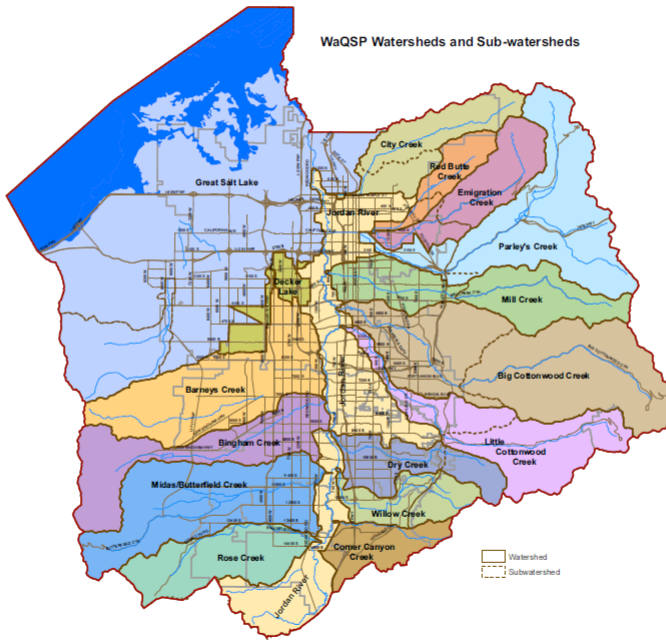


Climate Modeling to Support Urban Water Management in the Wasatch Range



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Presentation Overview

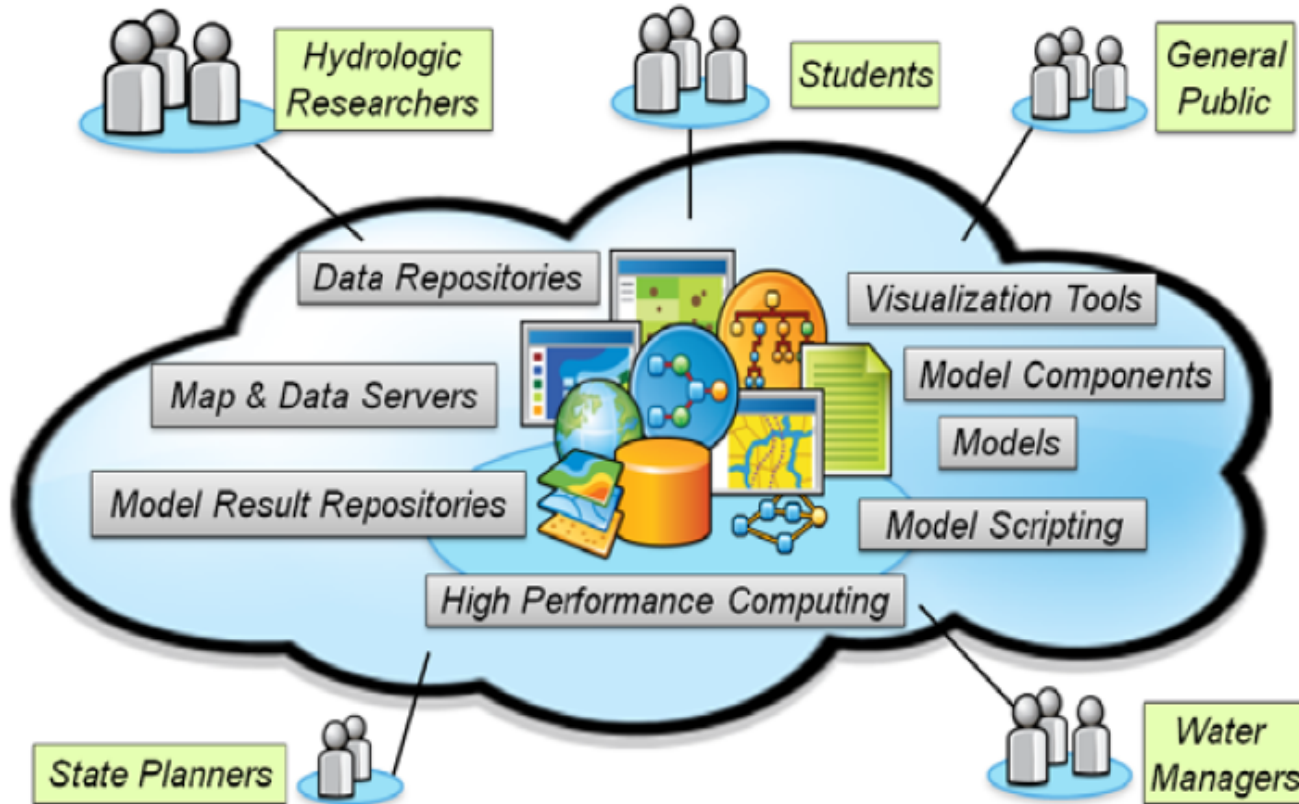
Objective

Describe cyberinfrastructure research activities linking climate and urban water management

Outline

- Background
 - The CI-WATER project
 - Wasatch Range precipitation and urban water management
- Regional modeling using WRF
 - Model configuration
 - Historical validation for water year 2008
- Future research plans
- Summary

CI-WATER Project



Goal is to provide and use these tools to enhance the capacity for water resource planning and management in the Utah-Wyoming region

Brigham Young University



Norm Jones, Jim Nelson, Gus Williams

Utah State University



David Tarboton, Jeff Horsburgh, David Rosenberg

The University of Utah



Steven Corbato, Laura Hunter, Steve Burian, Christine Pomeroy, Court Strong

University of Wyoming



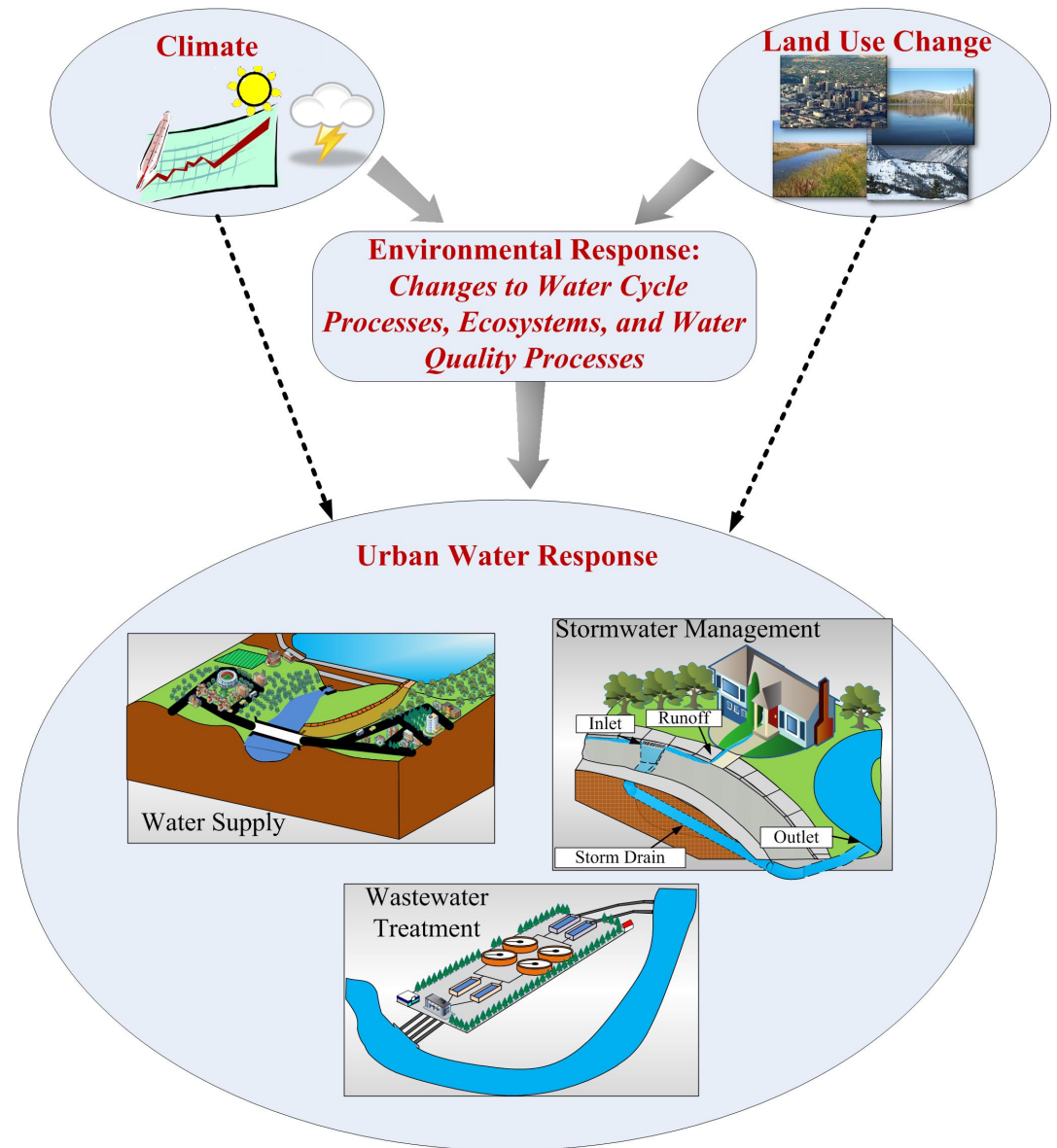
Fred Ogden, Craig Douglas, Kristi Hansen, Scott Miller, Ye Zhang, Gi-Hyeon Park, Ginger Paige, Robert Aylward

CI-WATER – UU Goals

1. Climate variability including extremes

2. Climate-urban-water cyberinfrastructure

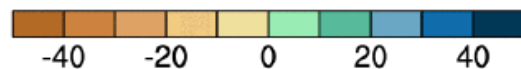
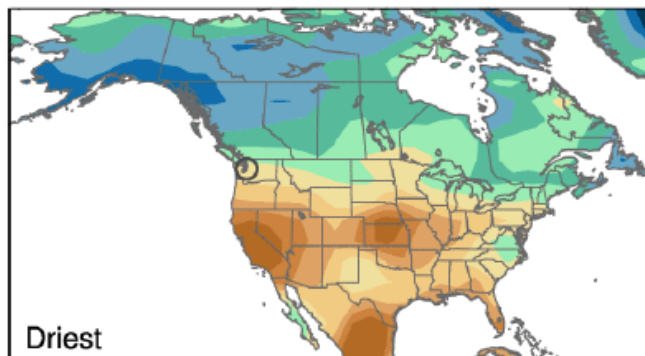
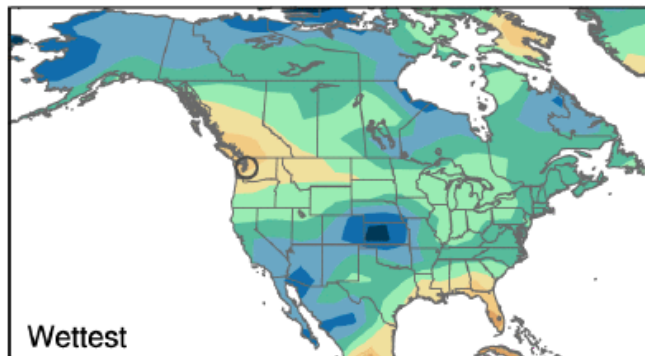
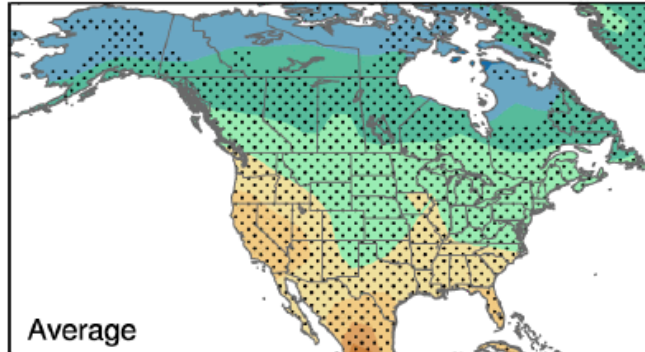
3. Design, operation, and risk of urban water infrastructure



Climate-urban-water CI

- Probabilistic framework
 - Manage massive urban watershed input data sets
 - Execute hundreds of thousands of simulations
 - Store and post-process terabytes of data
- Climate uncertainty
 - Account for different greenhouse gas scenarios
 - Account for different model biases
 - Develop terabytes of boundary conditions and initial conditions that will be used to constrain our hydroclimate projections.

DJF Precipitation Trend 2005-2060



Deser et al. (submitted)

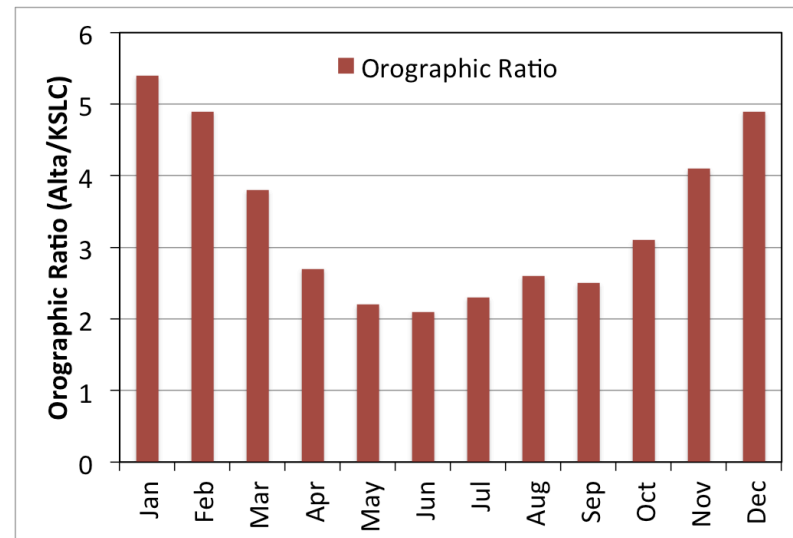
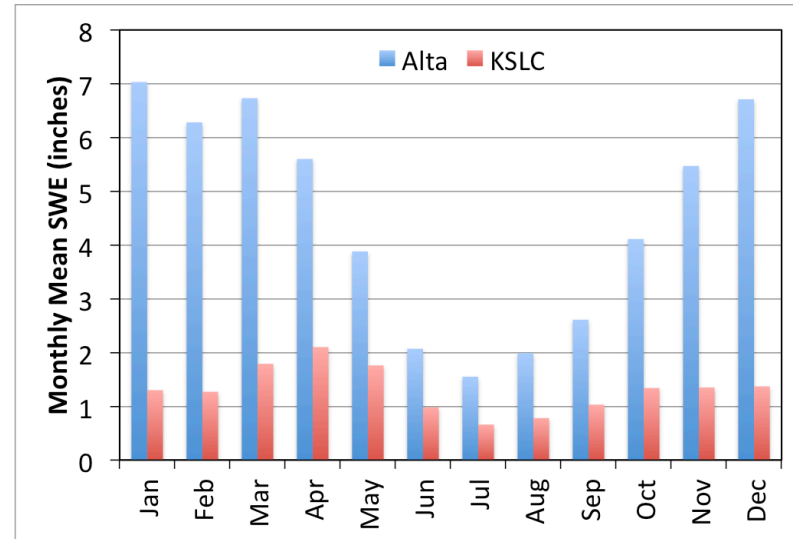
Importance of initial conditions

- The Large Ensemble Project
 - One model: CCSM3 (T42)
 - One forcing: A1B 2000-2061
 - 40 simulations

Trends in precipitation [% per 55 years] expressed as a percentage of the model's ensemble-mean climatology for 2005-2060.

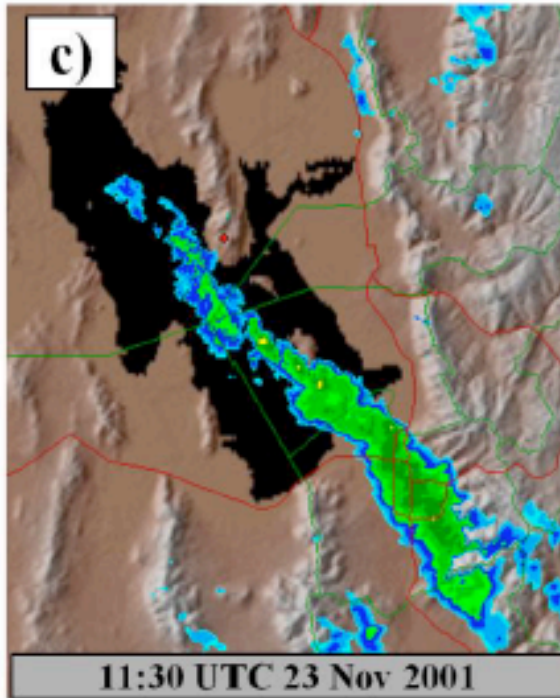
Wasatch Range Precipitation

Mountain versus valley floor annual cycles

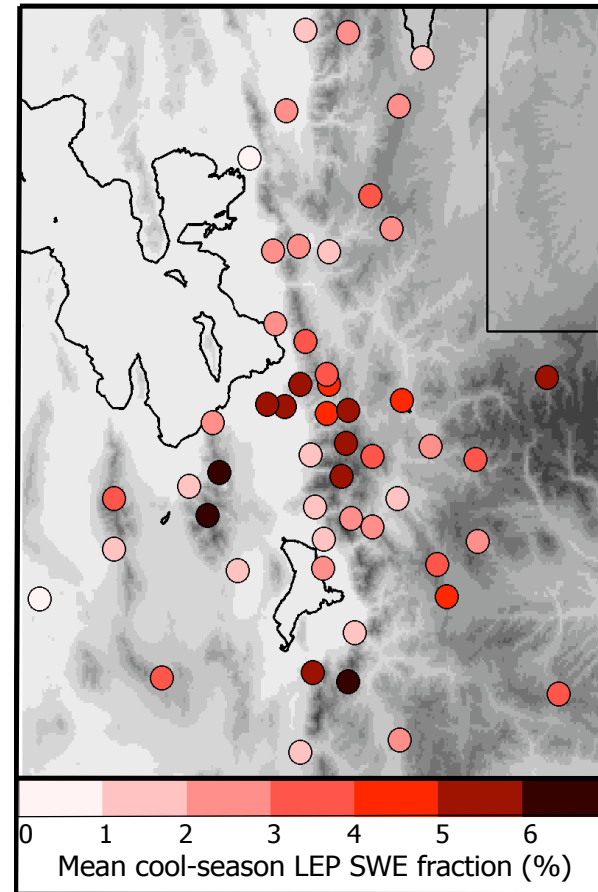


Wasatch Range Precipitation

Lake effect snow



Alcott et al. (Submitted,
Mon. Wea. Rev.)



Yeager et al.
(Submitted, *J. Appl. Meteor. Clim.*)

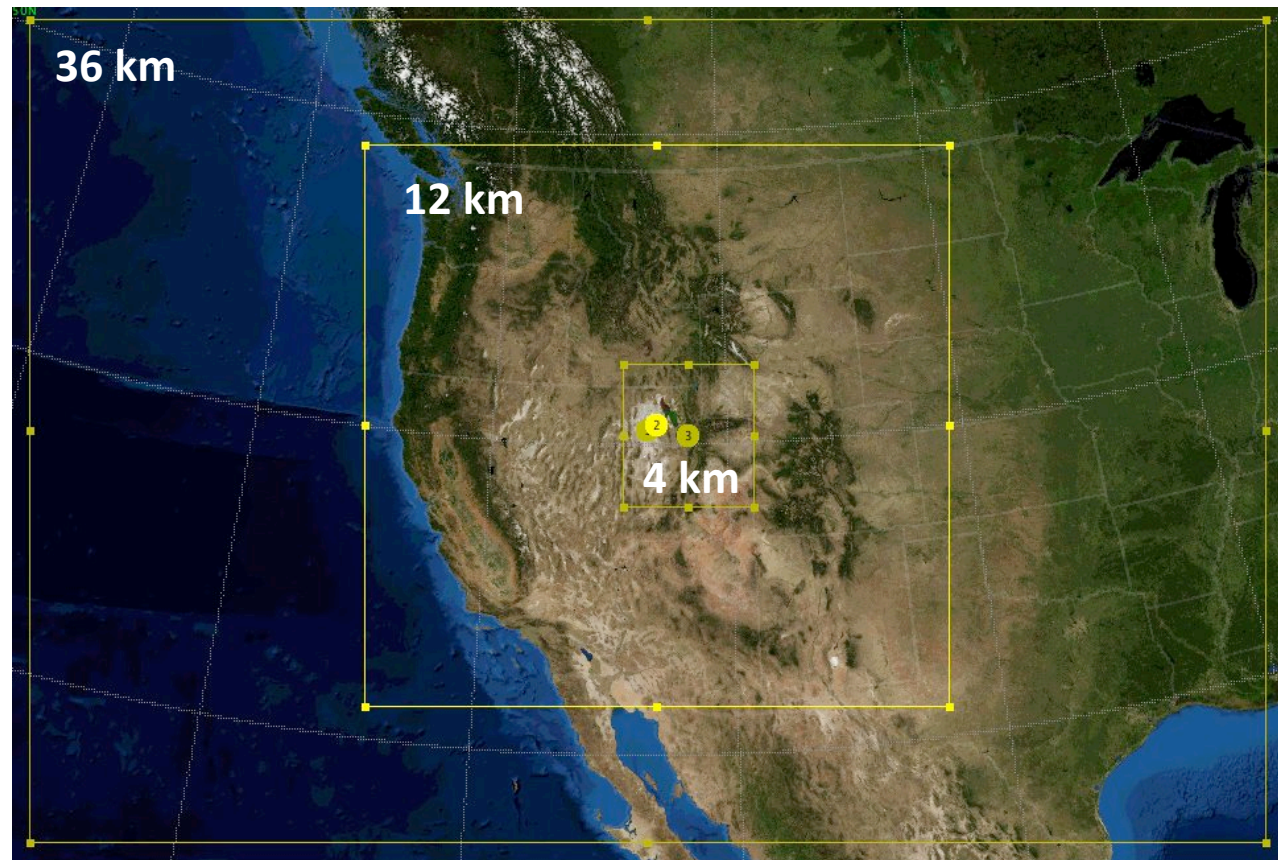
Regional modeling: model configuration

- The Weather Research and Forecasting (WRF) regional weather and climate model Version 3.3.1 (Skamarock et al. 2005)
- Configured following Headwaters Project (Rasmussen et al. 2011):
 - Noah land surface model
 - Mellor–Yamada–Janjic planetary boundary layer scheme
 - Community Atmosphere Model’s (CAM) longwave and shortwave schemes
 - Thompson et al. (2008) cloud microphysics scheme
- Plus some customizations to account for Great Salt Lake

Regional modeling: model configuration

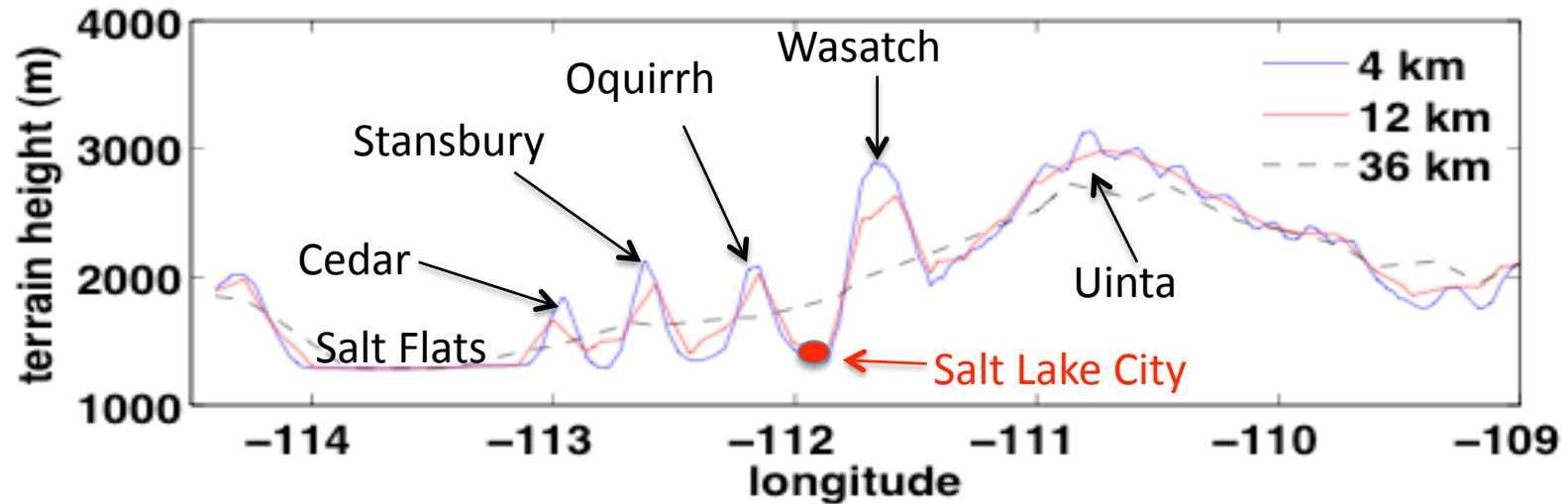
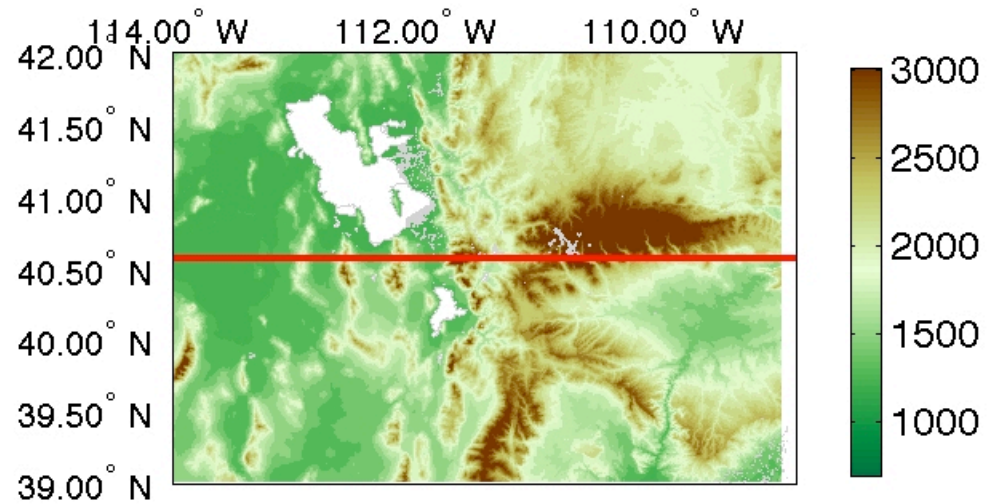
- Lambert conformal projection, three domains

Boundary conditions:
6-hourly NCEP
Climate Forecast
System Reanalysis
(38-km
resolution).
Water year
2007-2008



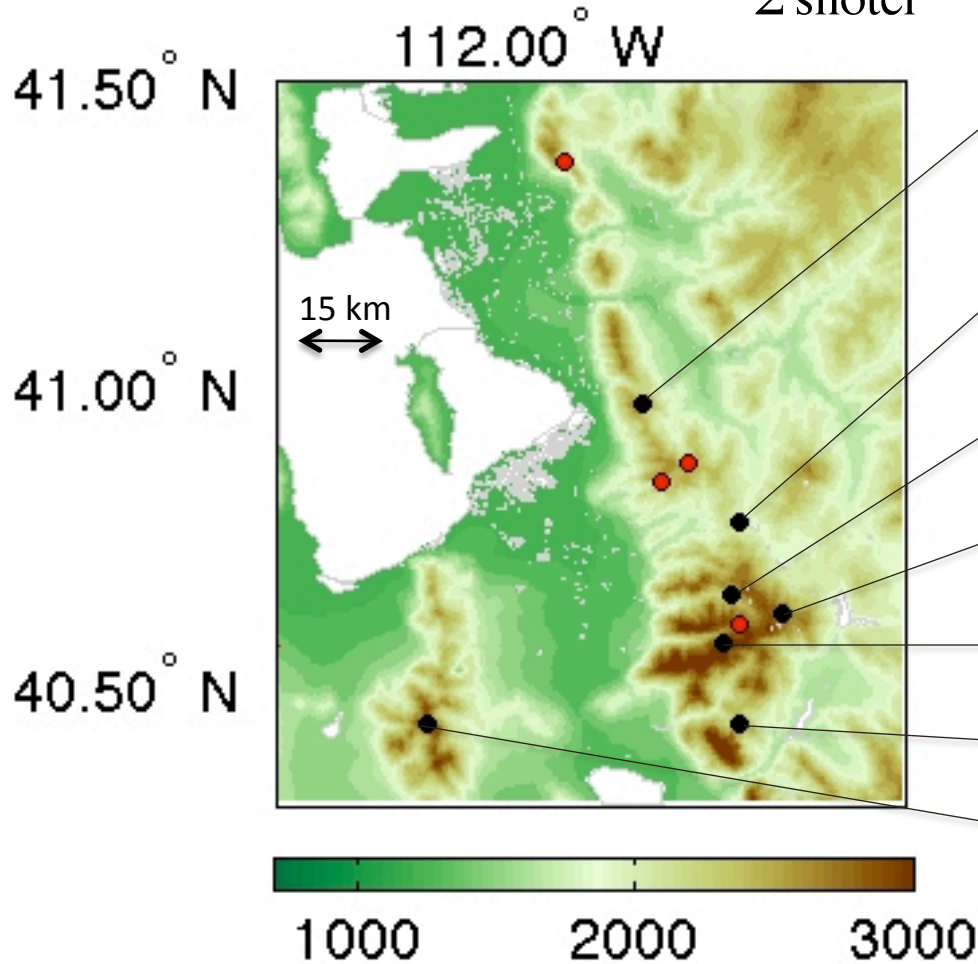
Regional modeling: model configuration

- Resolution of topography

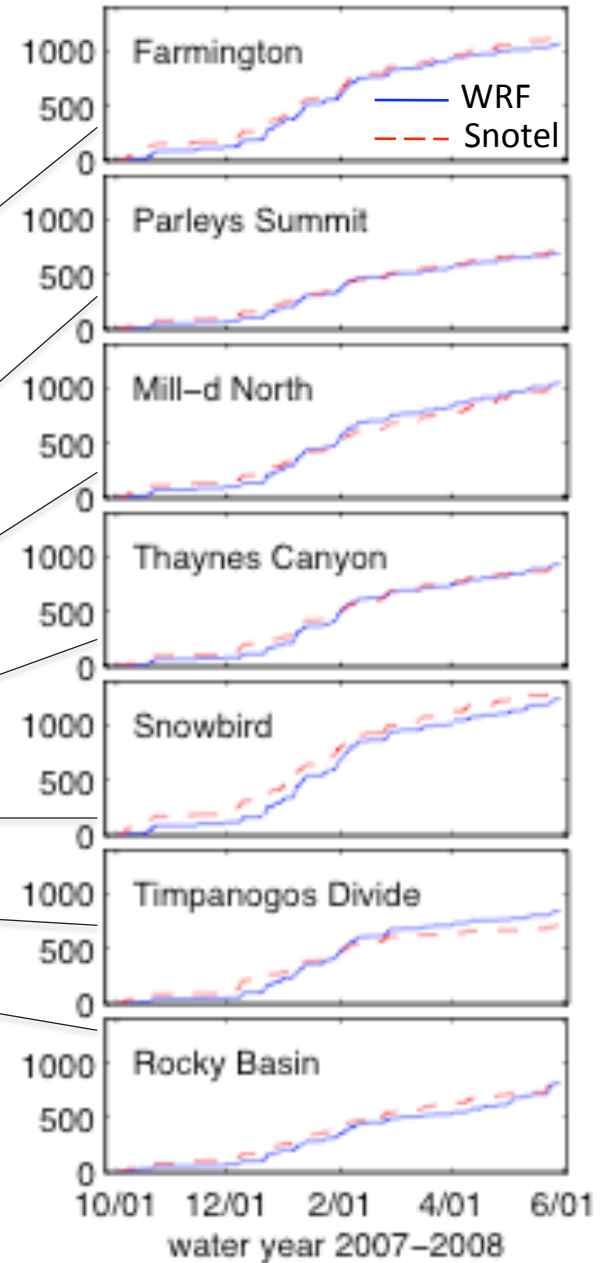


Regional modeling: historical validation

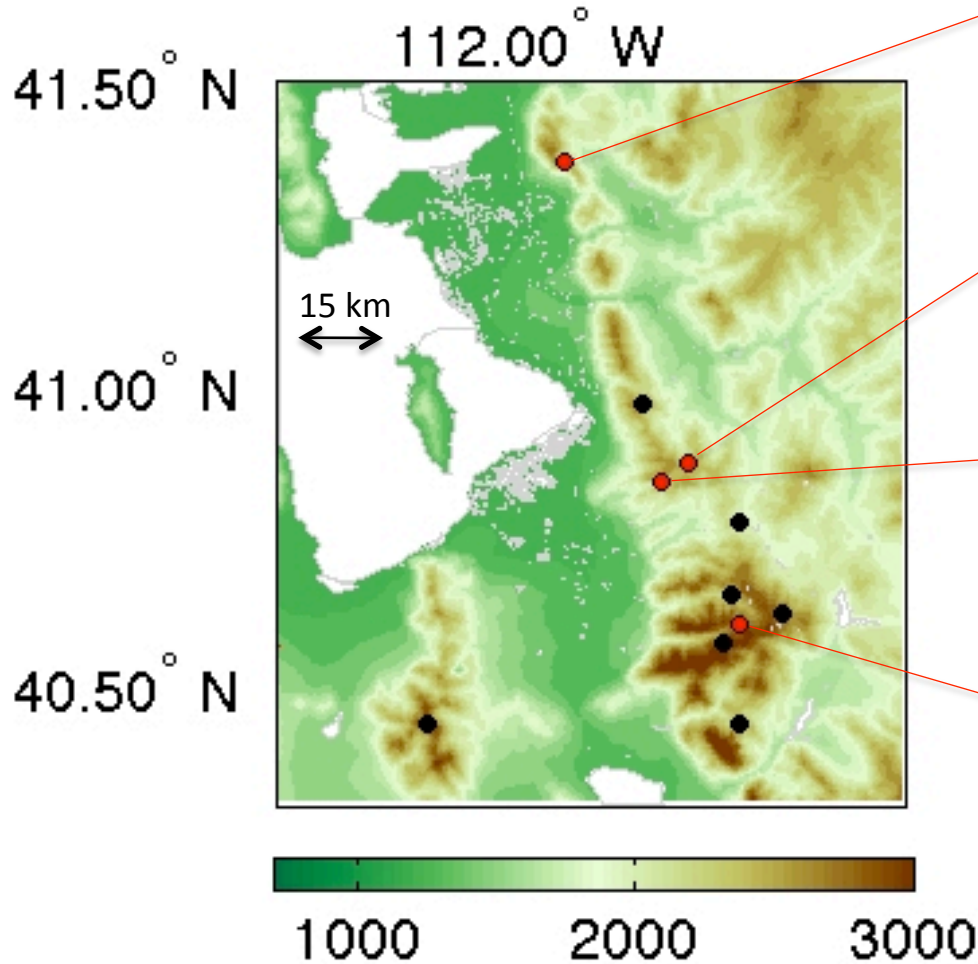
$$\frac{\sum \text{WRF}}{\sum \text{snotel}} = 1.003$$



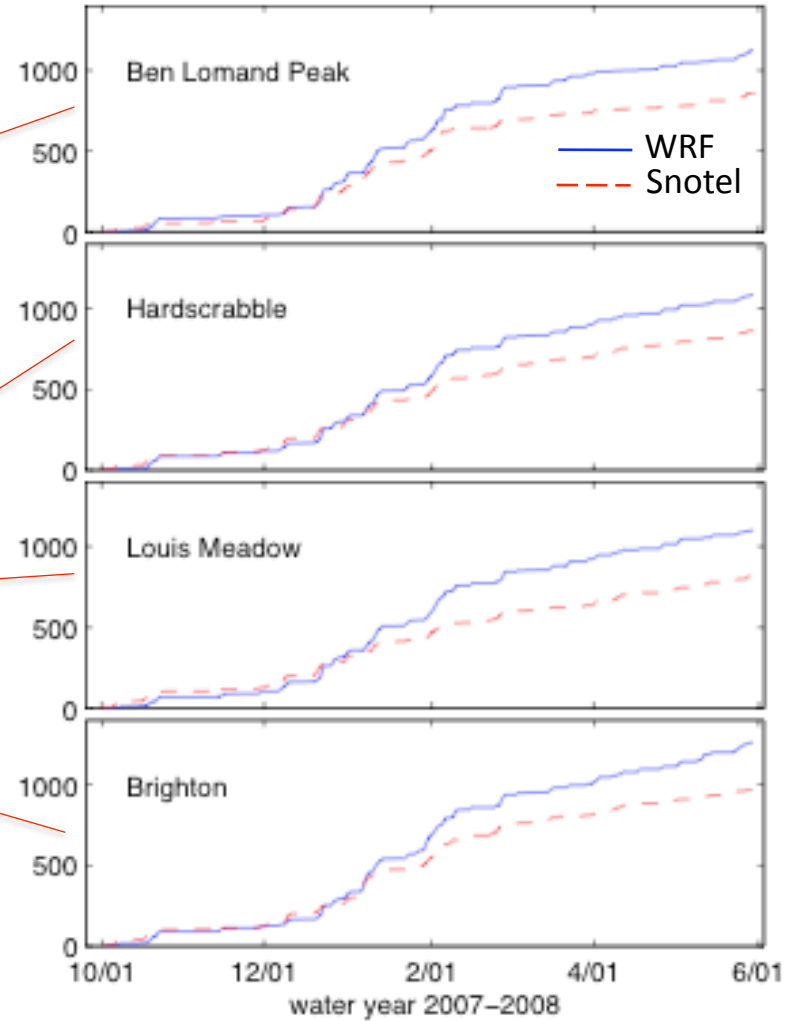
Precipitation (mm)



Regional modeling: historical validation

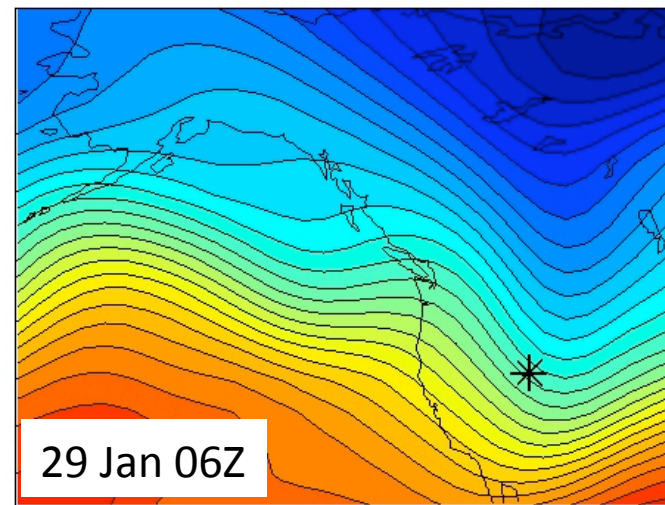
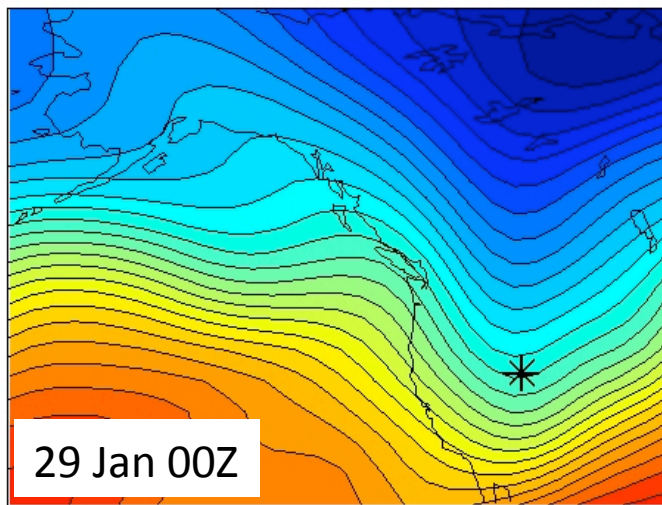
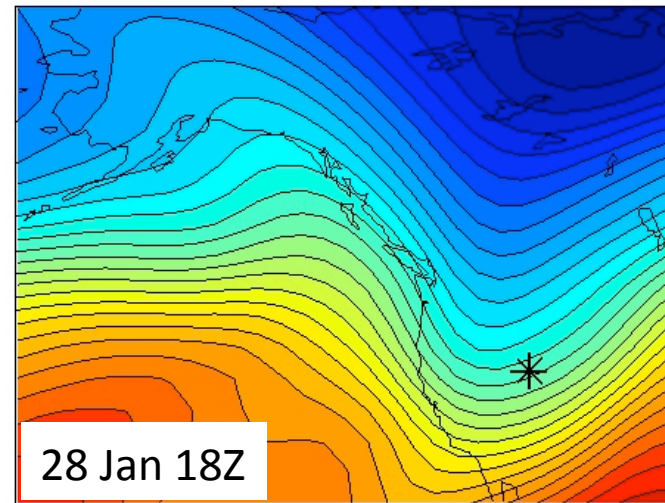
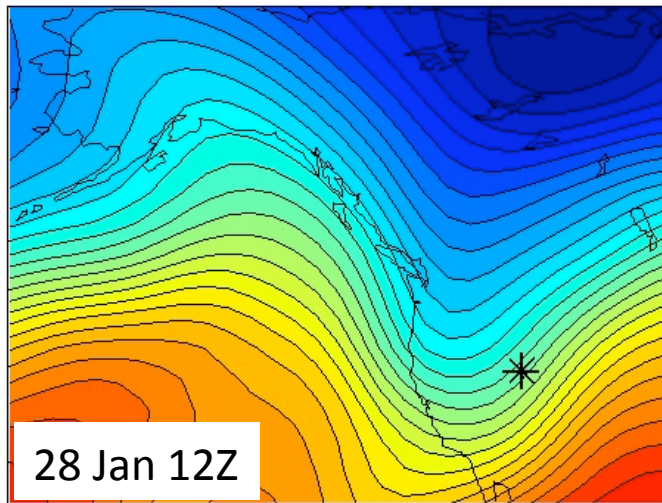


Precipitation (mm)



$$\frac{\sum \text{WRF}}{\sum \text{snotel}} = 1.302$$

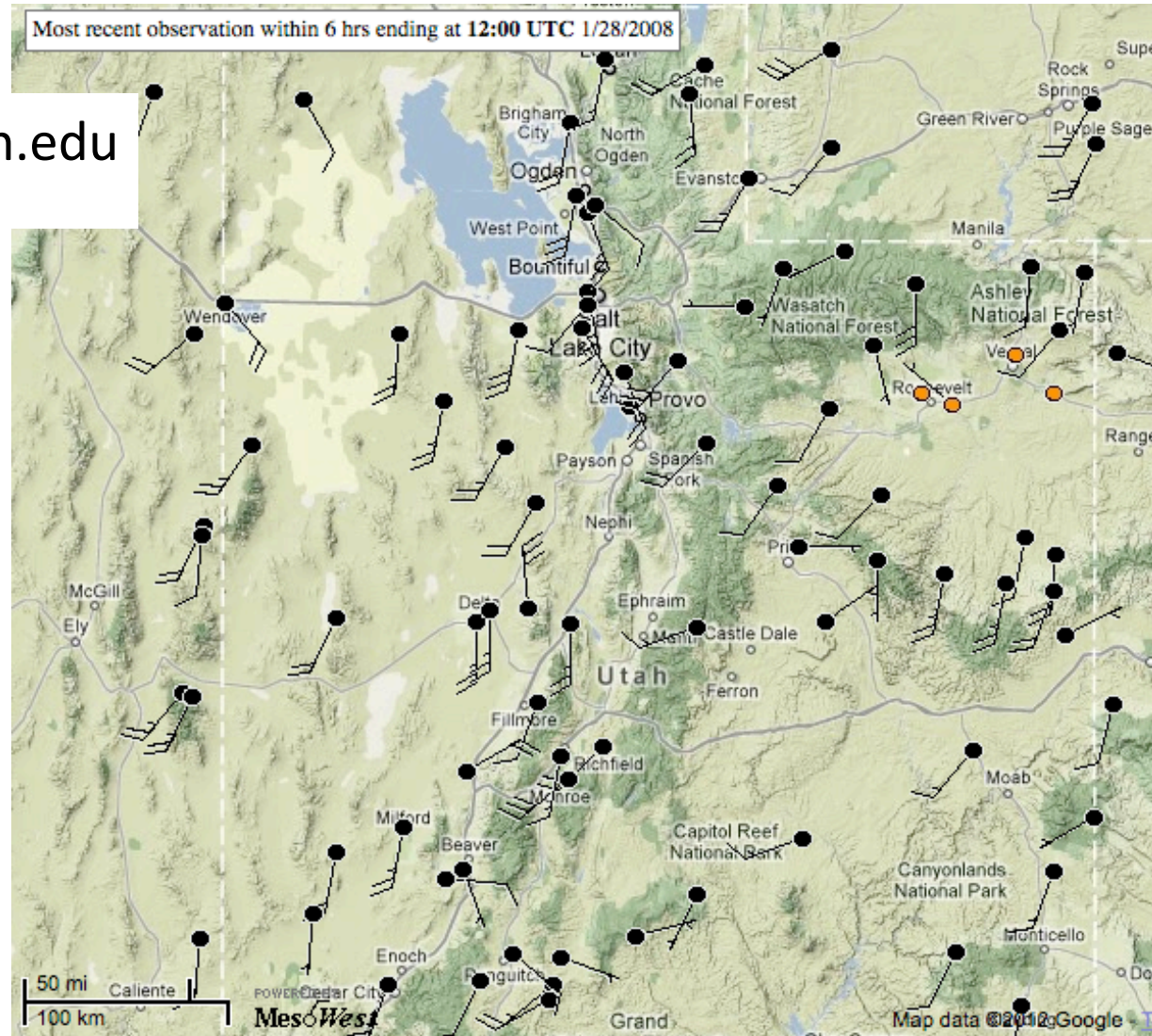
250-mb geopotential height 2008



NCEP / NCAR Reanalysis

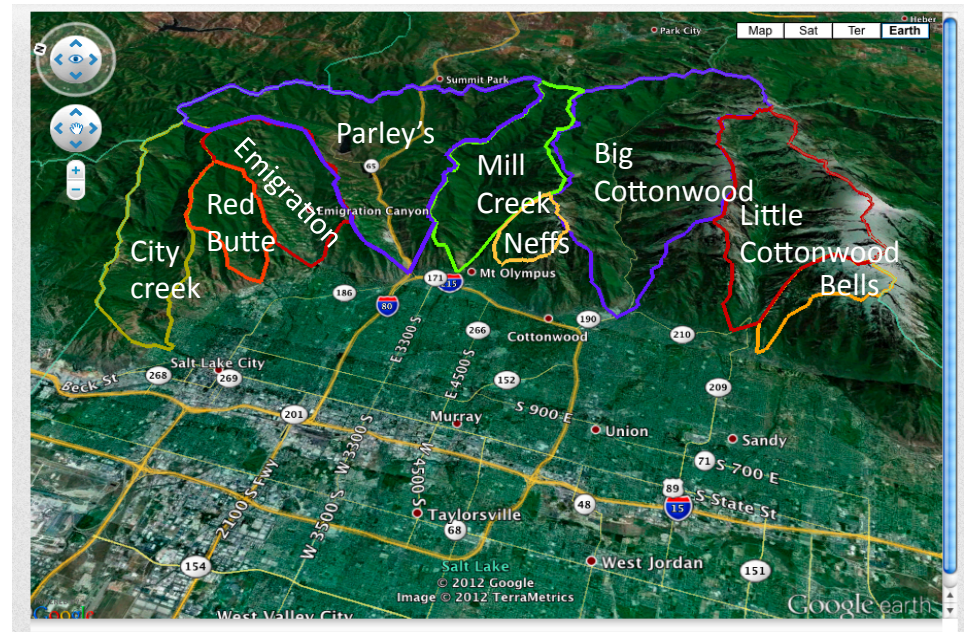
28 Jan 2008 12Z

mesowest.utah.edu



Summary and future research plans

- Additional historical runs
- Boundary force WRF with climate model projections
- Develop software to quickly generate future meteorological (precip., temp., etc.) scenarios
- Link climate simulation results to urban water systems models
- Analyze urban water system response to climate variability and the associated adaption costs



<http://www.hiddenwaters.org/>

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