

New for 2024

Streamflow Forecasting is now powered by Machine Learning

This year the NRCS will begin using the Multi-Model Machine-Learning Metasystem, otherwise known as M4, as the engine to power the agency's streamflow forecasting models. M4 makes forecasters more efficient by automating the selection of stations that are most skillful for model input. This will allow for more frequent model recalibration and more time for model interpretation and value-added analysis. The system combines results from six different models to produce an ensemble mean. Testing shows that the skill of the ensemble mean generally equals or exceeds the skill of individual model members. The multi-model approach also insulates against individual model vulnerabilities on a particular year. While the change in systems will be significant for forecasters, the nuts and bolts of how the NRCS shares and publishes forecasts with the public will largely remain unchanged. Additionally, how forecast distributions are interpreted also remains unchanged. For those that want to understand the inner workings of the new system please refer to these peer reviewed journal articles:

- [Assessing the new NRCS Water Supply Forecast Model for the American West](#)
- [A Machine Learning Metasystem for Robust Probabilistic Nonlinear Regression-Based Forecasting](#)

Gus Goodbody will continue for a second year as the NRCS forecaster for Nevada and the Eastern Sierra. Gus is happy to field questions about M⁴. Reach out via angus.goodbody@usda.gov.

New Interactive Chart Controls

All [interactive charts](#) have new controls located above the chart. These allow users to control what is displayed. You can **add a title**, and **clear extra information** to make the charts more presentation friendly. As in the past you can click the years in the legend to turn years on or off. Once you select the years of interest the new **Active Only** option allows you to display only the selected years.

New Interactive Snow Depth Chart

The NRCS added snow depth to the list of [interactive charts](#). The new chart allows you to see how deep the snow in 2023 got compared to other years. While snow depth and changes in snow depth are of particular interest for winter recreation, keep in mind snow water content is a better metric for quantifying the snowpack for water supply purposes.

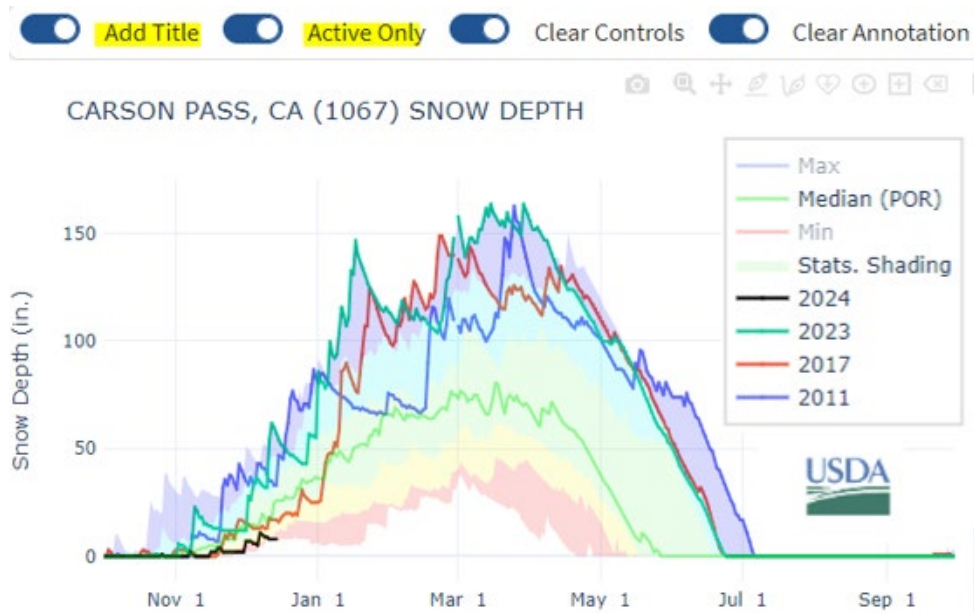


Figure 1: An example of the new snow depth interactive charts. Controls above all interactive charts give increased functionality. Use the Active Only option to display only the selected years.

Summer 2023 Field Accomplishments

After such massive snow totals last winter, this summer we were pleased to find the SNOTEL network across the region had survived mostly intact. There are still a few noteworthy changes made to the network over the summer.

Taller Precipitation Gages to Adapt to Bigger Winters

The record-breaking snow depths last winter resulted in a few SNOTEL precipitation gages getting buried and damaged by snow in the eastern Sierra. This summer we replaced existing gages with taller ones at Ebbetts Pass and Poison Flat SNOTELs in the Carson Basin and Virginia Lakes SNOTEL in the Walker Basin. These sites are now better prepared for the next big winter.

New Snow Depth Sensors

This summer the NRCS began a multi-year effort to swap snow depth sensor models. The snow program has been using Judd Ultrasonic sensors since snow depth measurements were added at SNOTELs starting ~20-25 years ago. These sensors have provided valuable data, but they sometimes fail to make measurements especially during storm events. This results in missed data that must be estimated during data quality checks. Testing has demonstrated that sensors from Sommer Messtechnik ([USH-9](#)) and Campbell Scientific ([SnowVue10](#)) are more reliable. To date twenty-four SNOTELs across Nevada and the Eastern Sierra have had their Judd sensor replaced. Next summer much more progress on this project is expected.

New Willow Flat SNOTEL

The NRCS added a brand-new monitoring site in eastern Sierra. [Willow Flat SNOTEL](#) is in the Little Walker Basin at 8,215 feet elevation. Construction occurred September 12-13, 2023. The new SNOTEL is one mile from an existing snow course where measurements began in 1925. Like most other stations in the Sierra, last winter [Willow Flat snow course](#) saw a record amount of snow. The April 1 snow course measurement recorded 91 inches of snow depth with 37.4 inches of water content. The new SNOTEL's location is as close to the snow course as possible while still allowing summer vehicle access.



Figure 2: Flying a taller precipitation gage into Poison Flat SNOTEL.



Figure 3: New snow depth sensors USH-9 (left) and SnowVue10 (right).



Figure 4: The new Willow Flat SNOTEL