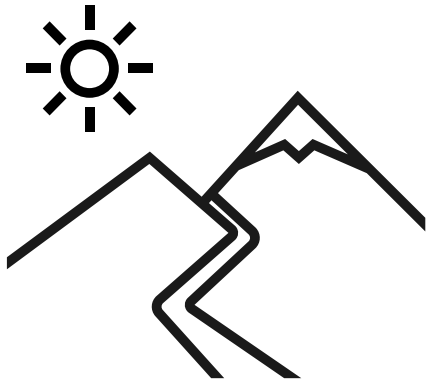


Colorado River Climate and Hydrology Work Group

Seth A. Shanahan
Colorado River Program Manager
Southern Nevada Water Authority

November 18, 2024

Background and Motivation

- Started in 2016
- Leadership role for Local and State agencies
- Build on and support Federal efforts
  - Climate Change and Water Working Group (2007)
  - Interim Guidelines Appendix U (2007)
  - Addressing climate change in long-term planning (2011)
  - Short-term water management decisions (2013)
- Kickoff symposium in 2017
  - Strengthen dialogue, share information, and advance research
- Project implementation since 2018

Participants

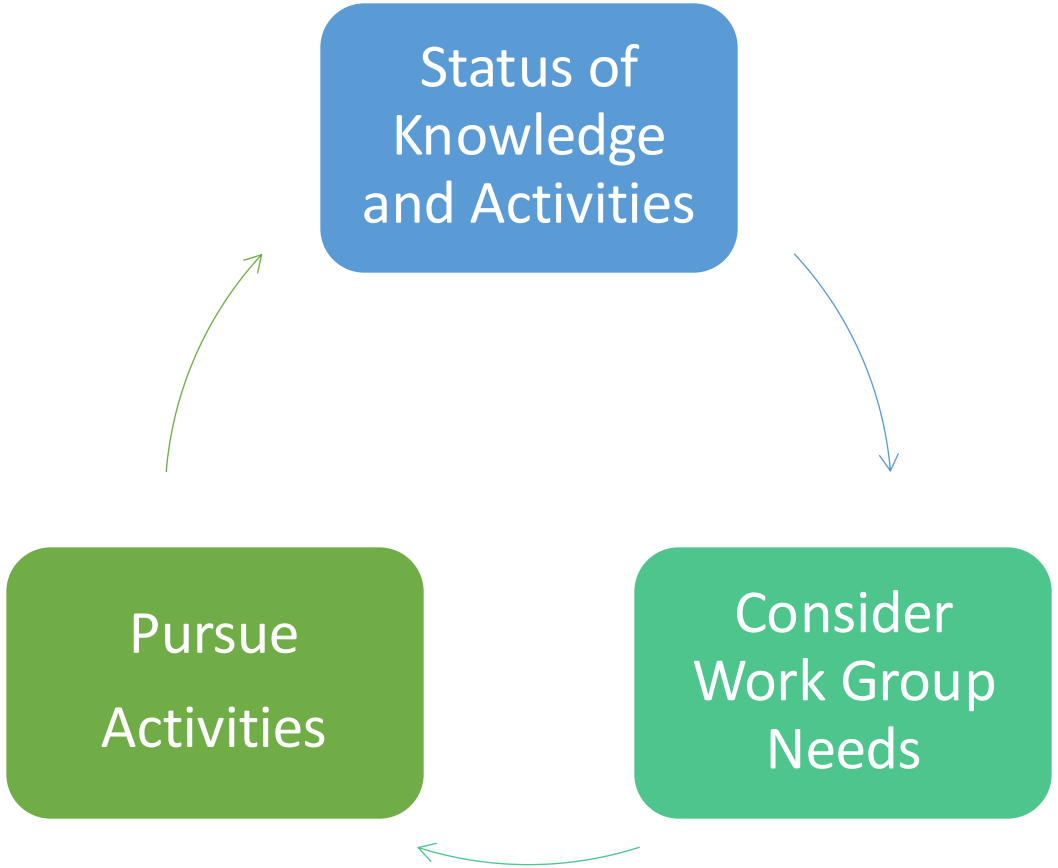
Work Group Goal

Advance scientific understanding to improve the accuracy of hydrological forecasts and projections, to enhance the performance of predictive tools, and to better understand the uncertainty related to future supply and demand conditions in the Colorado River Basin.

Structure and Process

- Informal
- Voluntary
- Facilitated by coordinator(s)
- Driven by water user needs
- Consensus on priorities
- Willing parties fund and implement projects
- Informative to other needs but not conflicting

Process


Status of Knowledge and Activities
Consider Work Group Needs
Pursue Activities

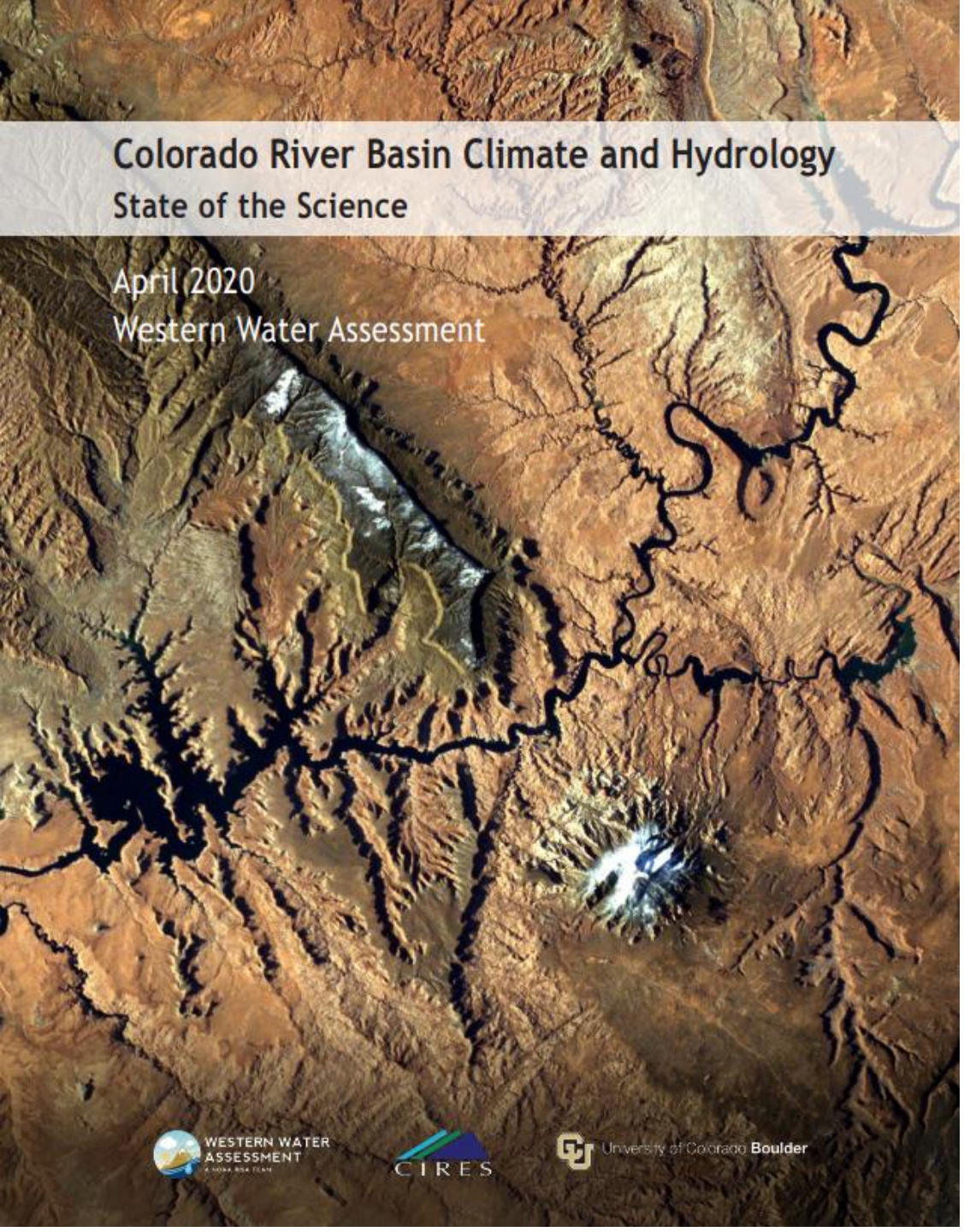
The “Blue Table” of Priorities

Timeframe	Number	Activity/Concept/Project	Models or Processes Benefitted by Activity				Activity Lead/Owner				Symposium Presentation #	Gap Analysis #	SOS Opportunity #	How to Complet
			CBRFC	BOR			CBRFC	BOR	State(s)	Other				
				24-MS	MTOM	CRSS								
Short-term	1	Sensitivity Analysis of Hydroclimatic Parameters within CBRFC's Modeling Framework	X	X	X		X	X					SOS 2.2, 6.2	CBRFC (in-house) $0 cash.
Short-term	2	Create a new set of hydrological inputs that are not based on climatology (i.e. use the Weather Generation approach like Balaji) as an experiment and run side-by-side comparison to evaluate skill over time.	X	X	X		X	X			19, 3	U.10.3 (1) LT.3.03		BOR - Any new set of hydrolog could be tested using the Colo Streamflow Testbed.
Short-term	2a	HEFS integration	X	X	X		X				10	U.10.3 (2)	SOS 7.7	CBRFC would test; would need develop

- Model to be improved
- Planning horizon (short to long-term)
- Time to complete the work
- Time to make an impact
- Cost

Priority #1

Comprehensive assessment of the state of the science



- Identified <u>challenges</u> and <u>opportunities</u>
- Documented state of knowledge and practice
  - Weather and climate
  - Hydrology
  - Decision-support tools
- Tool for engaging researchers

Some Challenges

Inadequate characterization of the snowpack

Evapotranspiration and crop water use estimation could be improved

Soil moisture is poorly monitored and understood

Sub-seasonal and seasonal climate predictions could be improved

Priorities and Projects

Model Sensitivity Analysis

An Overview of CBRFC's Hydrologic Model Sensitivity to Changes in Precipitation, Temperature, Soil Moisture, and Evapotranspiration Perturbations

October, 2020

National Oceanic and Atmospheric Administration (NOAA)

National Weather Service (NWS)

Colorado Basin River Forecast Center (CBRFC)

CBRFC Water Year in Review

An Overview of Operational Changes, Improvements, and Investigations over the course of Water Year 2023

October, 2024

National Oceanic and Atmospheric Administration (NOAA)

National Weather Service (NWS)

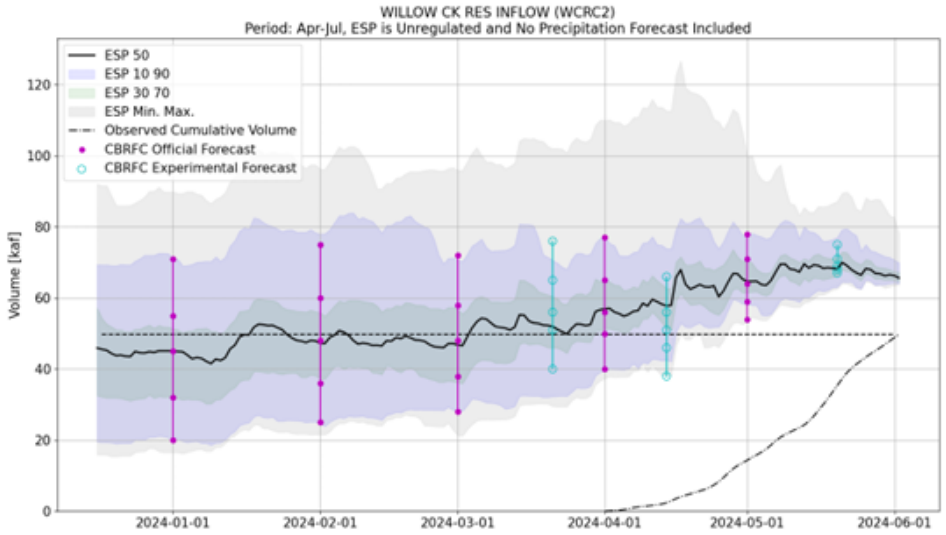
Colorado Basin River Forecast Center (CBRFC)

Experimental Seasonal (Apr - Jul) CBRFC Forecast with direct insertion of estimated SWE from airborne lidar survey

Location: Willow Ck - Willow Ck Reservoir, Granby, Nr (WCRC2)

Date of Flight: May 30, 2024

This experimental forecast product is provided for information purposes only and is not intended as an official forecast product of the Colorado Basin River Forecast Center (CBRFC). The experimental forecast shown in blue on the figure and provided in the table is created by running the Ensemble Streamflow Prediction (ESP) model after direct insertion of basin average snow water equivalent (SWE) from Airborne Snow Observatory Inc. (ASO) into the CBRFC's operational, calibrated, and lumped parameter snow model (SNOW-17).

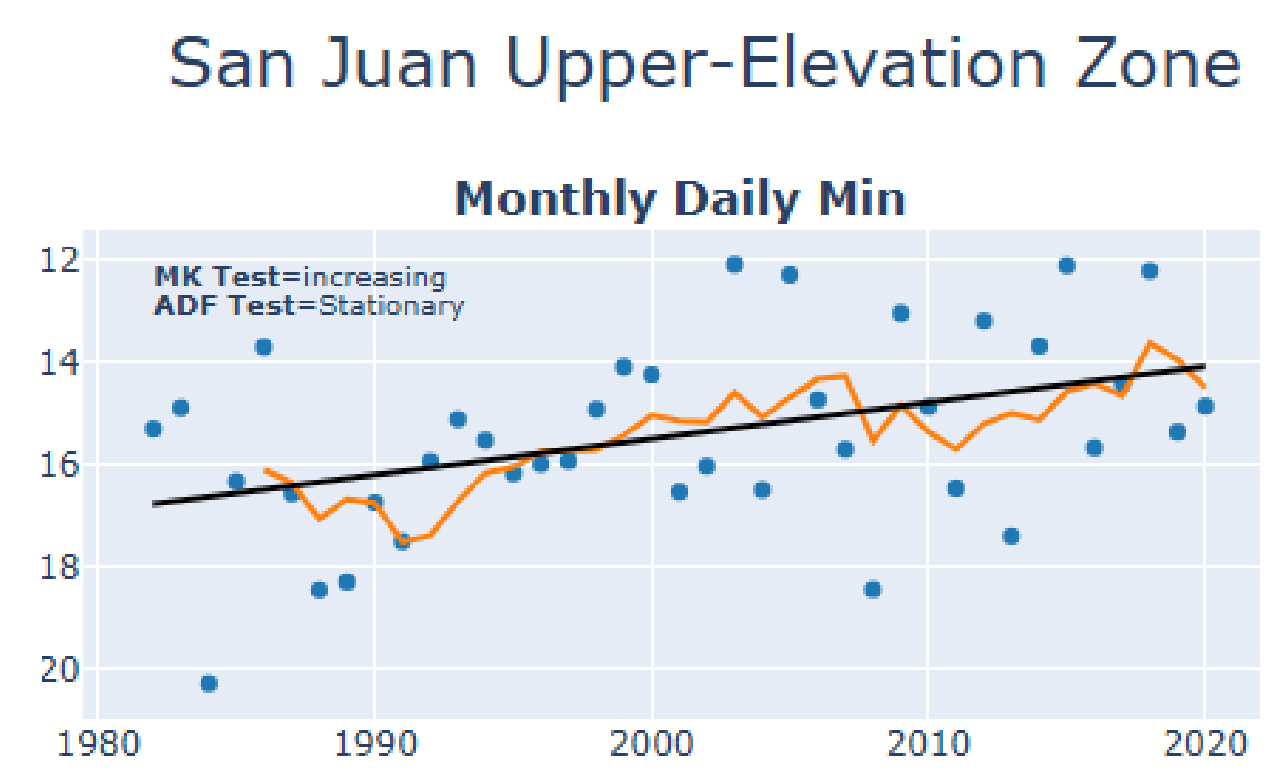


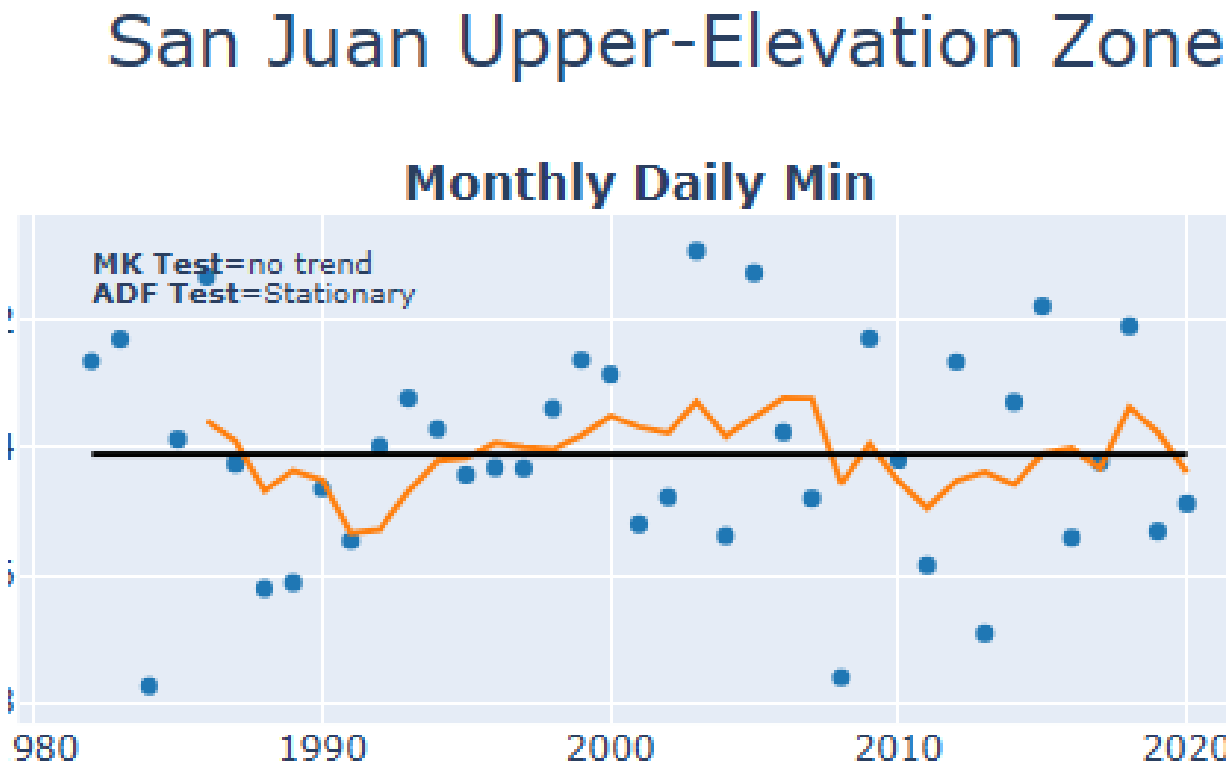
Forecast / Exceedance Value	ESP90	ESP70	ESP50	ESP30	ESP10
CBRFC Experimental Forecast 5/30/2024	67	68	69	71	75
CBRFC ESP Model Guidance 5/30/2024	64	65	66	68	72

Probabilistic forecast volumes in thousands of acre-feet (kaf). Columns indicate exceedance values.

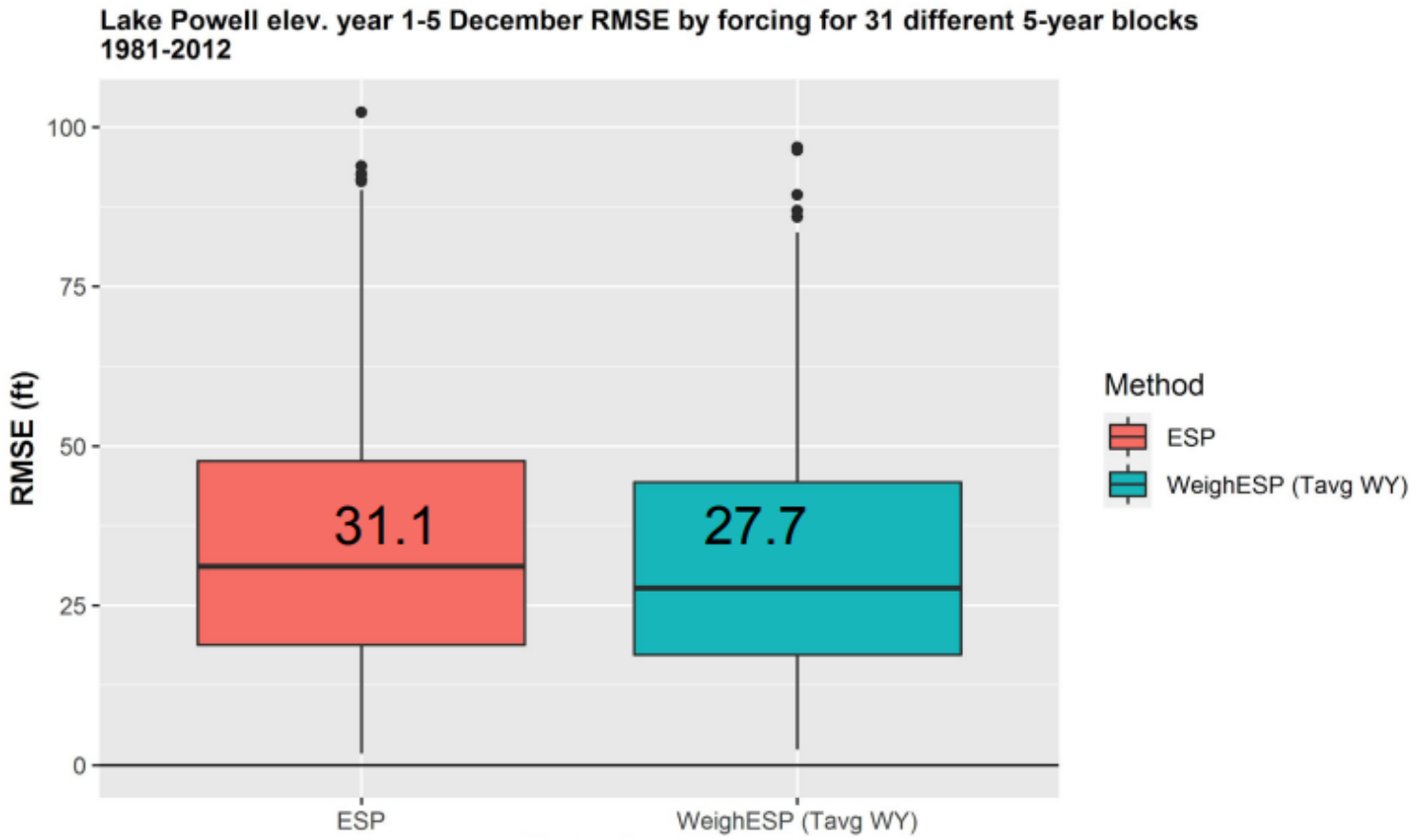
Please contact the CBRFC with any questions regarding this product - cbrfc.operations@noaa.gov

Detrend Temperature





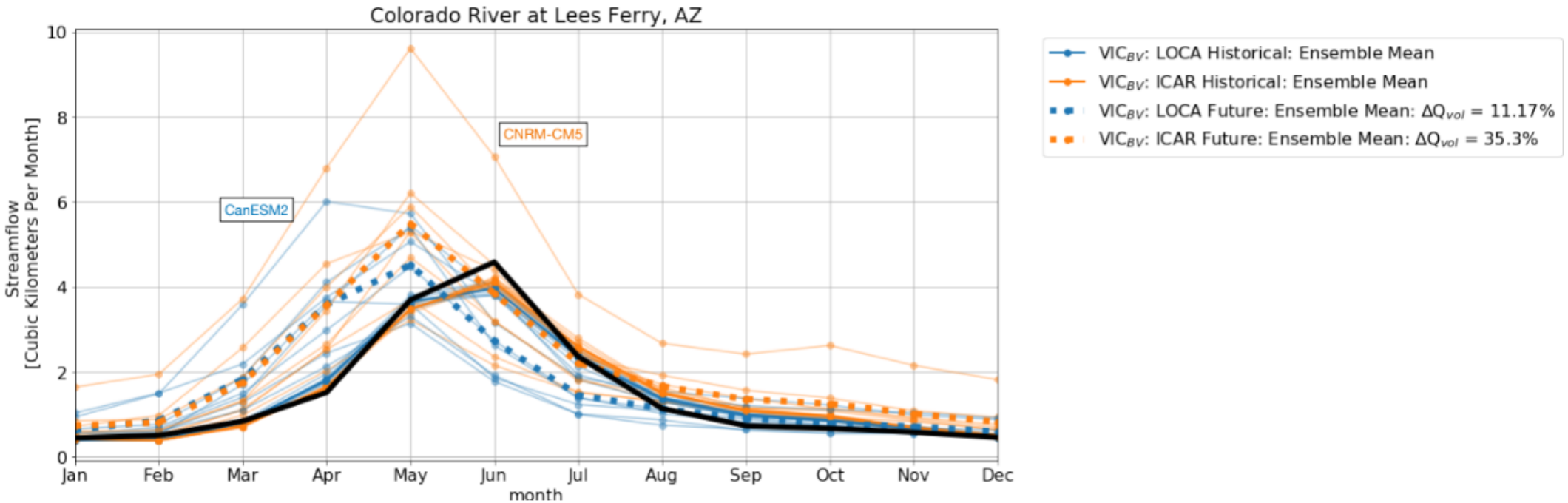
Consider 5 Year Temperature Trend

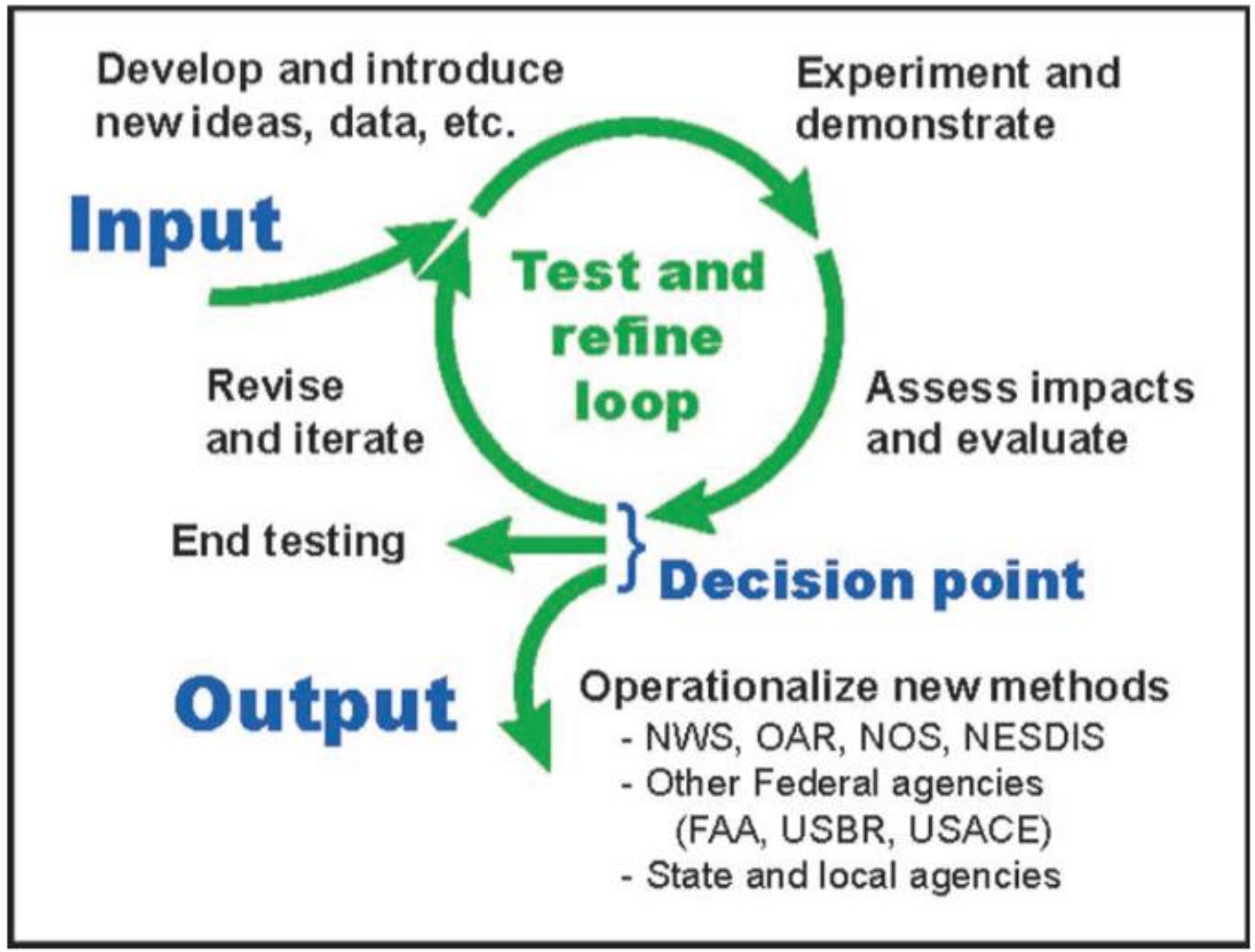


Changes in Streamflow at Lee's Ferry

From ICAR and LOCA

8 GCM's
rcp85

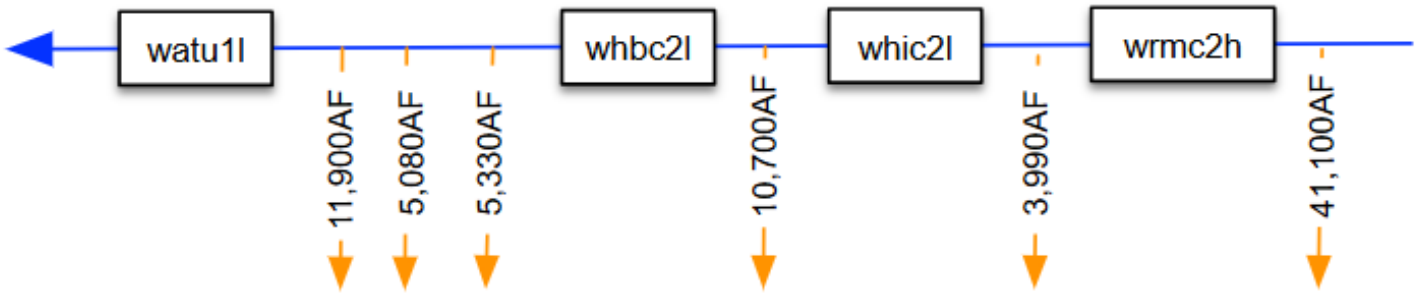




Ralph et al. (2013)

Priorities and Projects

- Improve unmeasured depletions and ET modeling
- Springtime (MAM) precipitation



White River

Priorities and Projects

- Improve 1-5 year water supply forecast skill
- Explore different statistical and dynamical downscaling methods and the steamflow ensembles that result
- Evaluate differences stemming from downscaling methods, bias-correction methods, and hydrologic models

Partnerships Make it Happen

Thank you for your time!