Addressing Critical Science and Data Gaps to Improve Water Management in New Mexico

Max Gersh

New Mexico Office of the State Engineer, Hydrology Bureau

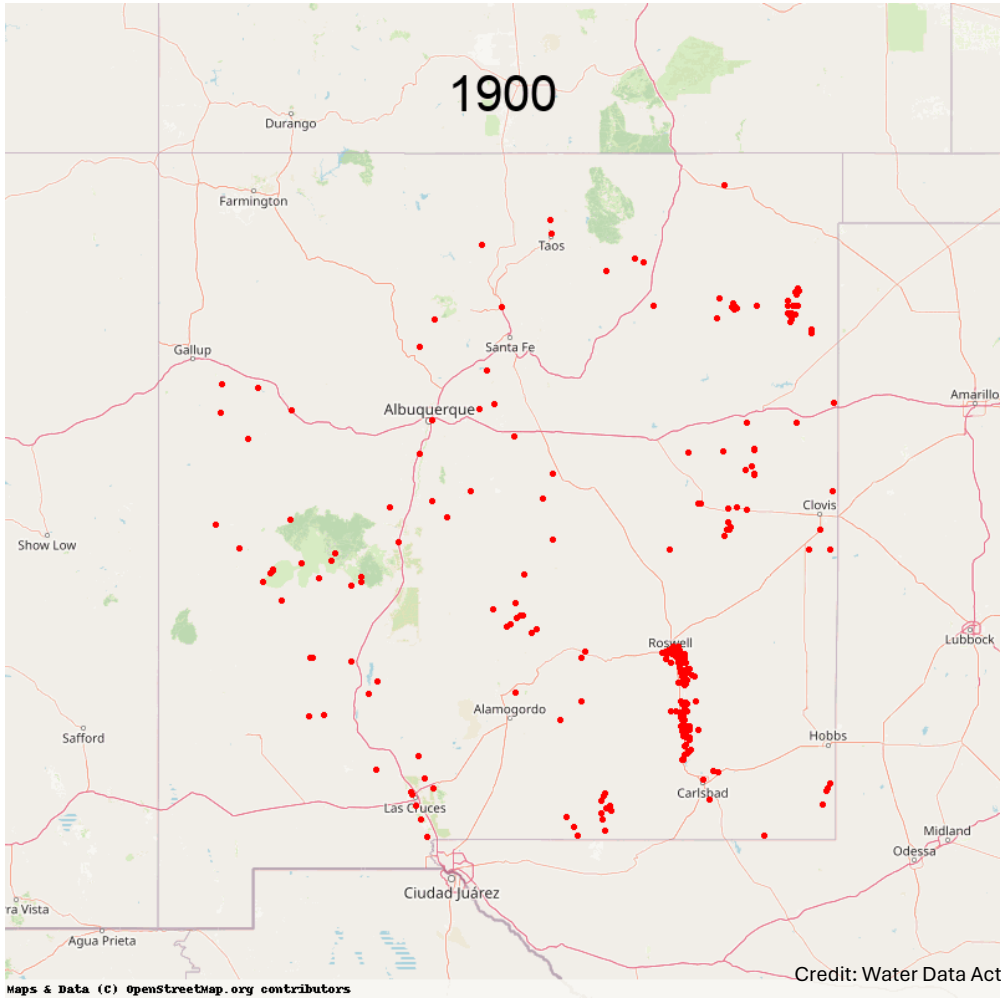
October 3, 2024

OSE's Role

- Regulatory agency
- Administer and protect the state's water resources through the supervision, measurement, appropriation, and distribution of all surface and groundwater
- Cooperate with Pueblos, Tribes, and Nations

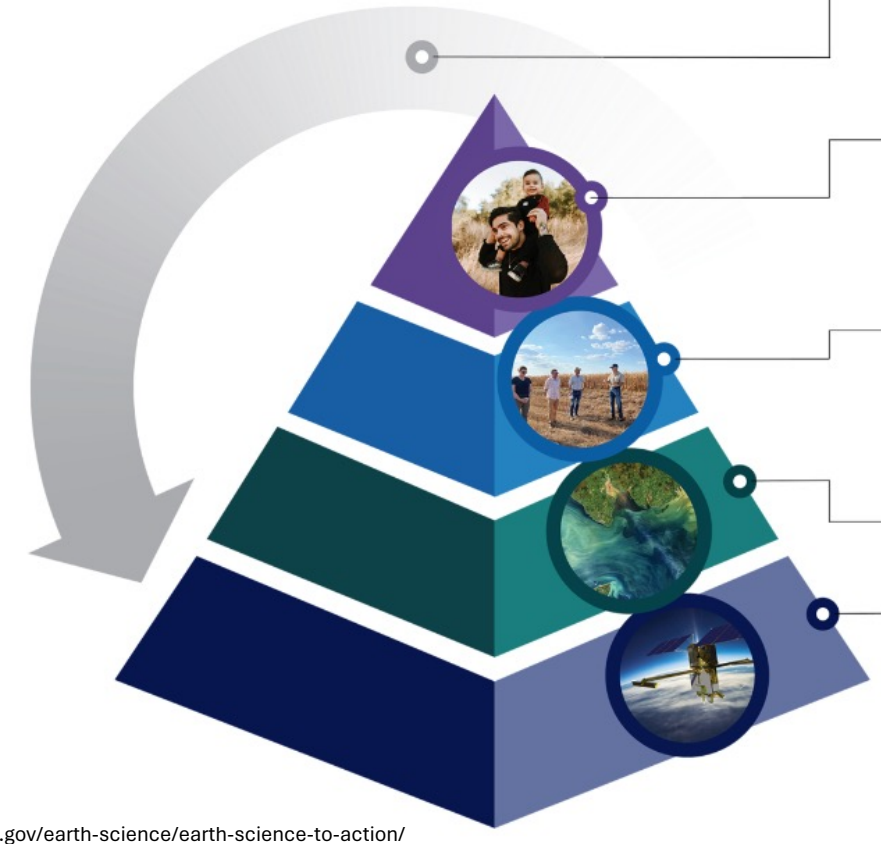
Hydrology Bureau

- Conduct scientific research and technical support for OSE/ISC staff



Credit: Water Data Act

Bridge the Gap – NASA, OSE, and the End User



Virtuous Cycle
- User needs inform next iteration of programs, missions and initiatives

Public Understanding & Exchange
- Put more scientific understanding into public sphere
- Deliver applied science to users
- Participate in multi-way info exchange
- Use input to inform subsequent work

Solutions & Societal Value
- Offer models, scientific findings and info through Open-Source Science principles
- Support climate services
- Provide science applications and tools to inform decisions

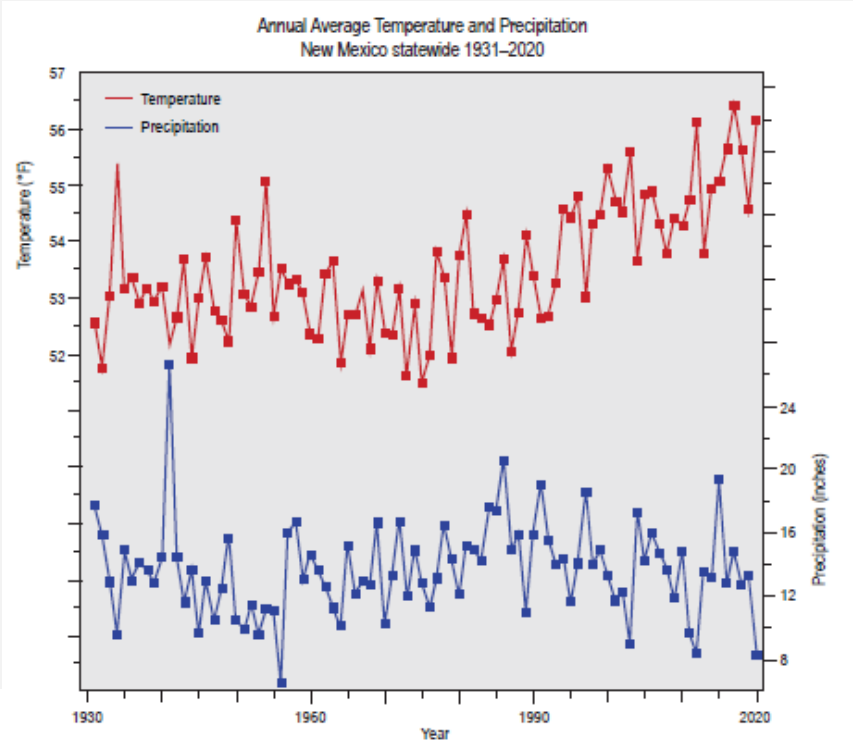
Earth System Science & Applied Research
- Grow scientific understanding of Earth's systems
- Develop predictive modeling for science applications and tools to mitigate, adapt and respond to climate change

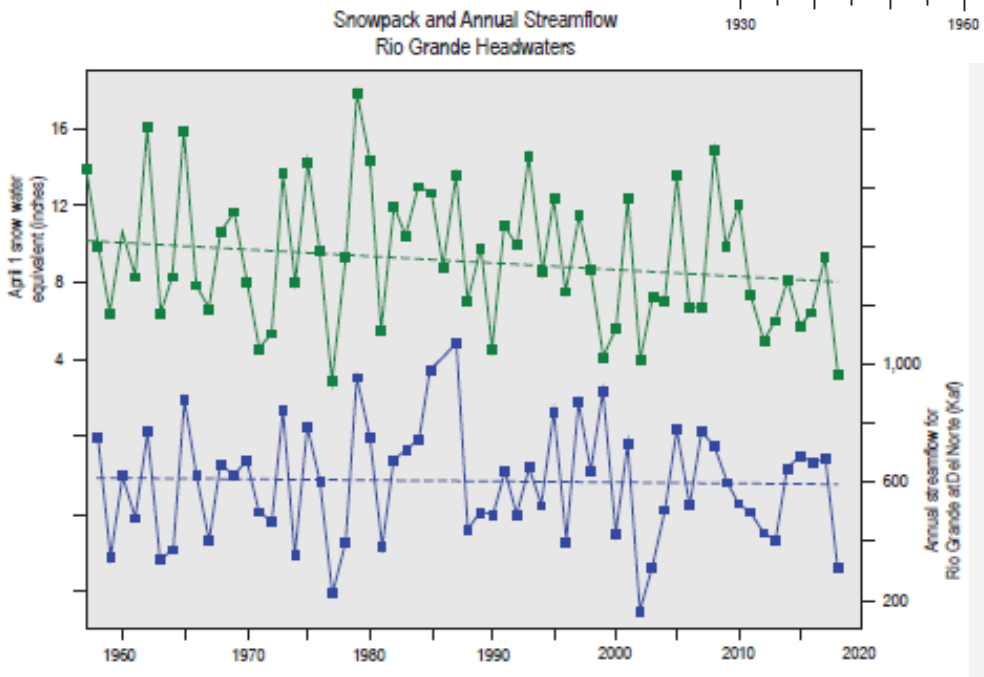
Foundational Knowledge, Technology, Missions & Data
- Technology innovation
- Earth observations missions
- Data collected from space, air and ground

https://science.nasa.gov/earth-science/earth-science-to-action/

Future Climate in New Mexico

- Increased aridification
- Increased variability by region and physiographical factors
- Warmer temperatures lead to changes in the water budget

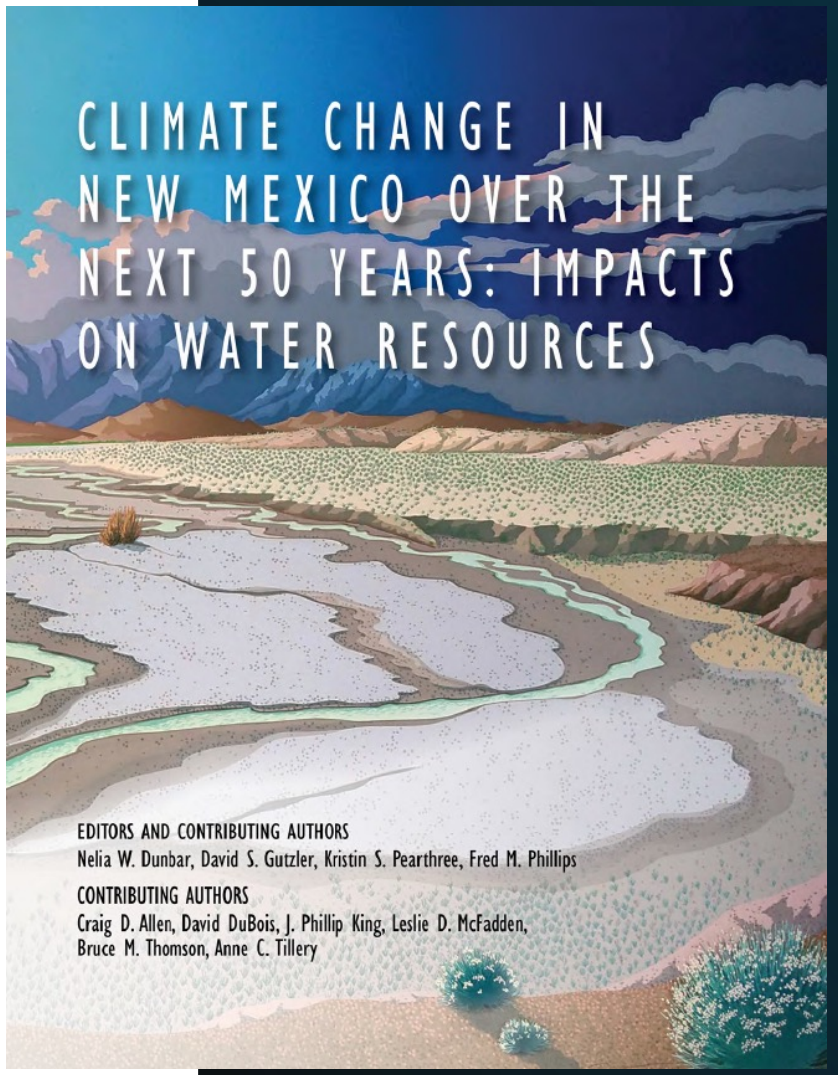




Leap Ahead Report, 2022.

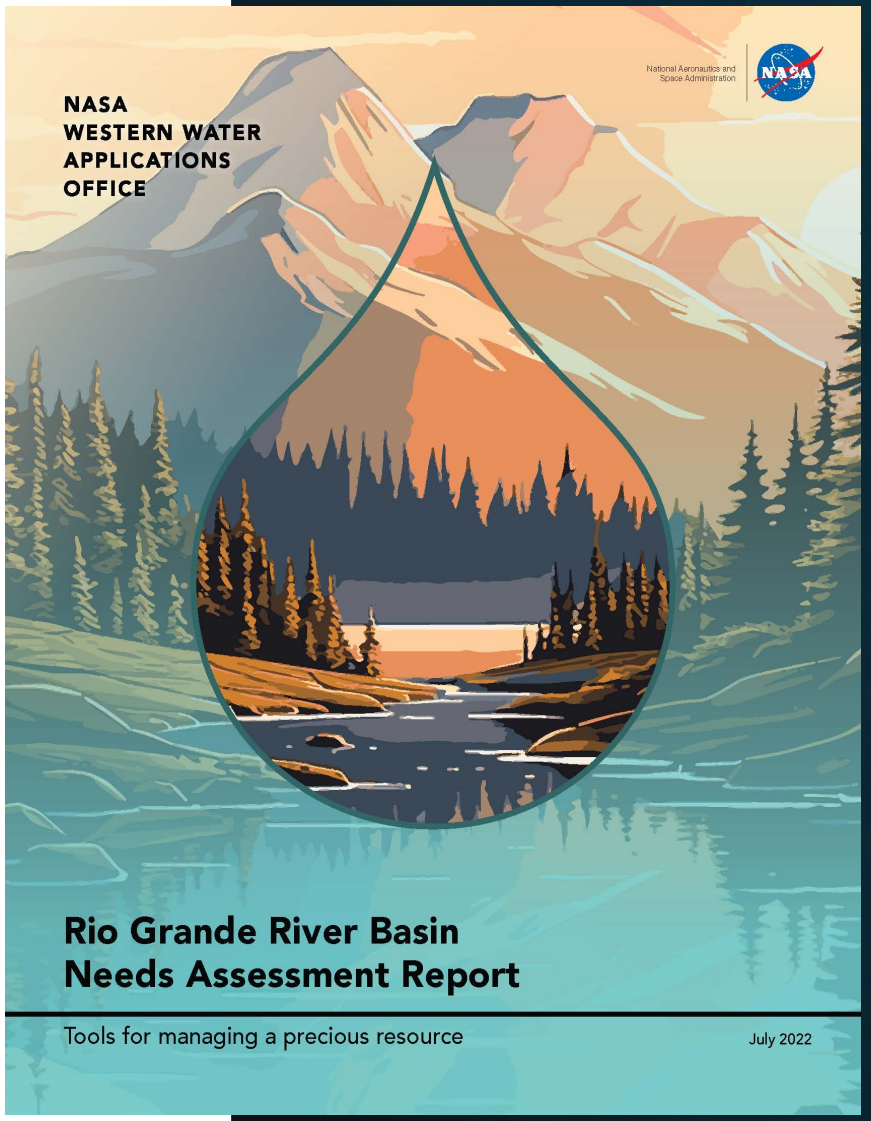
Identifying Critical Needs in NM

- Snow characteristics
  - Snow covered area and snow-water equivalent (SWE)
  - Snow albedo, dust-on-snow, forest fire effects on snow
- Summer monsoonal trends and forecasting
  - Sediment transport challenges
- Landscape/Vegetation/Crop characteristics
  - Vegetation density, type, and moisture stress
  - Post-fire changes, erosion, sediment transport
- Surface water-groundwater interaction
  - Soil moisture, recharge, and ET



Addressing the Needs with WWAO

- Navajo Nation Drought Severity Evaluation Tool
- Rio Grande Needs Assessment
  - Two projects on assessment of snowpack conditions in headwater forests
  - Two dashboards – one on hydrologic data and modeling, and one on future hydroclimate conditions
  - An integrated modeling framework
  - An analysis of surface-water and groundwater interaction
  - A water supply forecasting tool

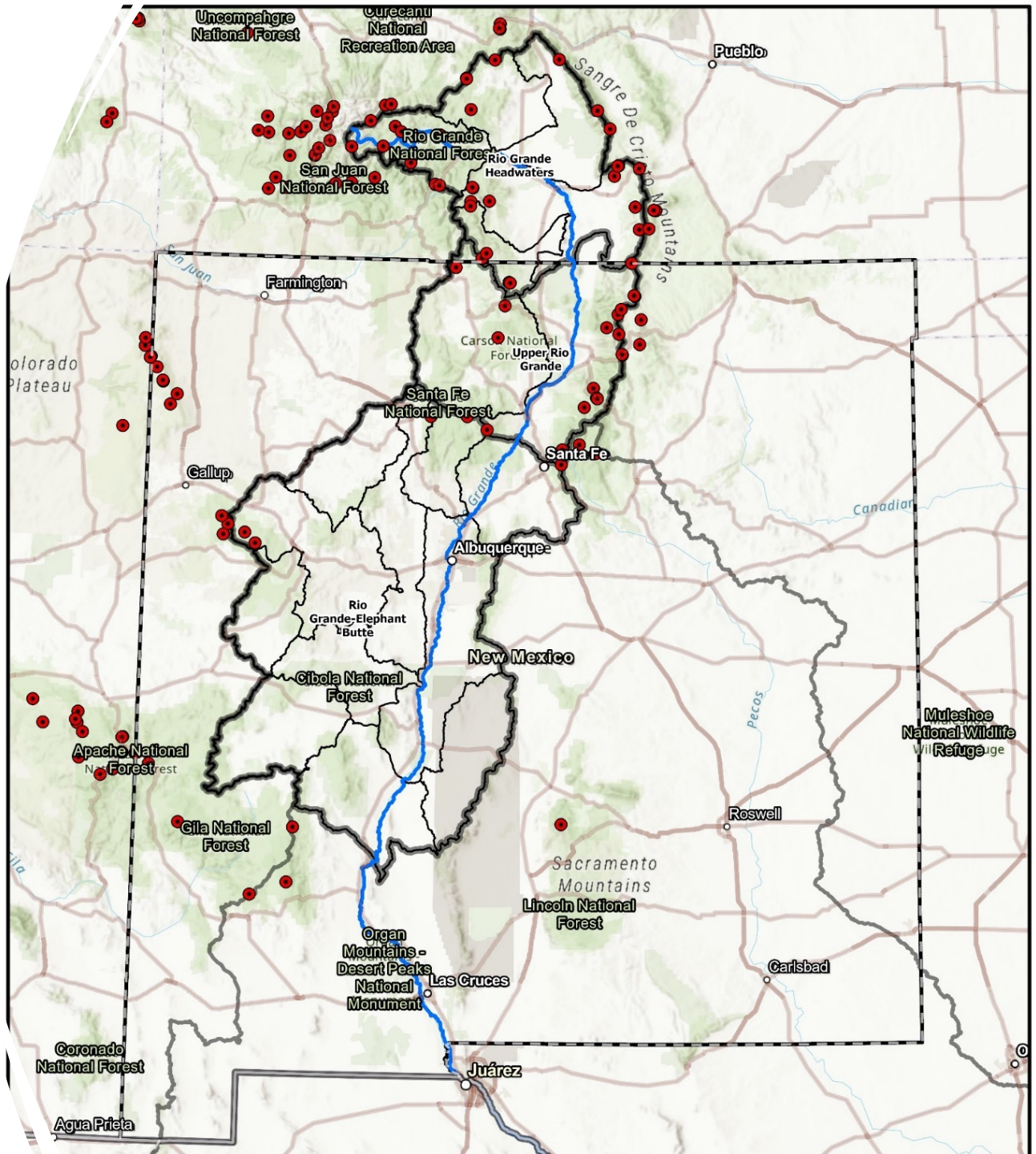


OSE/ISC Current Projects

- **Operational SWE Analysis Tool**
  - Improve our understanding and seasonal projection of snow-water supply
  - Dust-on-snow and forest fire effects on snowmelt timing and availability
- Statewide Consumptive Use Estimate Tool
  - Improve our understanding of (agricultural) water demand
- Historical supply studies
- Surface water-groundwater interaction
  - Updating administrative groundwater models
  - Supplemental wells to surface water
  - Soil moisture, recharge, and ET
- Groundwater level monitoring, microgravity, and InSAR (NISAR)
- Improved monsoon forecasting
  - Sediment transport and management

Operational SWE Analysis Tool

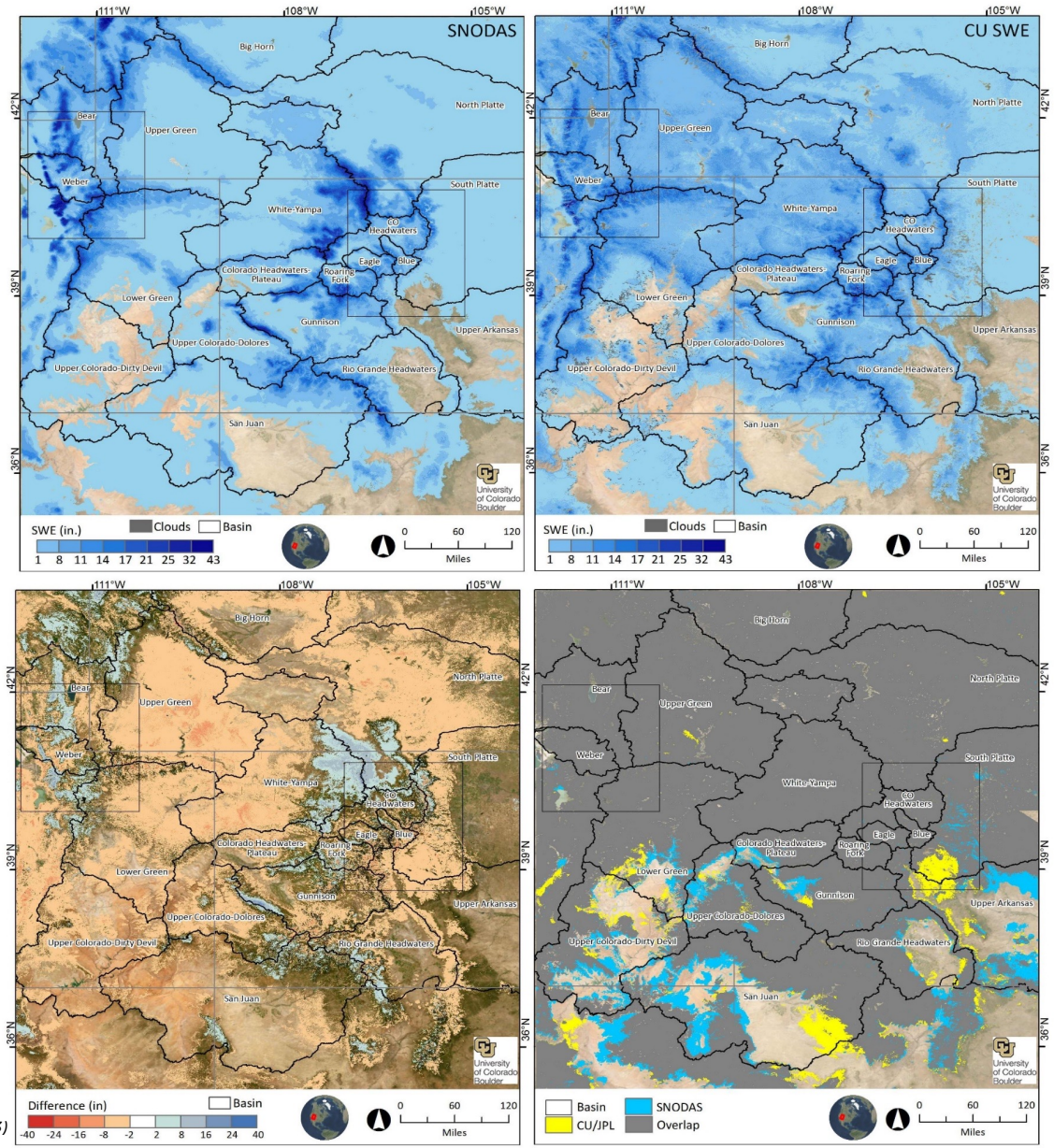
- Analyze existing SWE products that utilize NASA satellite data to produce an ensemble of near-real-time spatial estimates of SWE.
- Improve the near-real-time SWE estimations for the Rio Grande Basin.
- Build an operational tool and generate bi-weekly (?) reports with information on the near-real-time spatial SWE analysis, snow cover information, and assess product performance and uncertainty.



Operational SWE Analysis Tool

- Three Products:
  1. CU-SWE
  2. SWANN SWE
  3. SNODAS SWE

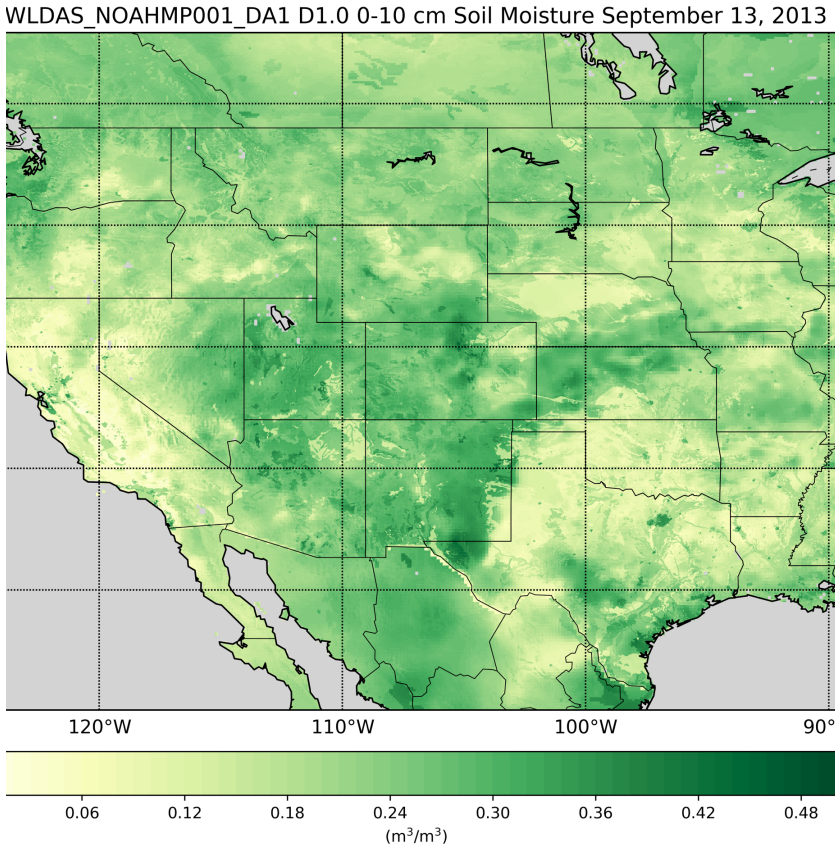
- <u>Update</u>:
  - Potentially adding a 4th NASA product!
  - Western Land Data Assimilation System (WLDAS)



Molotch, N. P., and Lestak, L. (2023)

Western Land Data Assimilation System (WLDAS)

- Land surface modeling and data assimilation to furnish a system
- Provides long-term record of near-surface hydrology
- Great product to include in the SWE Analysis Tool
  - Model outputs include 1km daily snow depth and SWE
- Potential for future additions to the SWE Analysis Tool
  - Daily soil moisture, ET, derived groundwater recharge, etc.



How can we (and others) utilize this tool?

- Expand OSE/ISC knowledge and understanding of SWE characteristics in the Rio Grande Basin
- Seasonal streamflow and reservoir predictions
  - Coupled with climate indices, long-term seasonal forecasts, streamflow gages, and other land antecedent conditions
  - *Example: McClure and Nichols Reservoirs – Snowmelt Prediction Tool (City of Santa Fe)*
- Rio Grande Compact Compliance Projection Tool (ISC and Hydros Consulting)
- Compare past seasonal water supply with future seasonal predictions
- Provide end users with an operational tool to improve delivery projections
- Expand to other areas of NM? Snow albedo for light-absorbing particles? Soil Moisture?

Thinking Ahead

- Supply and demand imbalances are expected to increase
- Continue to bridge the gap between science, decision-makers, and end users
- More data, more tools, more models… more engagement
- Near-real-time spatial SWE estimations are critical
- The SWE analysis tool will provide critical insight on the seasonal variability of snow-water timing, availability, and supply

Jon Austria – Rio Grande Headwaters

Thank you

Max Gersh

Max.Gersh@ose.nm.gov

Please reach out with any questions or comments.