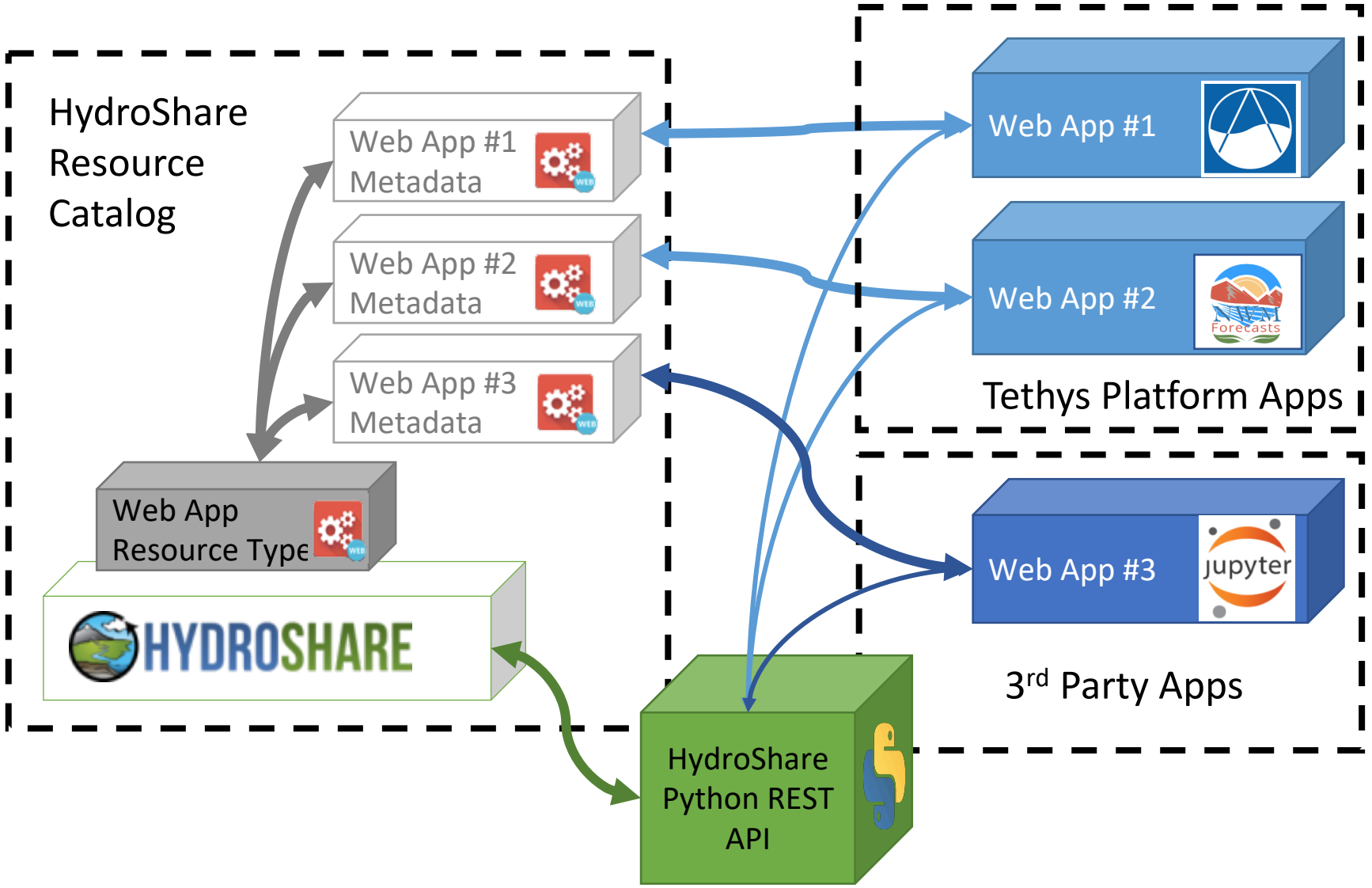


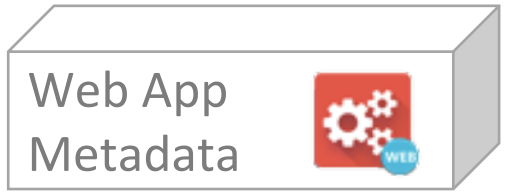
File level



Web App Connector

Anybody can create a web app on any web server and configure a web app Connector 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}

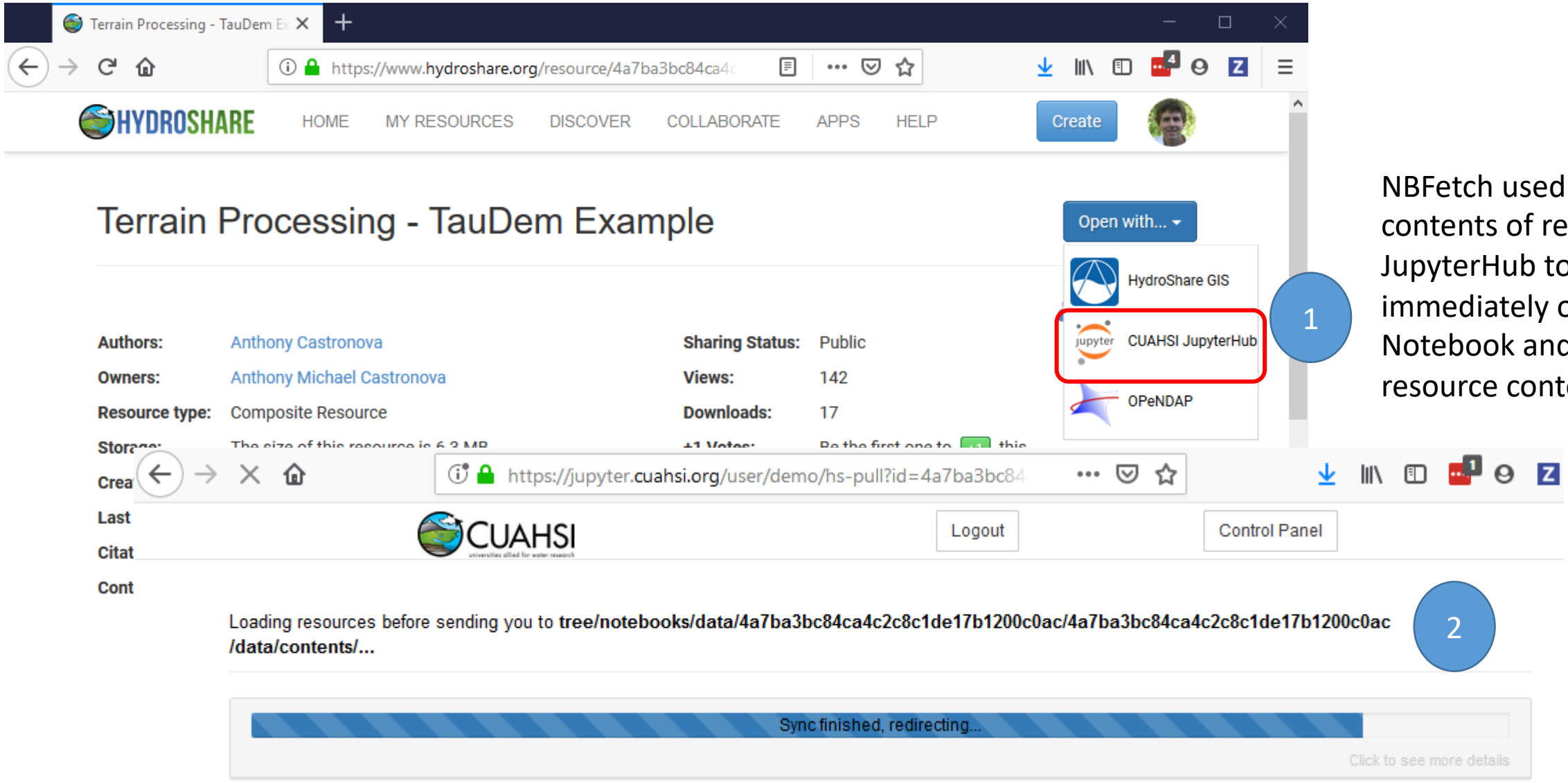
Examples:

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

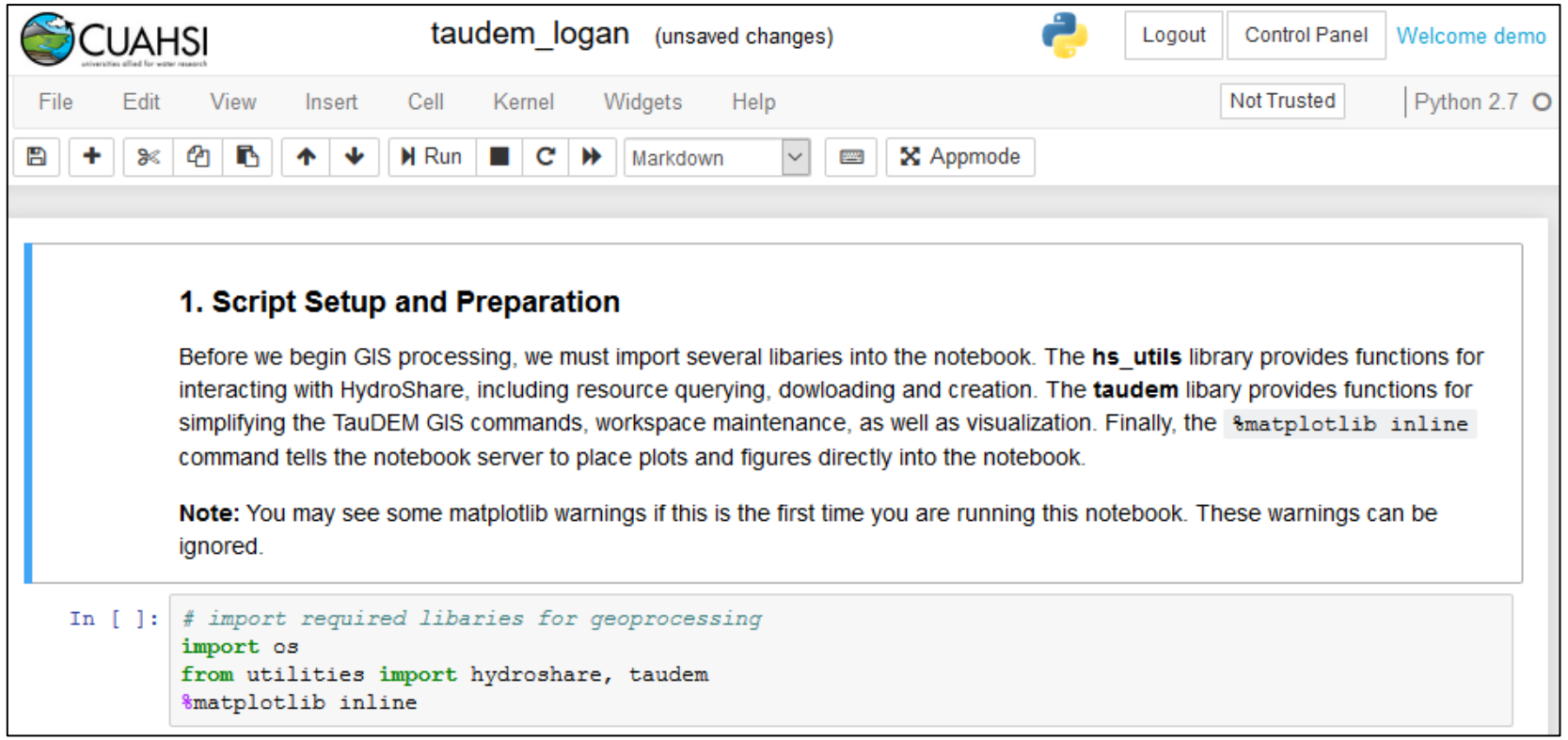


NBFetch used to retrieve contents of resource into JupyterHub to be able to immediately open Notebook and act on resource content files

Implemented through collaboration with Martin Hunt, Science Gateways Community Institute Consultant

JupyterHub

3



4

Analysis in JupyterHub

5

Save Results back to HydroShare

Summary

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

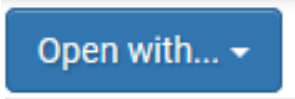
- Sharing and publication of data (DOI)
- Social discovery and added value
- Model sharing

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
- Interoperability
- Reduced needs for software installation and configuration



Thanks to the HydroShare team!

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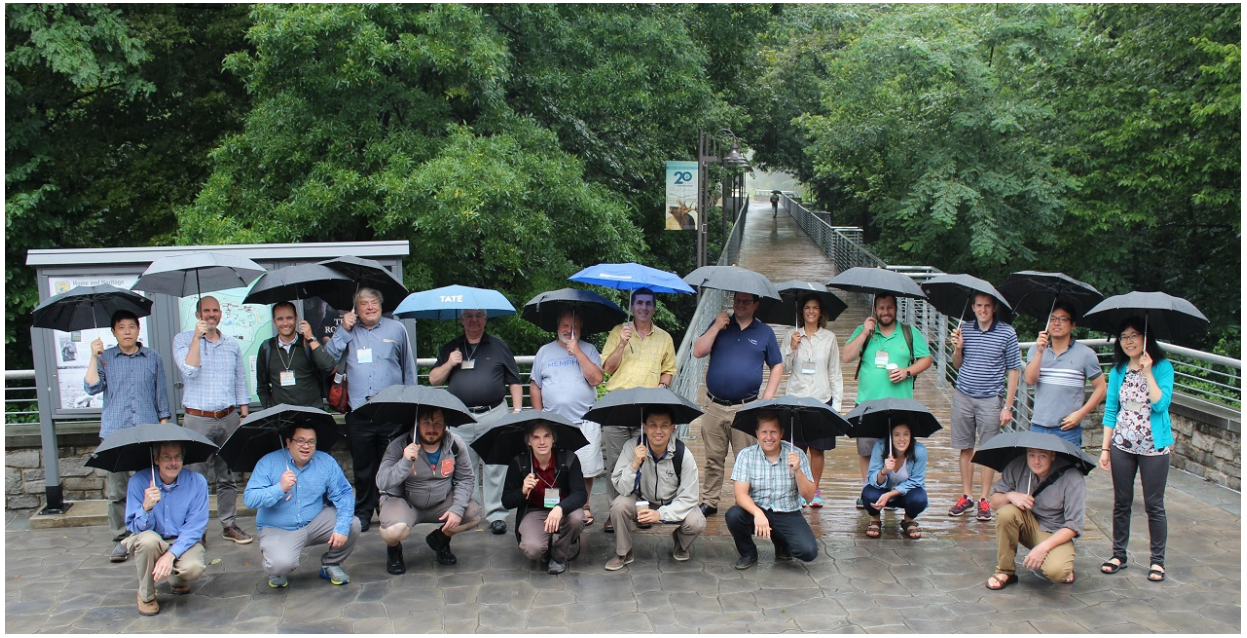

To learn more

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

HYDROSHARE

http://www.hydroshare.org

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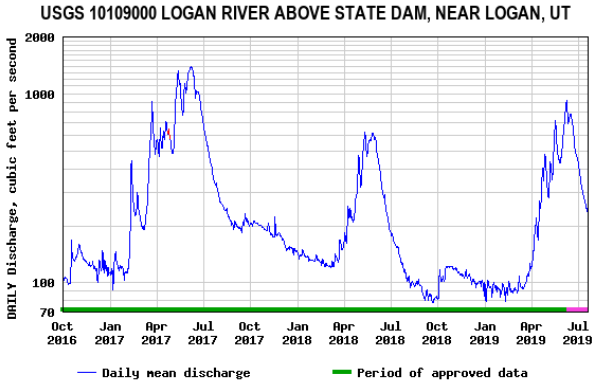
universities allied for water research

Extra Slides

Value that HYDROSHARE provides

- Integration of information from multiple sources to enhance research
- Re-use of data beyond the purpose for which it was originally collected, extending the value of measurement, monitoring and research investments
- A platform for data management to support mandates for open data and access to the data that supports research findings
- Enhanced trust in research findings and management decisions through transparency and support for reproducibility
- Web based computational analysis and modeling functionality to overcome desktop compatibility, dependency and capacity limitations



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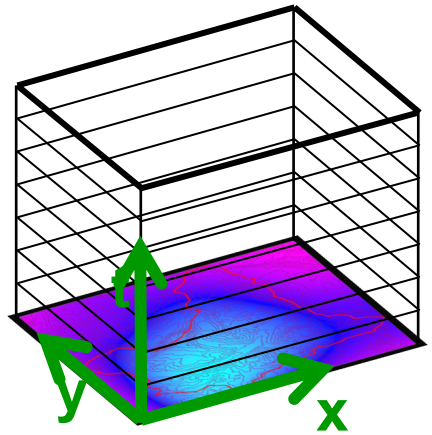
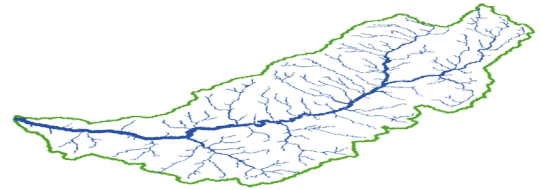
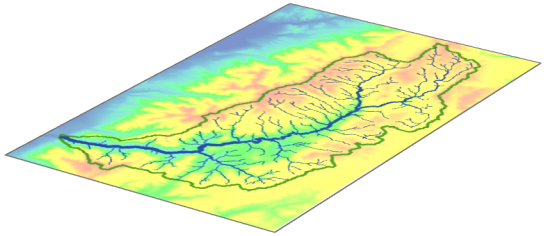
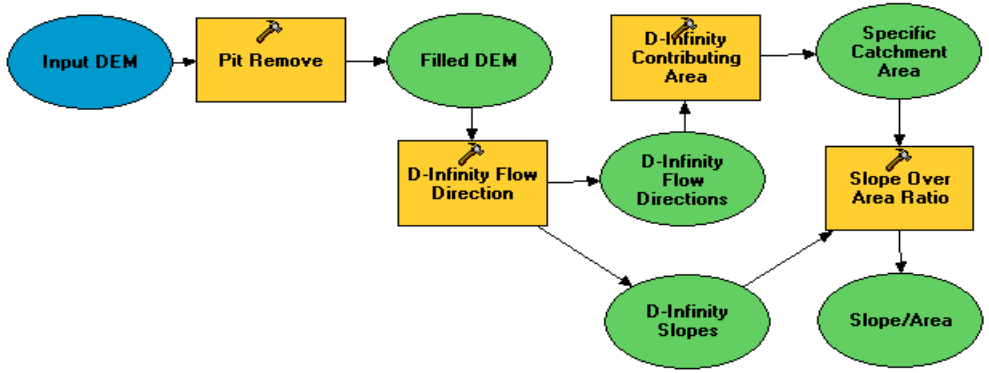
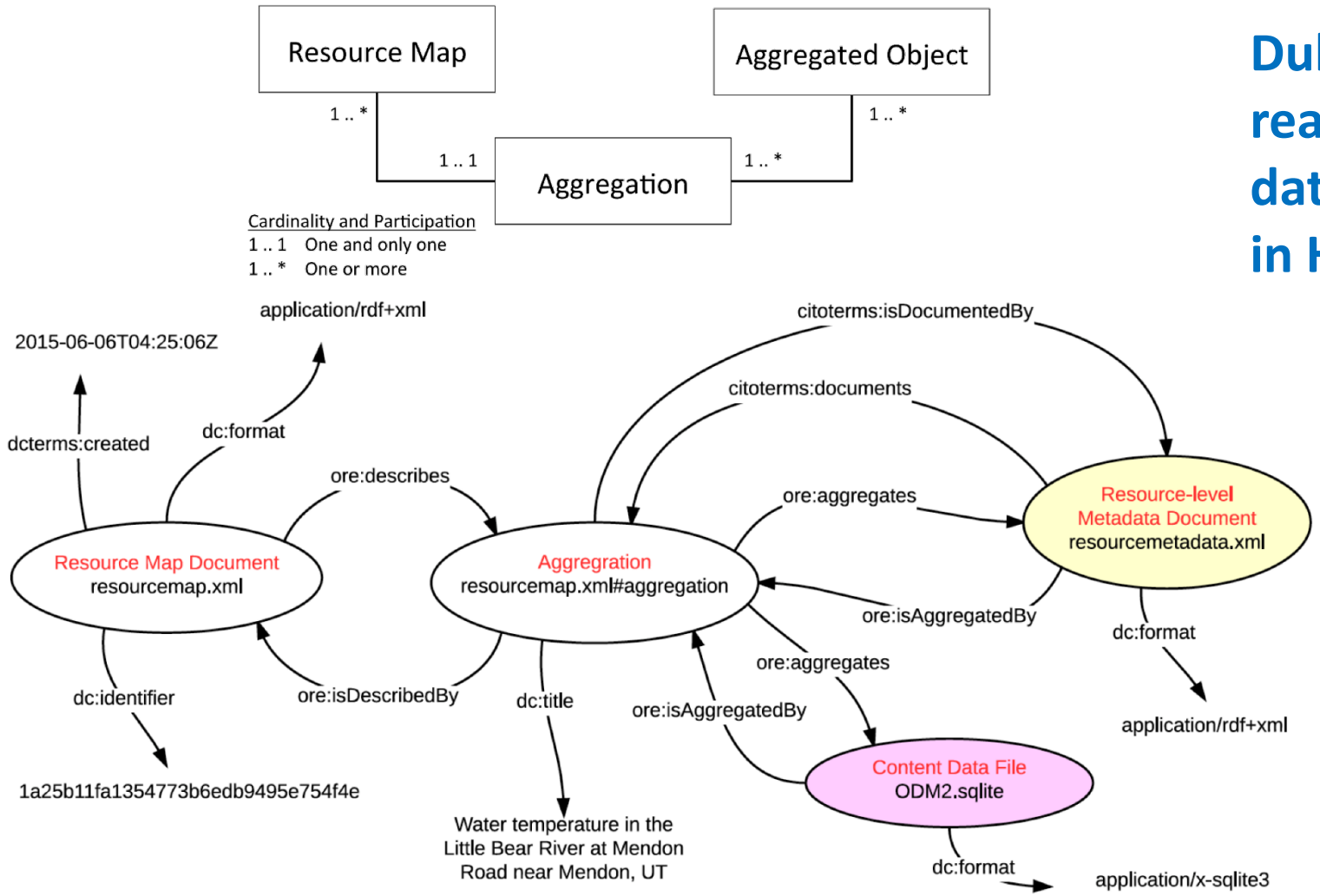








HydroShare OAI-ORE standard based Resource Data Model



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

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Resources and content aggregations

Resources

Primary

- RESOURCE
- COLLECTION
- WEB APP CONNECTOR

Legacy

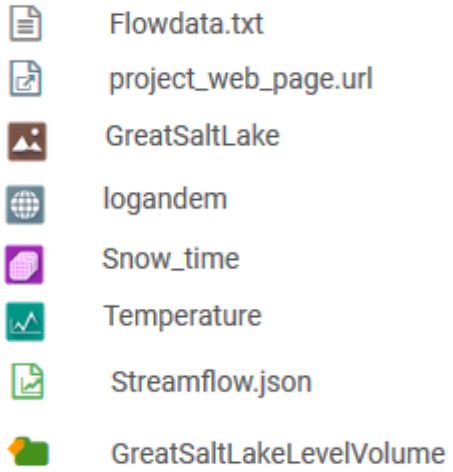
- MODEL PROGRAM
- MODEL INSTANCE
- SWAT MODEL INSTANCE
- MODFLOW MODEL INSTANCE

To be implemented as type aggregations within a composite resource

Composite resource contents

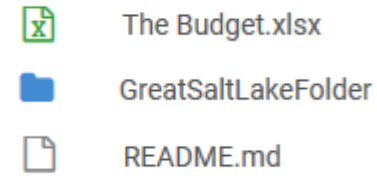
Content type aggregations

- Single File (with external reference as URL as a special case)
- Geographic Feature
- Geographic Raster
- Multidimensional
- Time Series (ODM2 format)
- Referenced Time Series (JSON))
- File set (Folder with files)



Files

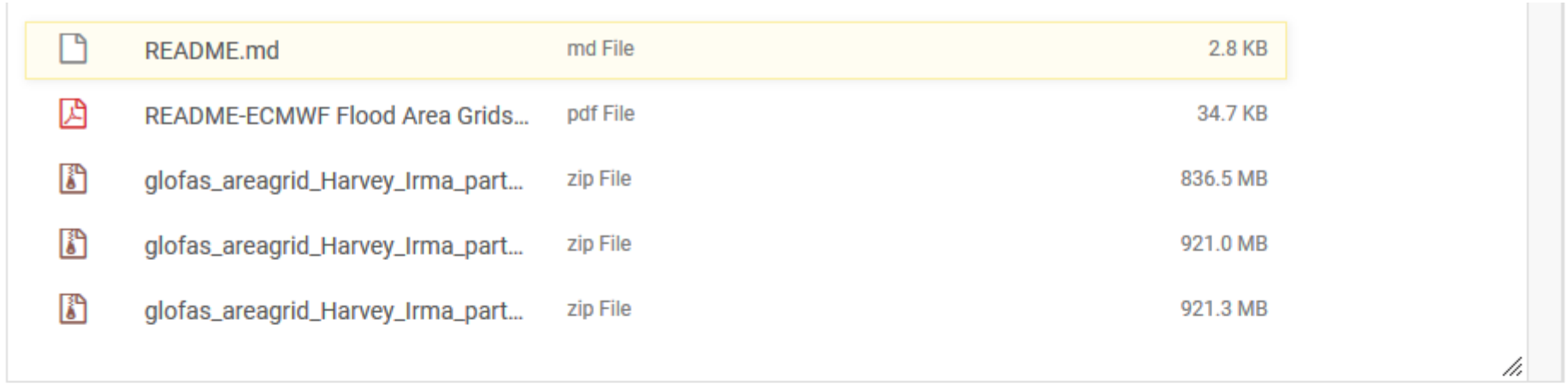
- Single File
- Folder
- Readme (markdown or txt) that renders on landing page



HydroShare App Development and Advancement

- Level 1: User creates app and web app connector. Private/shared with colleagues
- Level 2: Web app connector resource is public. Any user can access. Discoverable through discover. Needs to be deliberately added to open with, or associated with resource through appkey extended metadata. (e.g. GABBS multispec, Wikiwatershed)
- Level 3: The app meets documentation and maintenance requirements to be “CUAHSI Recommended”. Appears on Apps page. App developer supports and fixes bugs (e.g. SWATShare)
- Level 4: All of Tier 3 plus the app is hosted on CUAHSI server hardware - though the original developers own and maintain the code. App developer supports and fixes bugs (e.g. Data Rods Explorer)
- Level 5: All of Tier 3 plus the app is hosted on CUAHSI server hardware and the code is owned and maintained by CUAHSI. CUAHSI supports and fixes bugs. (e.g. CUAHSI JupyterHub, CUAHSI Time Series Viewer)

README.MD rendering



README.md

ECMWF GloFAS - Harvey Flood Area Grids

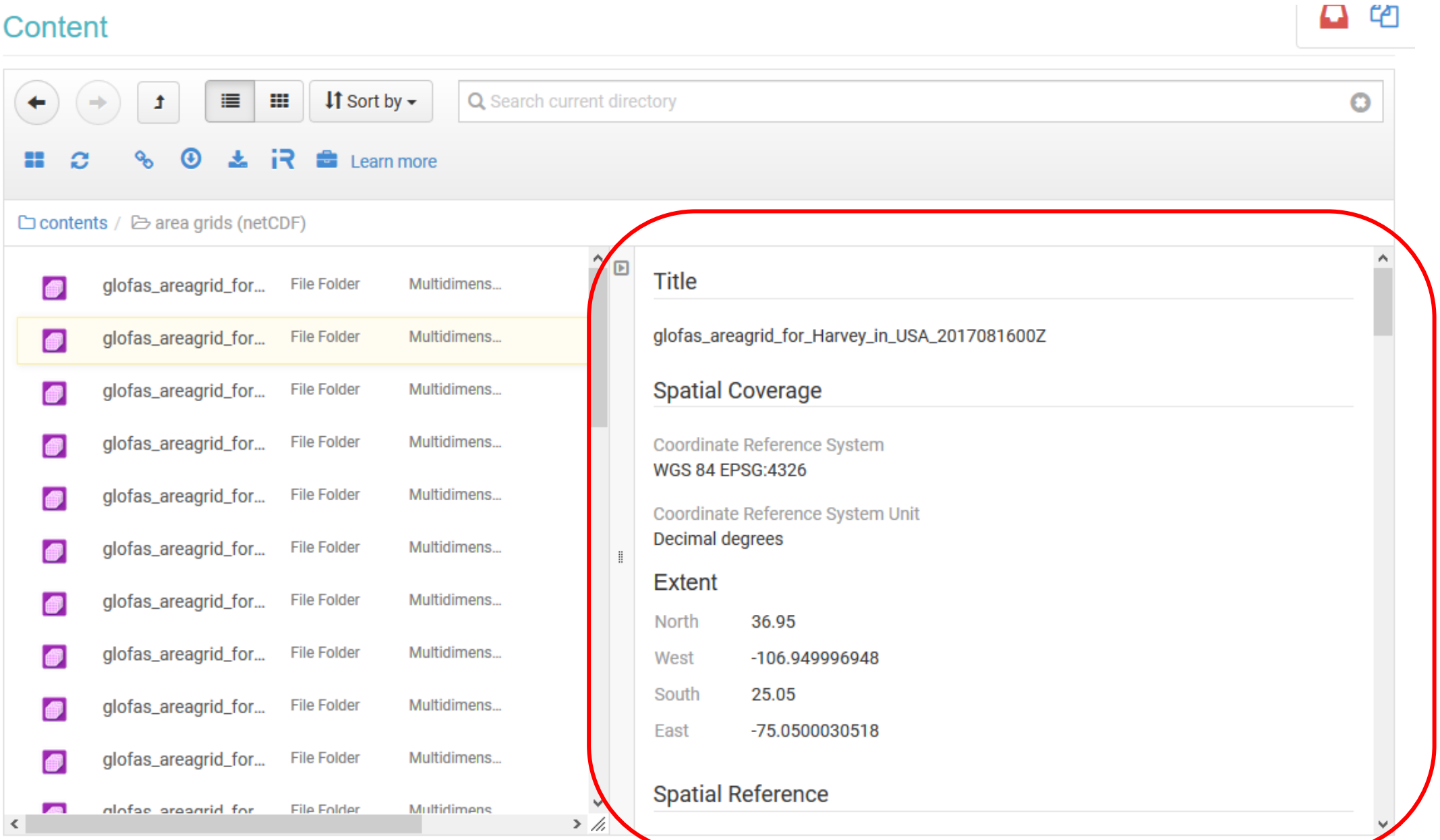
These datasets were obtained from ECMWF/GloFAS on November 13, 2017, to include the flood forecast (area grid) for Hurricanes Harvey and Irma in the USA from August 15 - September 15, 2017. These are contained in netCDF files, one file per day.

Note that while folders and files may have the words "areagrid_for_Harvey" in the name, all the data here are for the southeast USA, encompassing both Harvey and Irma impact areas.

Dataset variables

- **dis** = forecasted discharge (for all forecast step 1+30 as initial value and 30 daily average values, with ensemble members as 1+50 where the first is the so-called control member and the 50 perturbed members)

Display of content aggregation metadata



Display of metadata elements

References

Related Resources

This resource cites: http://www.globalfloods.eu/

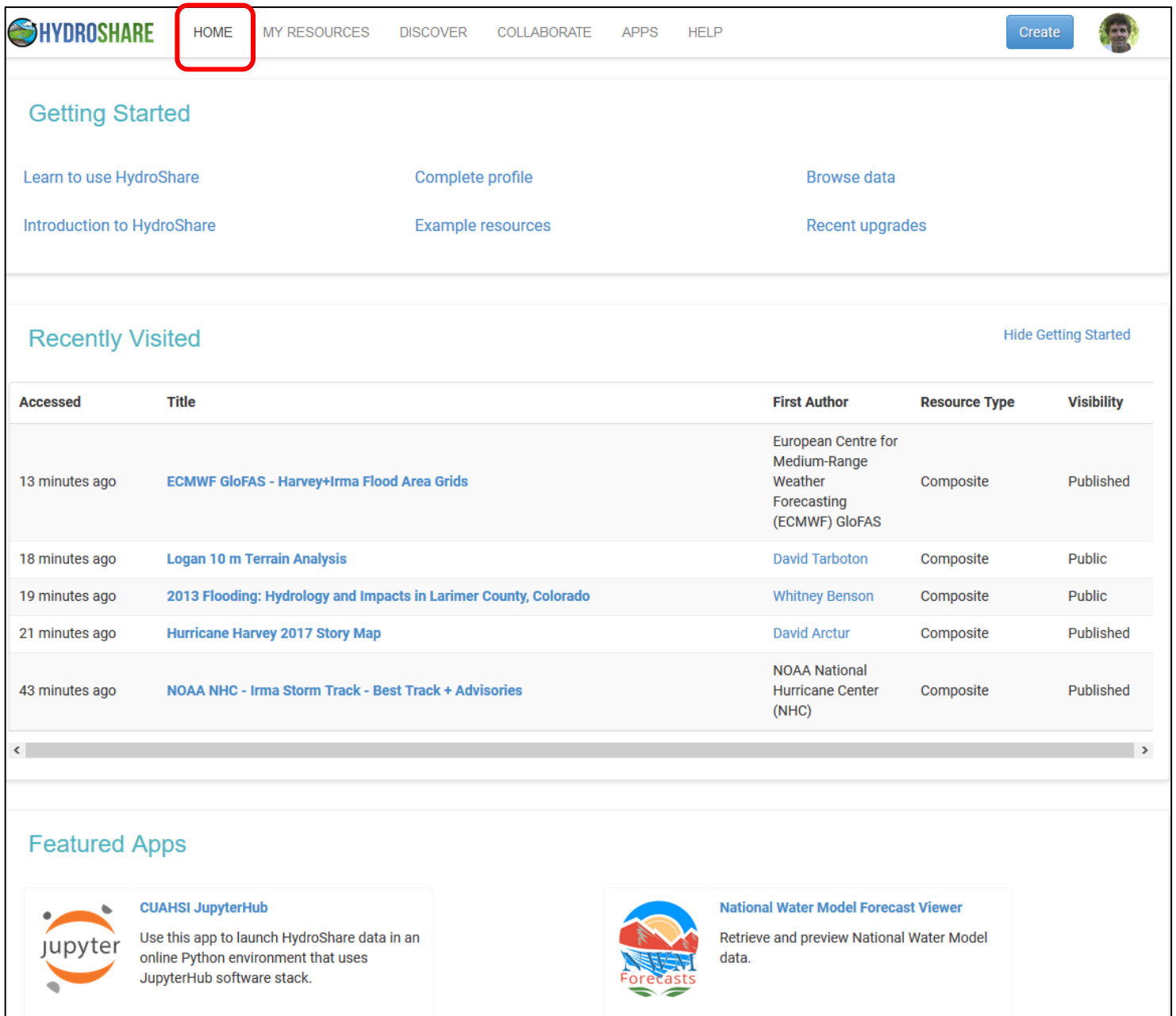
This resource belongs to the following collections:

Title	Owners	Sharing Status	My Permission
Harvey Flood Data Collections	David Arctur · Harvey datamgr	Published	View
Irma Flood Data Collections	David Arctur · datamgr Irma	Published	View

Credits

Funding Agencies

This resource was created using funding from the following sources:

Agency Name	Award Title	Award Number
National Science Foundation (NSF)	RAPID: Archiving and Enabling Community Access to Data from Recent US Hurricanes	1761673

User Dashboard