Supporting water supply forecasts with spatial SWE datasets

Joachim Meyer
Boise State University

NASA Community Snow Meeting - August 2024

CBRFC Collaborators:
Cody Moser, Paul Miller

BOISE STATE UNIVERSITY

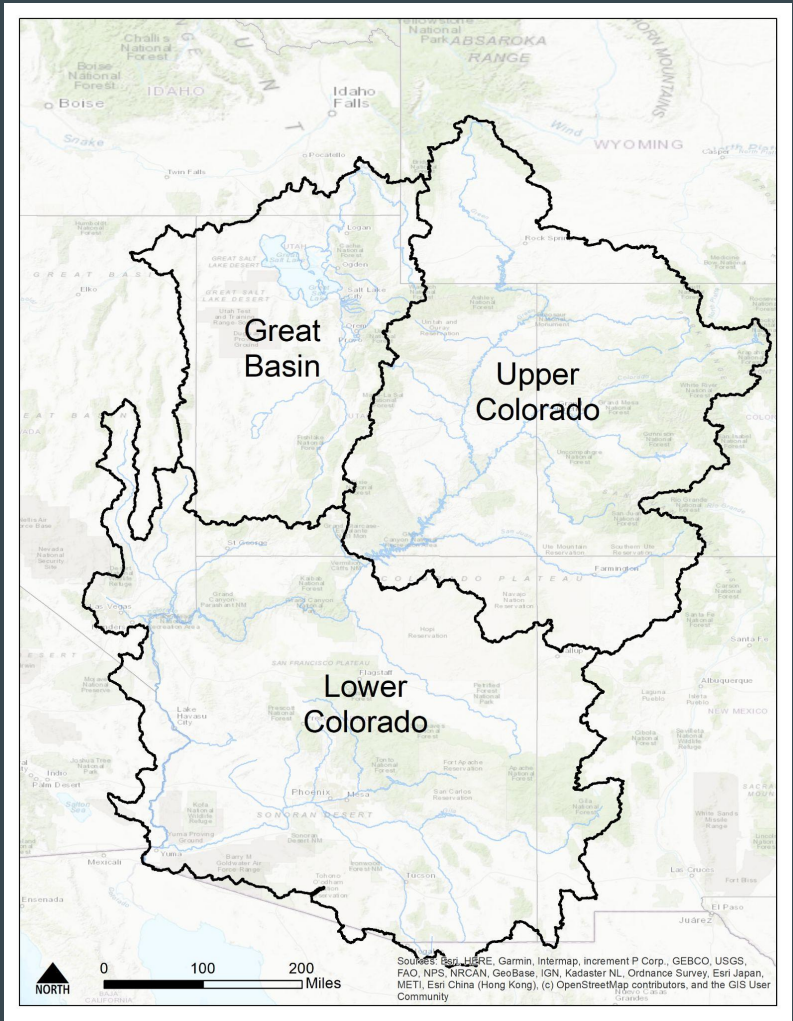
Colorado Basin River Forecast Center

River Forecast Centers (RFC):

- Part of the National Oceanic and Atmospheric Administration (NOAA)
- CBRFC is one of 13 hydrologic centers
- Publish water supply, peak flow, and 10-day streamflow forecasts

Current methods:

- SNOW-17 model (Anderson, 1976)
- SAC-SMA (Sacramento Soil Moisture Accounting) model
- Based on Hydrological Response Units



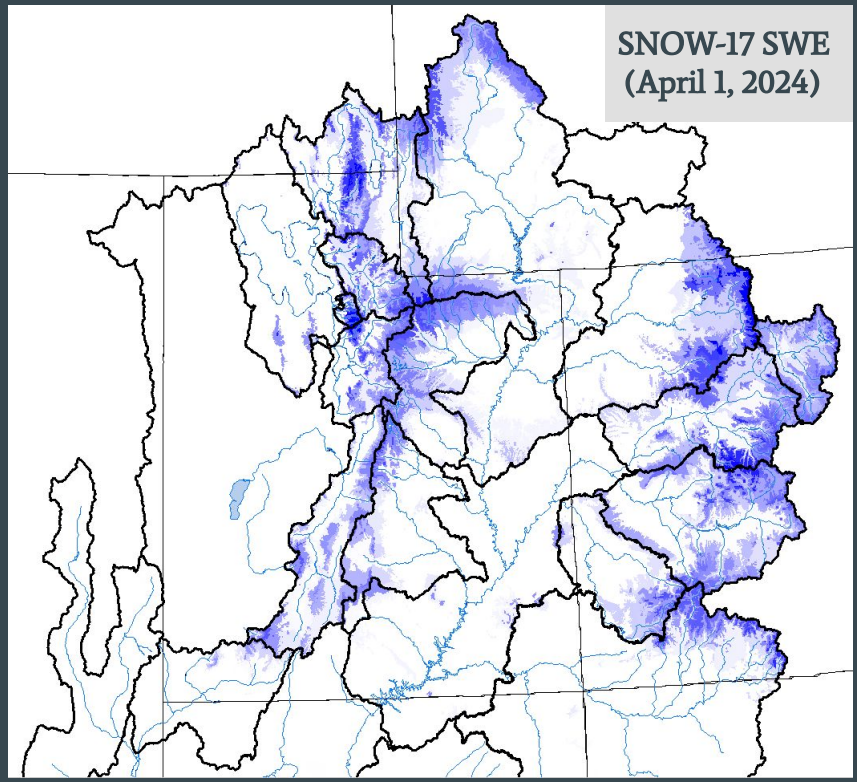
Colorado Basin River Forecast Center (CBRFC)

River Forecast Centers (RFC):

- Part of the National Oceanic and Atmospheric Administration (NOAA)
- CBRFC is one of 13 hydrologic centers
- Publish water supply, peak flow, and 10-day streamflow forecasts

Current methods:

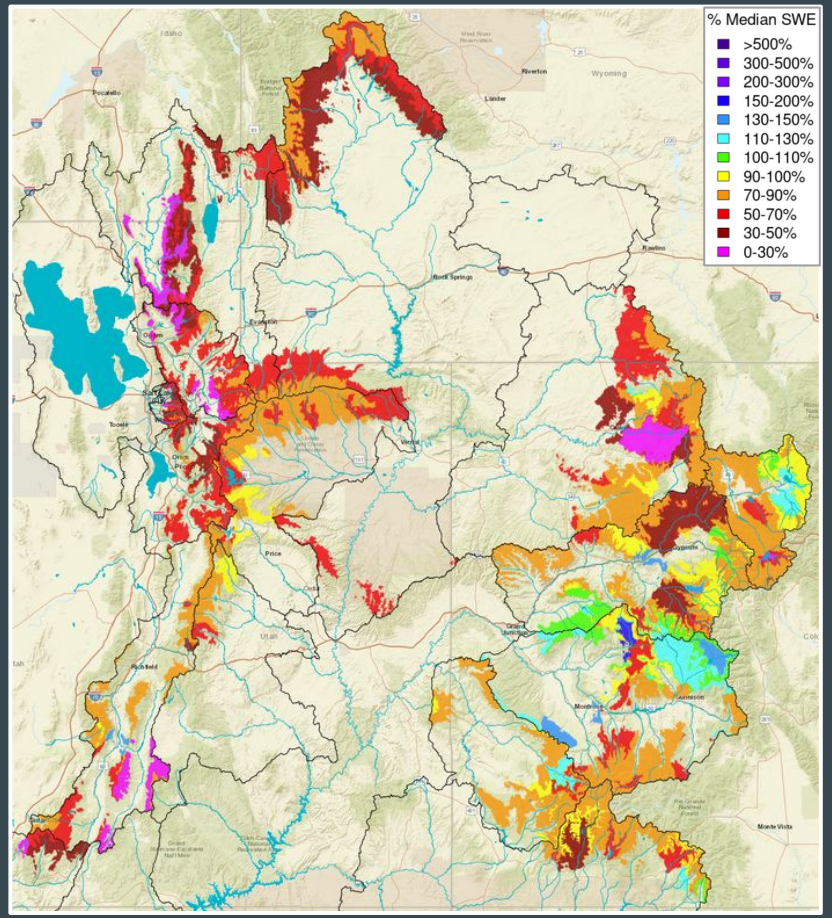
- SNOW-17 model (Anderson, 1976)
- SAC-SMA (Sacramento Soil Moisture Accounting) model
- Based on Hydrological Response Units



Why develop an integration platform?

- Ensure CBRFC mission objective to provide water supply forecasts
- Increased seasonal snow variability challenge point-based forecasts
- Higher spatial resolution products are actively developed
    - University of Arizona SWE
    - University of Colorado Boulder SWE
    - Airborne Snow Observatory (ASO)

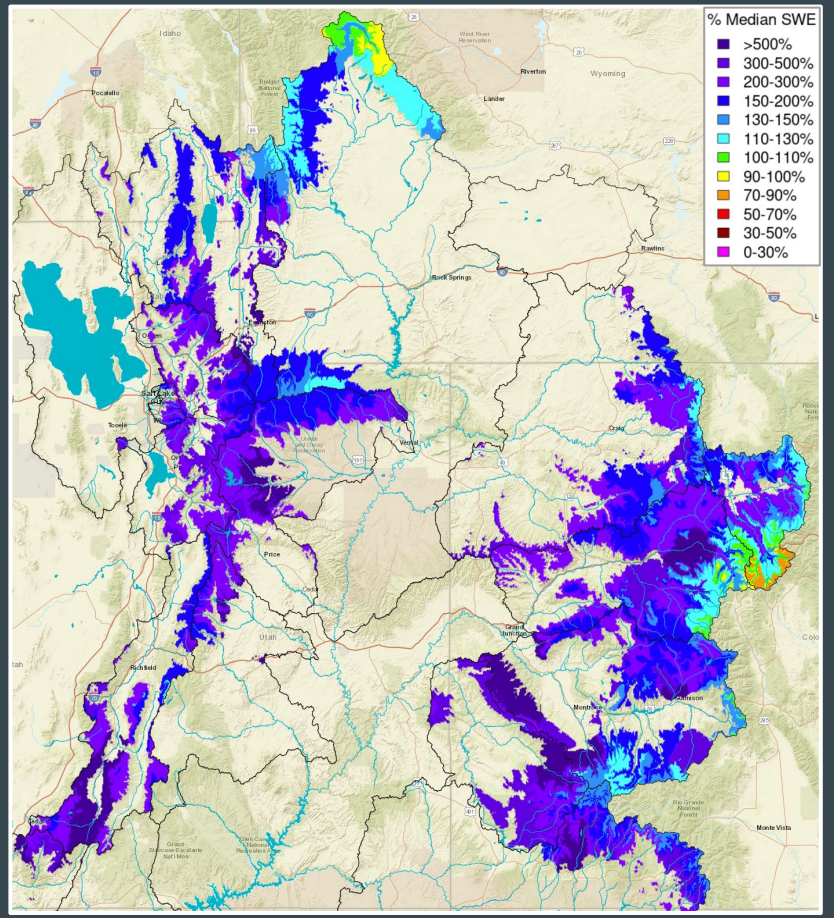
SWE Conditions 29th March 2022



Why develop an integration platform?

- Ensure CBRFC mission objective to provide water supply forecasts
- Increased seasonal snow variability challenge point-based forecasts
- Higher spatial resolution products are actively developed
    - University of Arizona SWE
    - University of Colorado Boulder SWE
    - Airborne Snow Observatory (ASO)

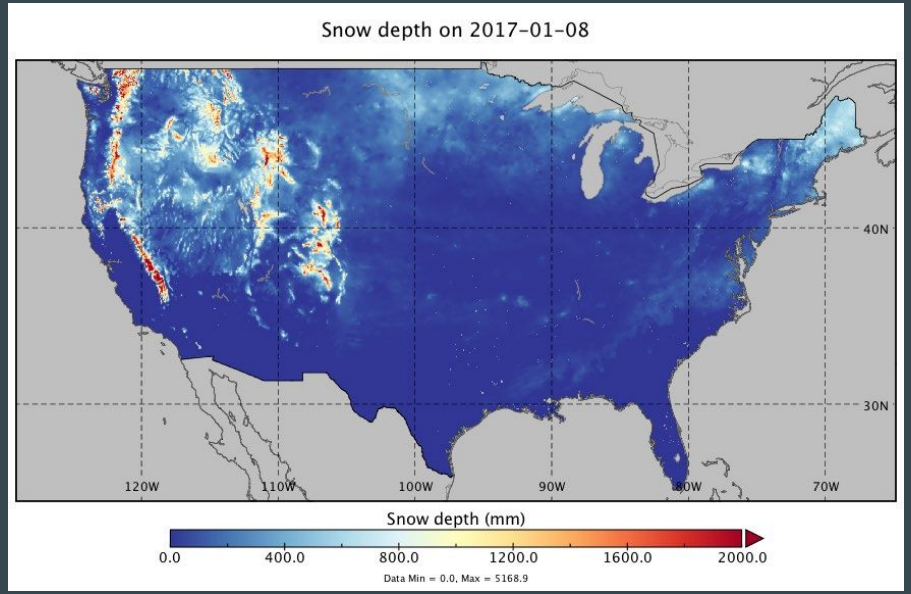
SWE Conditions 29th March 2023



Current investigated SWE datasets

University of Arizona SWE

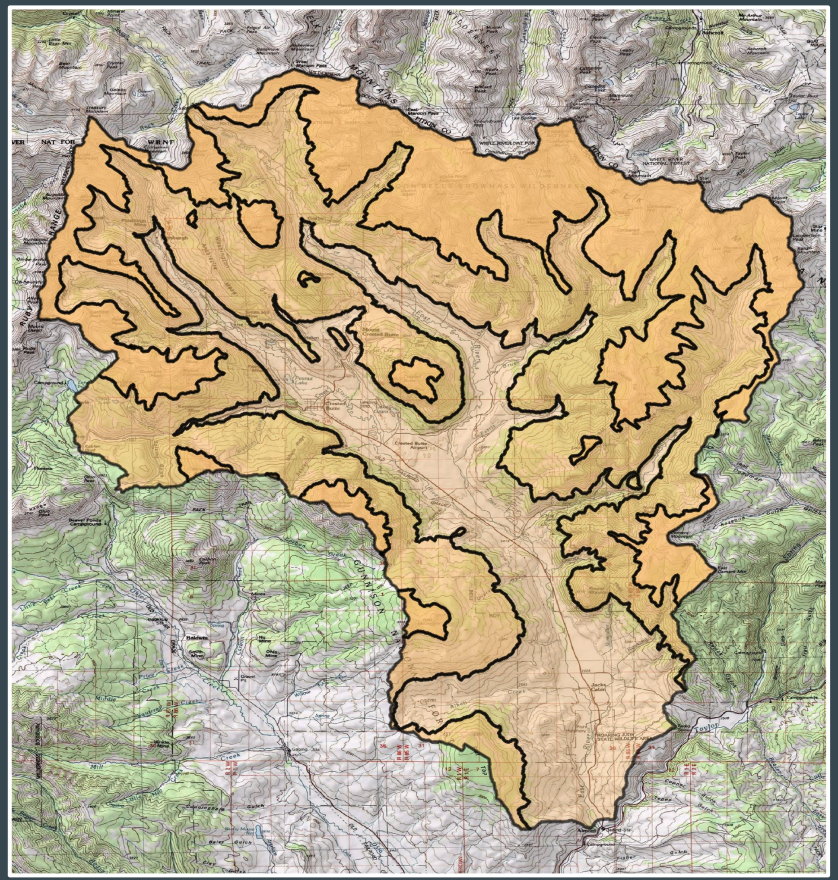
- Assimilated in-situ and modeled data
- Covers Continental United States
- SWE and snow depth
- 4-km resolution
- Daily updates
- Historic record since 1982 water year
- Available at NSIDC as Version 1



https://nsidc.org/data/nsidc-0719/versions/1

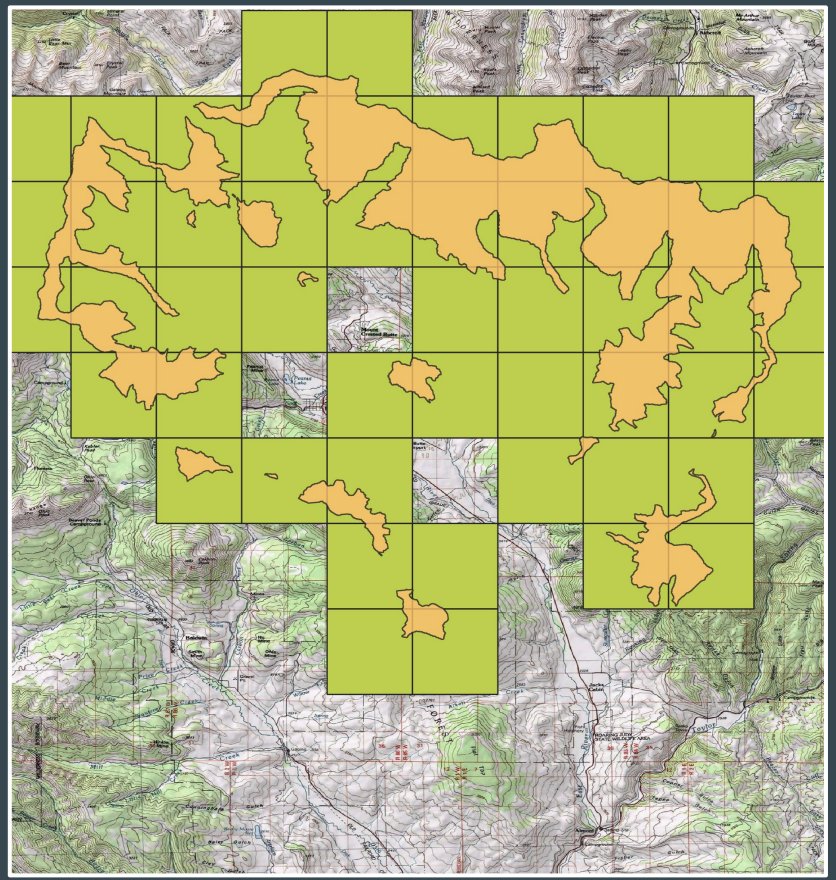
SWE evaluation

- Each watershed is organized by elevation zones
- SNOW-17 SWE based on areal mean by zones
- SWE datasets delivered gridded data
- Compare SWE by ‘touched’ pixels



SWE evaluation

- Each watershed is organized by elevation zones
- SNOW-17 SWE based on areal mean by zones
- SWE datasets delivered gridded data
- Compare SWE by ‘touched’ pixels



Test regions

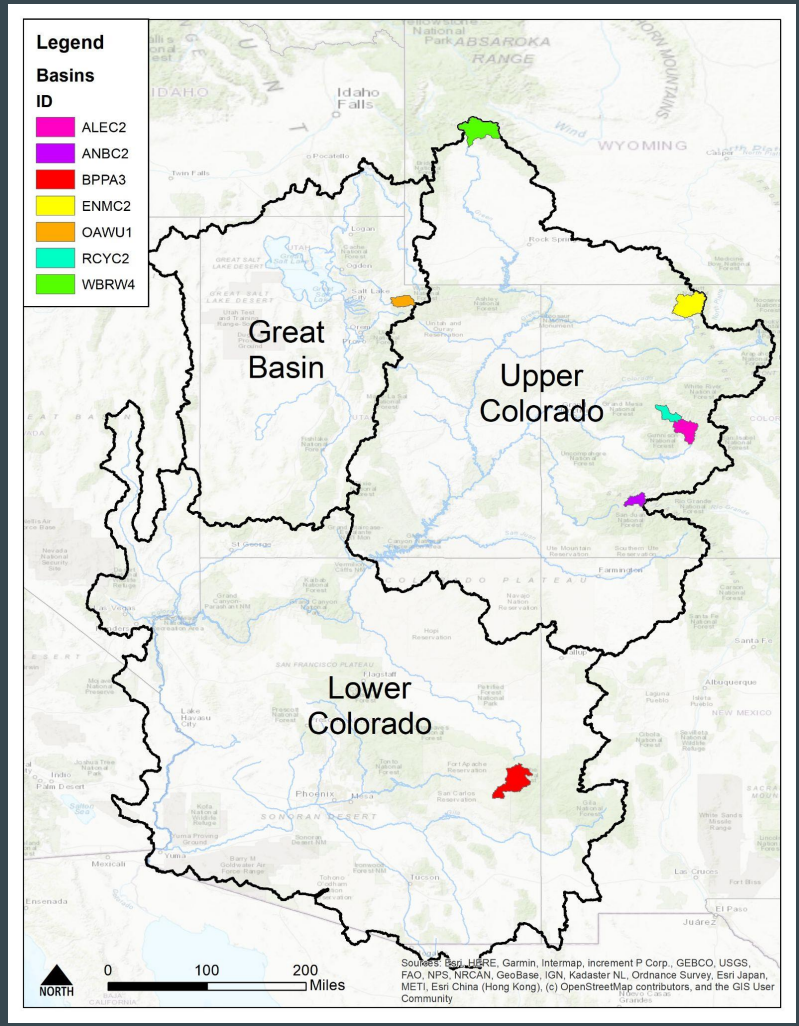
ID	Description	Region	Basin	Elevation Range (ft)	Area (mi2)
ANBC2	Animas below Silverton	UC	San Juan	9203-13833	146
RCYC2	Crystal River near Redstone	UC	CO Headwaters	6920-14080	167
ALEC2	East River at Almont	UC	Gunnison	8016-14216	289
ENMC2	Elk River near Milner	UC	White/Yampa	6586-12164	460
WBRW4	Green River at Warren Bridge	UC	Green	7474-13781	462
BPPA3	Black River near Point of Pines	LC	Salt	5729-11405	556
OAWU1	Weber River near Oakley	GB	Weber	6654-11920	162

ALEC2

- Higher elevation
- Snow-dominated
- April 27 average peak SWE date

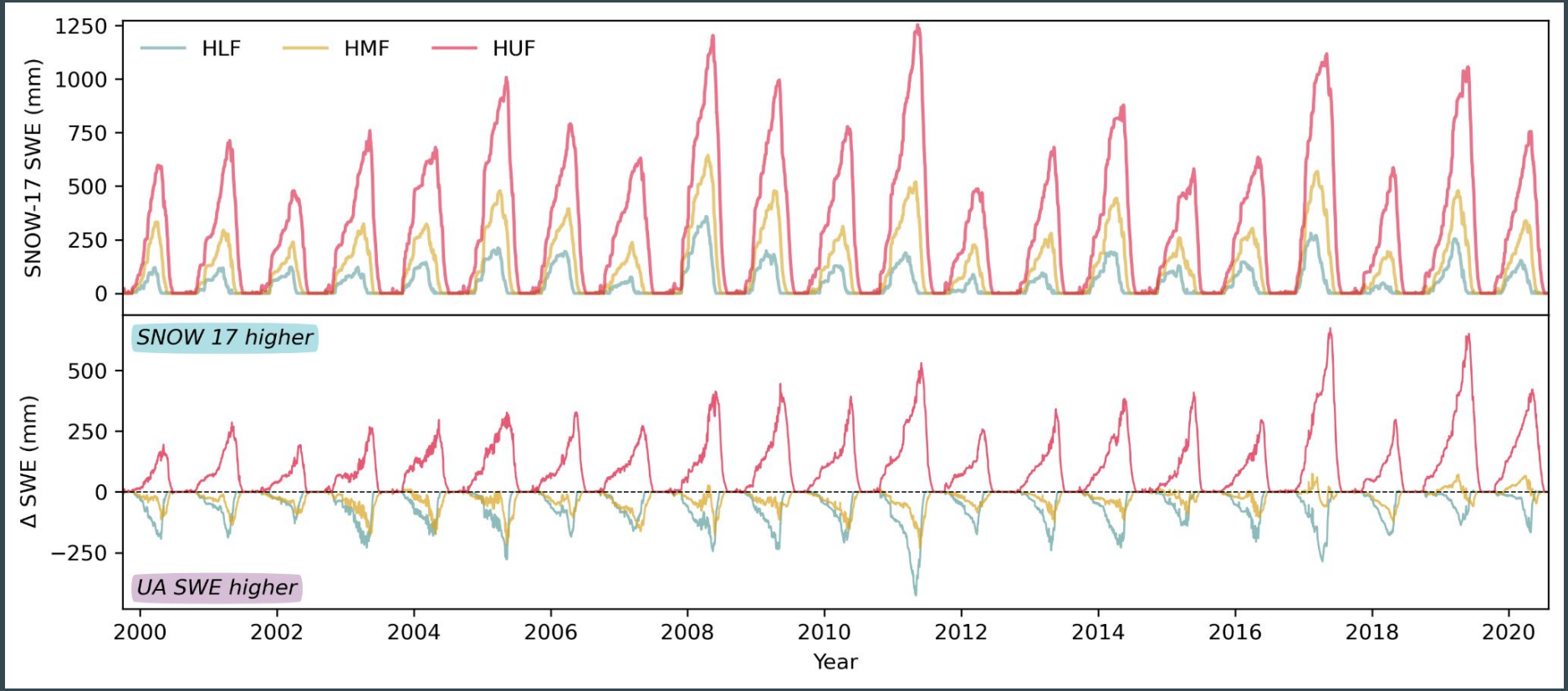
BPPA3

- Lower elevation
- Mixed (rain/snow) events
- March 3 average peak SWE date



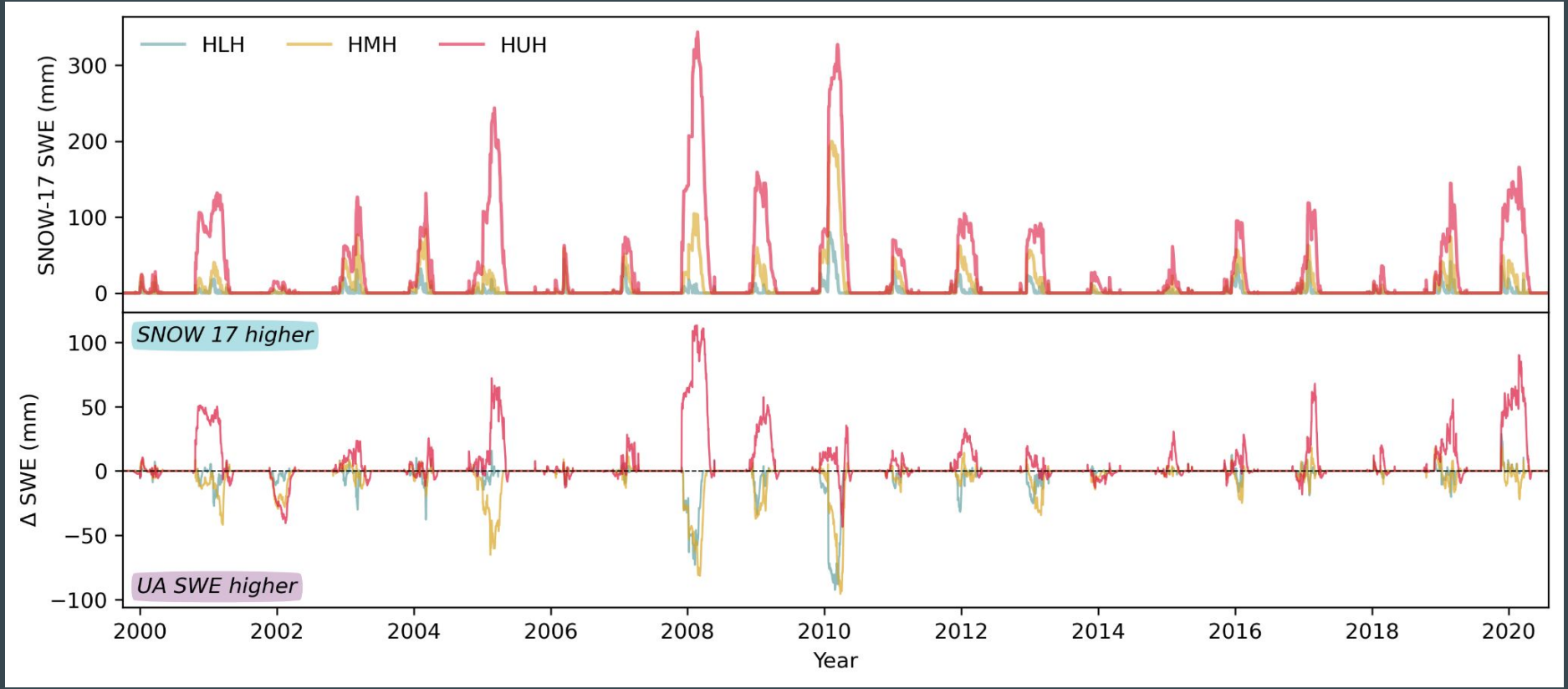
Results - East River - Areal mean SWE

$\Delta SWE = SNOW\text{-}17 - UA\ SWE$



Results - Black River - Areal mean SWE

$\Delta SWE = SNOW\text{-}17 - UA\ SWE$



Next steps

- Expand analysis to sub-seasonal differences
- Investigate other SWE extraction methods
- Use SWE data in CBRFC hydrologic model runs
- Compare other SWE data sets
- Automate to include daily updates
- Expand use for upcoming water year

Thank you!

This project is funded by the
U. S. Bureau of Reclamation

Joachim Meyer

jmeyer@boisestate.edu