CI-WATER: Cyberinfrastructure to Advance High Performance Water Resources Modeling in the Intermountain Western U.S.

CI-WATER A Utah-Wyoming Cyberinfrastructure Water Modeling Collaboration

http://ci-water.org/

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Abstract

The CI-WATER project is a cooperative effort between the Utah and Wyoming EPSCoR jurisdictions, and is funded through a cooperative agreement with the U.S. National Science Foundation EPSCoR. The CI-WATER project is acquiring hardware, developing software cyberinfrastructure (CI) to enhance accessibility of High Performance Computing for water resources modeling and management in the Western U.S., and providing educational opportunities to a broad and diverse group of learners.

Project Goals

1. Provide hydrologic researchers, modelers, water managers, and users access to HPC resources without requiring them to become HPC and CI experts.
2. Reduce the amount of time and effort spent in finding and organizing the data required to execute the models.

We are developing cyberinfrastructure to make it easier to use high performance computing for water resources modeling, engineering and management.

Utah Data Repository

Stage 1: 1 Petabyte usable space ($230/TB – Dell) including Data Transfer Nodes (DTNs)

Housed at new University of Utah Data Center

Yellowstone

NCAR-Wyoming Supercomputer Center
72,000 processor cores

University of Wyoming Advanced Research Computing Cluster

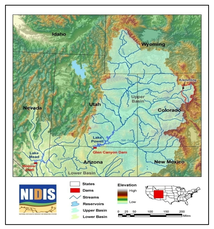
- Intel Xeon E5-2600 processors
- Infiniband interconnect
- Condo model with reservation allocation system
- 3000 processor cores
- Essentially a "baby Yellowstone"

Motivating Questions

- What are the potential impacts of climate change on the long term water yield from the Upper Colorado River basin?
- How will land-use changes due to development and natural causes such as fire and the mountain pine bark beetle outbreak affect water supplies?
- What are the effects of trans-basin diversions and increases/changes in consumptive use on the water storage in Lake Powell in 30-50 years?

Colorado River Basin

Upper Colorado River Basin

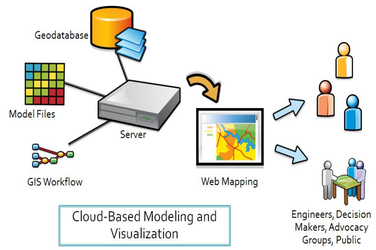


- Basin Area: 288,000 km²
- Streams: 467,000 km
- Population: 900,000 (USBR)
- Area above 2700 m (9,000 ft) 14.5%
- Area above 3050 m (10,000 ft) 3.2%
- Population depending on water >30,000,000

Project Objectives

1. Enhance cyberinfrastructure facilities
2. Enhance access to data- and computationally-intensive modeling
3. Advance high-resolution multi-physics watershed modeling
4. Promote STEM learning and water science engagement

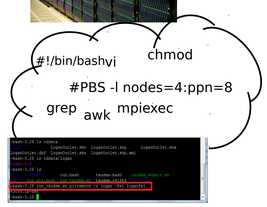
Cloud Computing with web interface



Bridge the Digital Divide

- Researchers
- Experimentalists
- Modelers

HPC Specialists

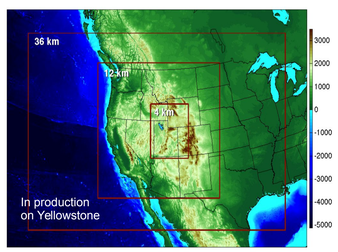


High Performance Climate Simulations

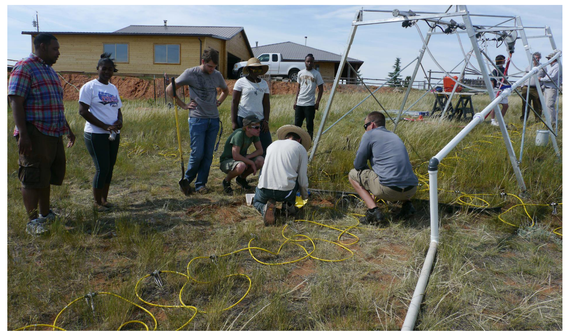
WRF customized with Great Salt Lake model and urban irrigation scheme

Boundary conditions:
6-houlry NCEP Climate Forecast System Reanalysis (CFSR)
~38 km resolution
1985-2004,
2007-2009

CMIP5 (~1°)
2025-2035
2055-2065
2085-2095

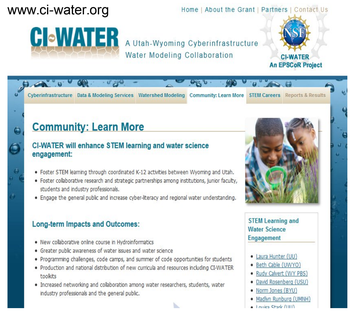


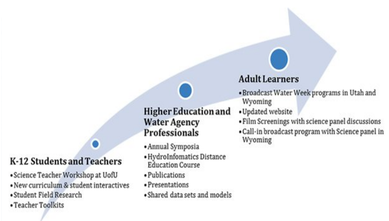
Education and Outreach



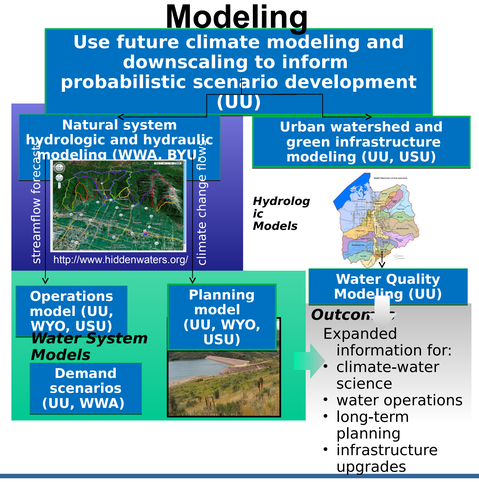
Rainfall simulator/infiltration test with JSU students, July 2013.

www.ci-water.org



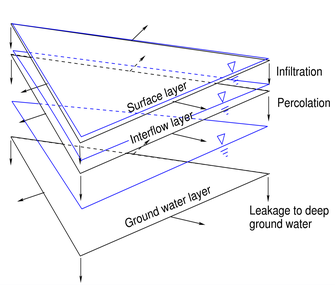


Urban Watershed Modeling



High-Resolution Large Watershed Model Development

ADHydro



Team Members

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Our Collaborators

NCAR NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

ERDC US Army Engineer Research and Development Center