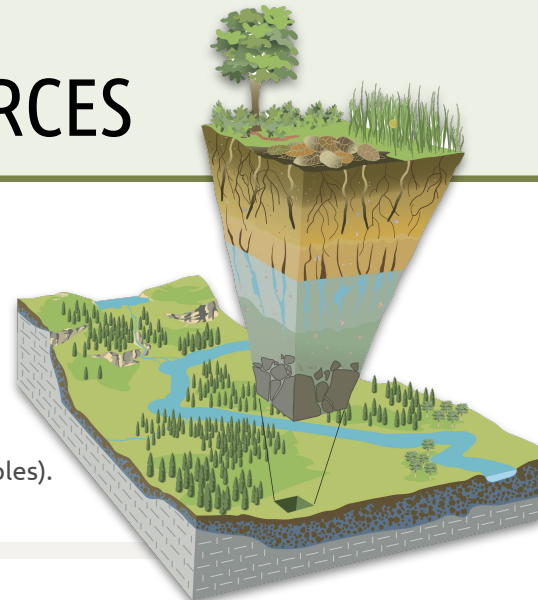




CZ science uses integrated, diverse data

Critical Zone scientists need integrated data to inform our theoretical frameworks, constrain our conceptual and numerical models, and test our hypotheses -- both within a CZO and across the CZO network.

- Highly interdisciplinary data, i.e. hydrology, geochemistry, meteorology, biology, geology.
- Very wide range of timescales.
- Many data types (sensors & samples).

Current data access

Start at CriticalZone.org

- Access data produced by CZO.
- Access CZ data produced by USGS, NOAA, USDA, NEON, LTER and other partners.

Search our centralized metadata catalog

- **400+ datasets**
- **2000+ URLs pointing to files & webpages**
- **Millions of data values**
- Browse 70 main topics including Meteorology, Soil Moisture, GIS/MapData, Streamflow/Discharge, Precipitation, Soil Temperature, LiDAR, Stream Water Chemistry...

Access additional resources

- Data catalogs at individual observatories.
- Domain-specific, long-term repositories (ie LiDAR at OpenTopography.org).

Network data products

Assembling cross-CZO datasets

In the past few years, CZO data managers have been synthesizing more of CZO's common measurements into cross-network data products. Some products are complete and available on CriticalZone.org via the national/data webpage. Transfer of some of the datasets to CUAHSI's HydroShare repository is underway.

Example cross-CZO datasets

- Stream chemistry. Soil chemistry.
- Eddy flux tower measurements of C & H₂O.
- Soil gas chemistry (CO₂ and O₂).
- Weather station data products.
- Digital elevation models and other LiDAR data products.
- Water budget data products (precip, throughfall, discharge).

Migration to CUAHSI's HydroShare

CZO is partnering with CUAHSI to migrate our data catalog from CriticalZone.org to CUAHSI's HydroShare.org repository in 2019. See details on the backside of this page.

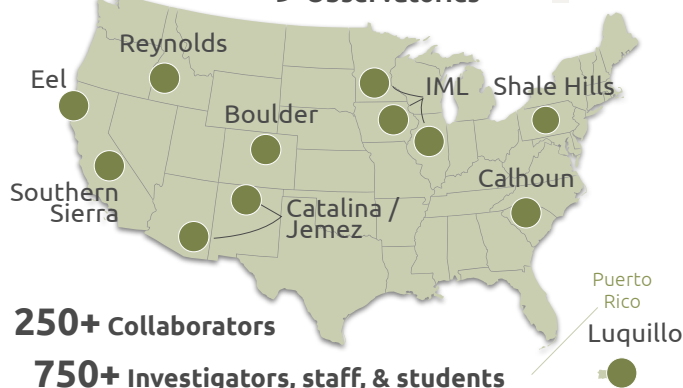
Tool development

Data management software

With our partners, CZO has contributed to a series of software projects that help structure and manage our diverse data. They include:

- **ODM2** - Robust data model for Critical Zone science.
- **ODM2 Admin** - Management of sensor and sample-based data collected from a field site.
- **Clowder** - Customized data catalogs in the cloud to help manage research data for catalogs and communities.
- **Dendra** - Interface for sensor database, University of California's SensorBase.

9 Observatories



250+ Collaborators

750+ Investigators, staff, & students

Improved data discovery across the CZO network, in one location

CZO is partnering with CUAHSI to migrate our data catalog from CriticalZone.org to CUAHSI's HydroShare.org repository in 2019

Partnering will provide a more sustainable data management solution for the CZO community. Improvements to HydroShare made on behalf of CZO will benefit the entire HydroShare user community.



CUAHSI HydroShare enables groups and individuals to share data and models: storage, analysis, and publication.

Central, long-term repository

Migrated data will have improved long-term viability and enhanced discoverability.

- Our current storage is limited to individual CZOs and domain-specific repositories like OpenTopography.org.
- Migration is especially important for data at risk of becoming inaccessible (i.e. grad student research).
- Completed data resources can be issued DOIs.
- Using HydroShare infrastructure will reduce our dependence on hardware and software at all CZOs.

Note: Not all CZO data can be migrated to HydroShare in 2019. Although we will migrate all the *metadata*, transferring all *data* is too large of a project for the short term. We will start with easily accessible flat files.

Improved search & browse

We gain a metadata catalog with more functionality.

- Current system has limited functionality derived from a standard Content Management System (CMS).
- HydroShare is optimized for science metadata, i.e., automatic extraction of metadata from some file types.

More controlled vocabulary (CV) terms than before.

- Yields better search results, improved data interoperability among CZOs and with outside organizations.
- More standardization of terms, especially for variables. For example, instead of a half dozen ways to denote dissolved calcium, there will be one.
- Initial work condensed ~1900 variable names down to 340 standard terms (within ODM2 information model).

Enhanced collaboration

CZO researchers can work together more easily and share more widely.

- Work privately with others on preliminary data. When ready, make data discoverable and/or downloadable.
- Explore data with others via the JupyterHub app, including online analysis & modelling.
- Share all products of a study, including primary data, supporting data, workflows, and models.
- Connect to the robust HydroShare API for data access and reuse by individuals and applications.

HydroShare + Clowder

CZO and CUAHSI are collaborating with the Clowder team (led by NCSA), with emphasis on authoring metadata and interoperability between HydroShare and Clowder.

- Clowder is online software that helps communities manage research data via customized data catalogs and data processing tools.
- **Clowder** has strengths in incrementally adding data and metadata, data visualization, & other custom functionality.
- **HydroShare** has strengths in long-term data archival, publication, discovery, and connections to models via apps.

