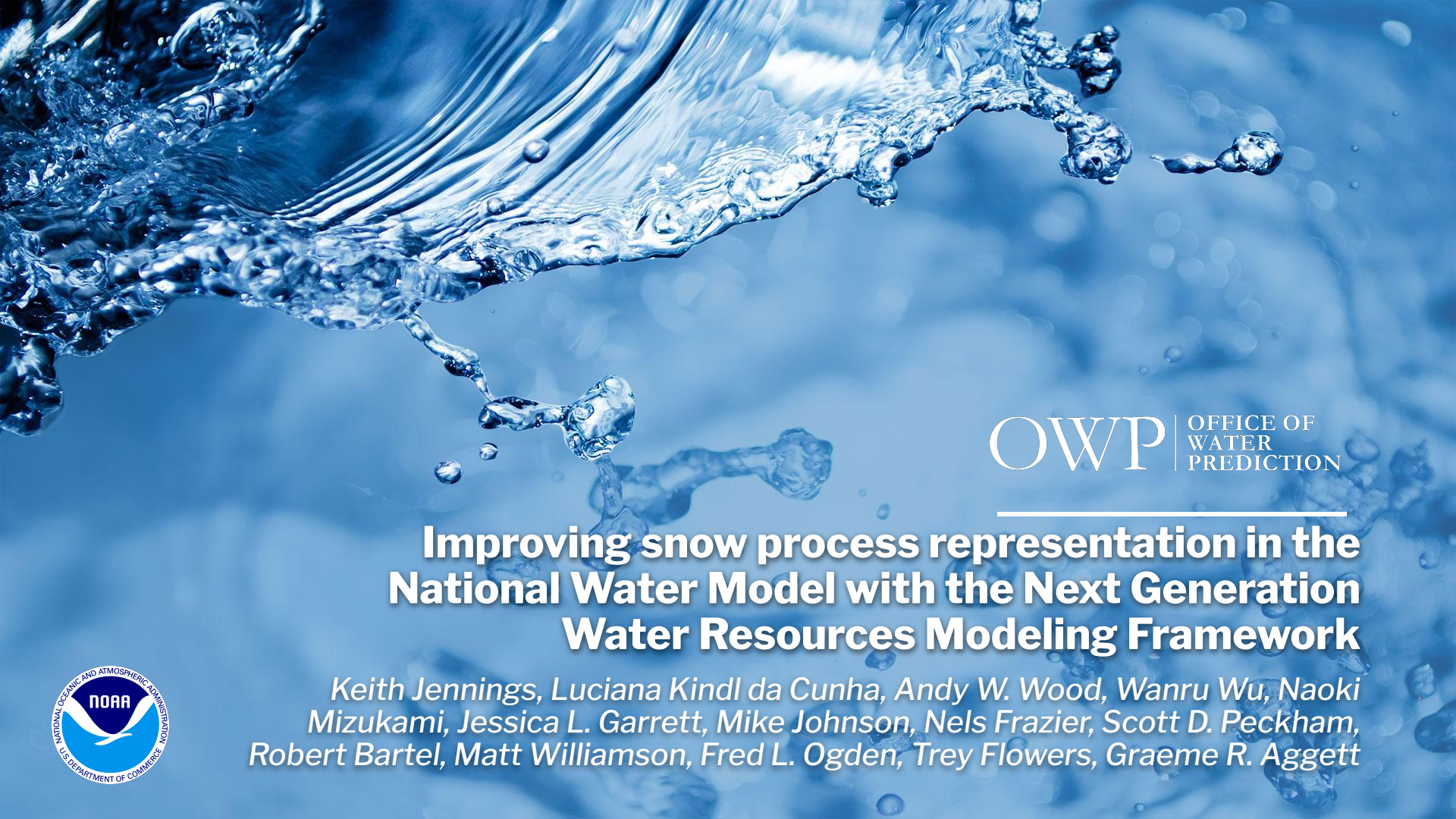
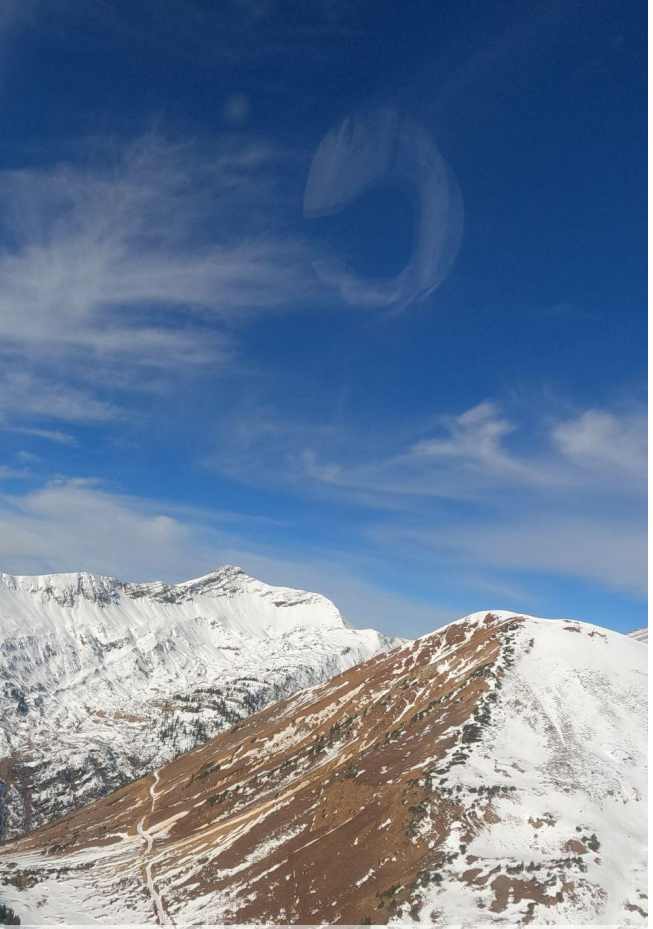


OWP | OFFICE OF WATER PREDICTION

Improving snow process representation in the National Water Model with the Next Generation Water Resources Modeling Framework

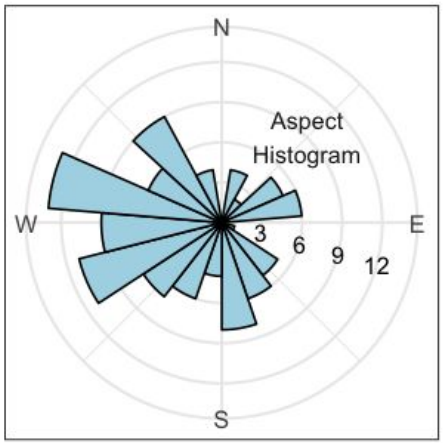
Keith Jennings, Luciana Kindl da Cunha, Andy W. Wood, Wanru Wu, Naoki Mizukami, Jessica L. Garrett, Mike Johnson, Nels Frazier, Scott D. Peckham, Robert Bartel, Matt Williamson, Fred L. Ogden, Trey Flowers, Graeme R. Aggett

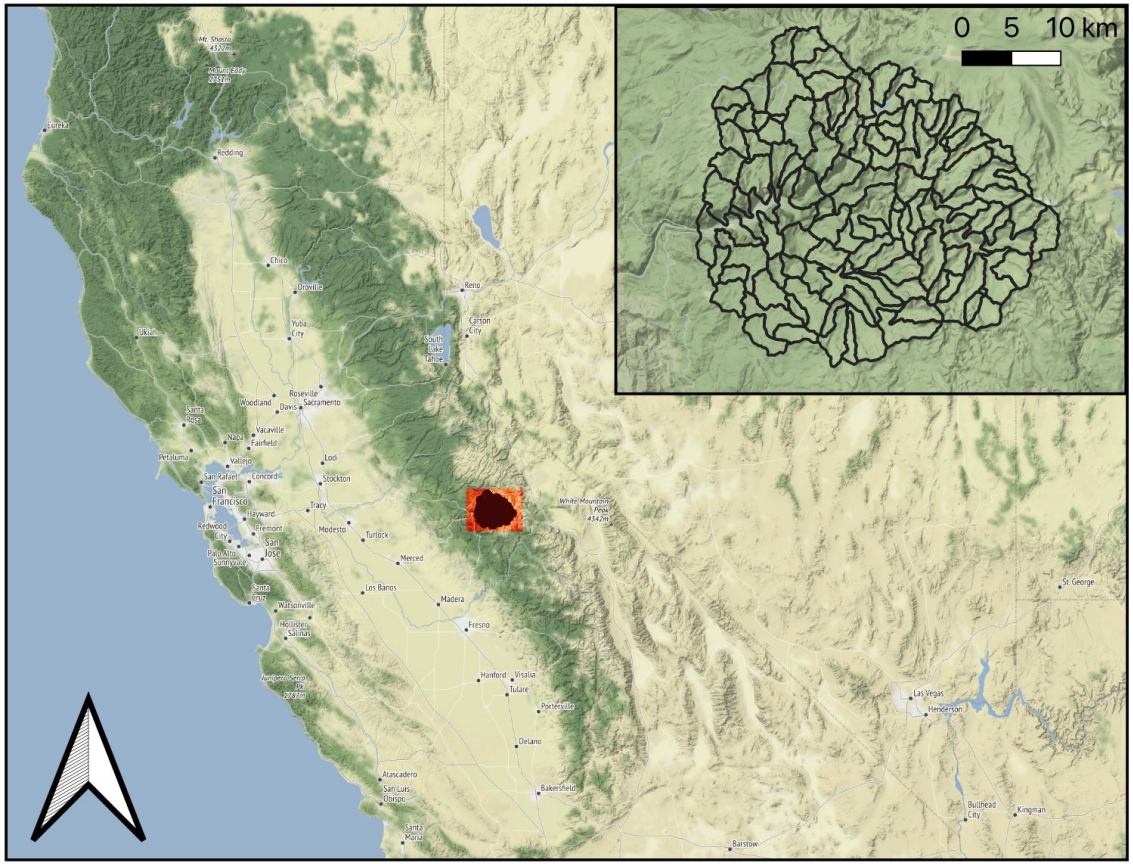


- **Goal:** improve snow representation in National Water Model (v4.0+)
- **Modify:** Noah-OWP-Modular
  - Correct incoming shortwave radiation for slope and aspect (Noah-MP assumes flat domain)
  - Add wet bulb temperature (T_w) threshold to split rain and snow (Noah-MP is air temperature only)
- **Run:** Next Generation Water Resources Modeling Framework
  - 2007-10-01 through 2019-09-30
- **Compare:** baseline output (NWM config) with scenario output
  - SWE = snow water equivalent
  - SCD = snow cover duration
  - Differences shown as modification minus baseline

Merced River headwaters, western Sierra Nevada, USA

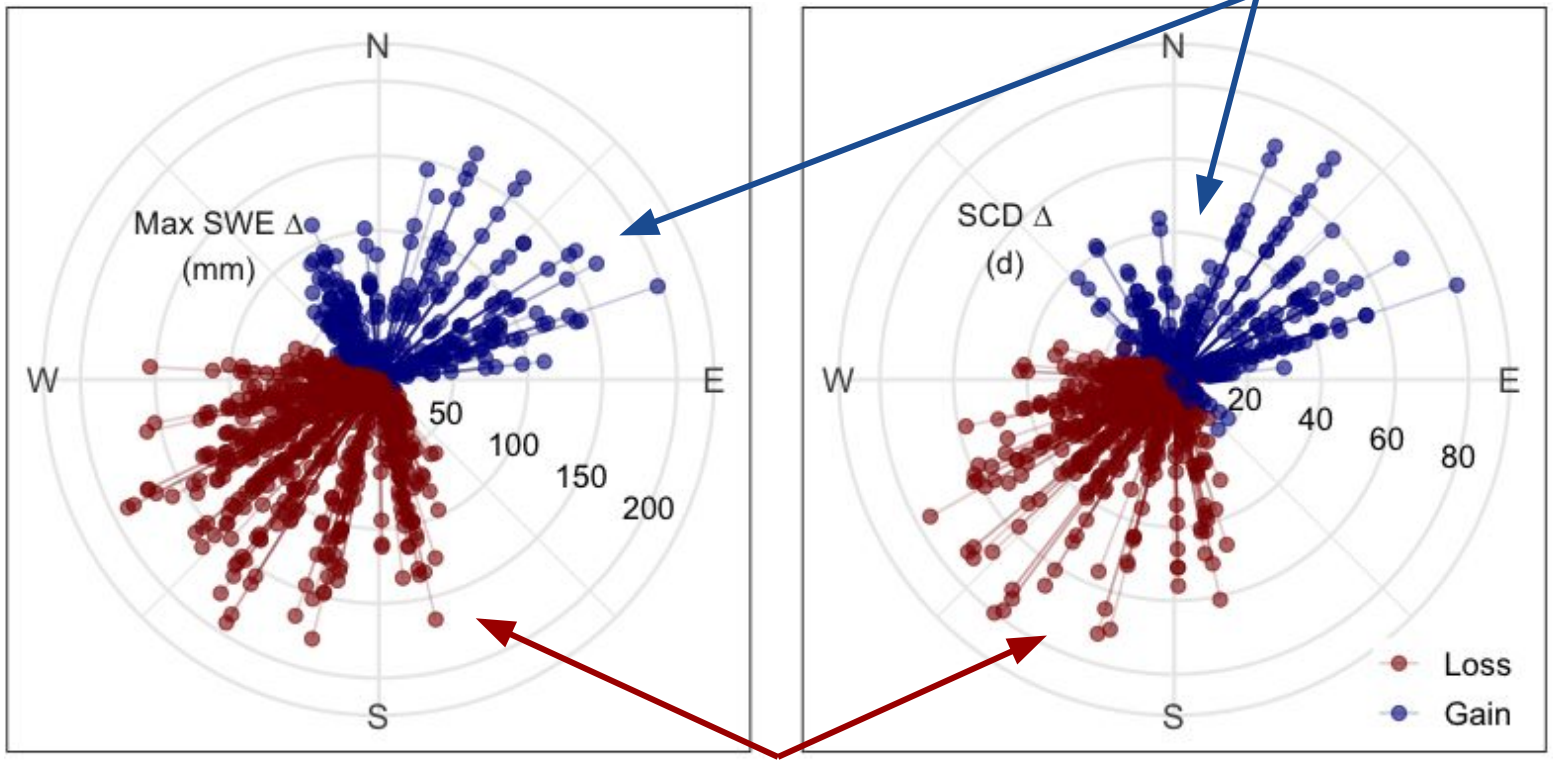
- Sub-basin info:
  - 1714 m to 3484 m elevation
  - 850 mm to 1270 mm annual precipitation
  - 44.4% to 94.4% annual snowfall fraction
  - 7.9° to 36.6° slopes





Slope and aspect modify maximum SWE and SCD

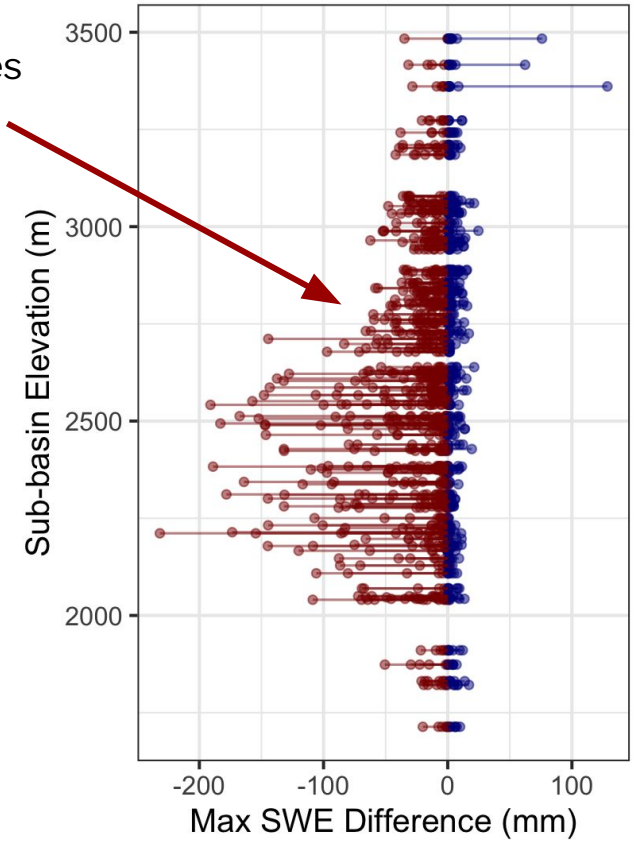
S&A mod produces **more** SWE and **longer** SCD on N-facing slopes

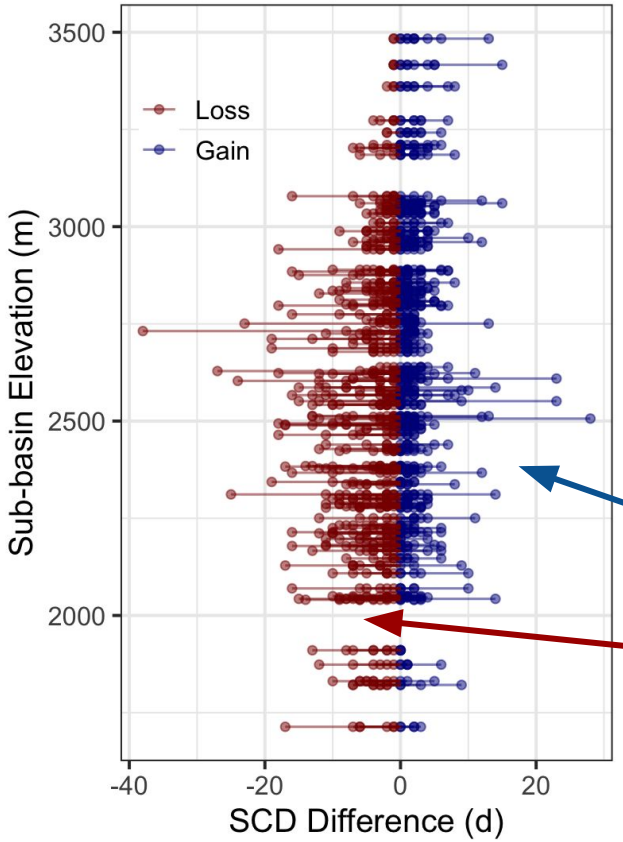


S&A mod produces **less** SWE and **shorter** SCD on S-facing slopes

Varying patterns of SWE and SCD loss and gain by T_w method

T_W mod produces **less** SWE at mid-elevations (generally)





T_W mod produces **mixed** SCD effects

Findings and next steps

- Noah-OWP-Modular modifications affect simulated SWE and SCD
  - Less snow for less time on south-facing slopes
  - Wet bulb temperature method produces less snow at mid elevations
- Evaluate additional basin configurations
- Analyze effect of modifications on simulated streamflow
  - Conceptual Functional Equivalent
  - TOPMODEL
- Further refinements and improvements
- Snow-17 as additional snow module
- ***Community input wanted!***

Thank You!

Keith Jennings

keith.jennings@noaa.gov

https://water.noaa.gov

OWP | OFFICE OF WATER PREDICTION