

# WaterSMART

Internal Applied Science Project



— BUREAU OF —  
RECLAMATION

## Snow-Dust-Runoff Decision Support Tool

### Improving Predictions of Peak Runoff

Reclamation's Western Colorado Area Office (WCAO) is developing a tool to improve forecasting and prediction of peak snow melt runoff. The importance of predicting the timing and volume of the snowpack runoff is crucial to water managers. Careful operations are needed to coordinate the natural spring runoff with planned releases to meet the competing water demands.

In recent years, dust has been identified as a component of predicting the mountain snowpack's peak runoff. As the snowpack begins to melt in the spring, dust layers deposited on the snowpack throughout the winter months begin to emerge (Figure 1). As the dust emerges, the snowpack's surface becomes dark and absorbs more solar energy, resulting in a quicker snow melt. Understanding when dust layers will become exposed can aid in predicting this peak runoff and therefore improve operational decisions.

### Snow-Dust-Runoff Monitoring Tool

WCAO water managers have historically used multiple types of information hosted on multiple websites to help make operational decisions. In 2019, WCAO developed and tested a tool

enabling them to monitor high elevation snow and dust layers and use that information to predict peak runoff. The tool successfully matched the Animas River's peak timing with releases from Navajo Dam, resulting in the second-highest runoff peak in ten years. Building off this success, this project developed improvements to the tool and performed a retrospective analysis to better explore the connection between dust and runoff.



Figure 1. Photo depicting dust layer on snow at the Upper San Juan SNOTEL (April 27, 2022). Photo taken by Valerie Lovett, courtesy of Center for Snow and Avalanche Studies (CSAS) Colorado Dust-On-Snow Program.

## Dashboard Development

This project developed the Snow-Hydrology Repo for Evaluation, Analysis, and Decision-making (SHREAD) Dashboard, or SHREAD Dash, as a single framework for accessing and displaying relevant datasets (Figure 2). SHREAD Dash retrieves and displays data from multiple sources, including the United States Geological Survey,

National Resources Conservation Service, Colorado Basin River Forecast Center, National Weather Service, and the Center for Snow and Avalanche Studies. Datasets included snow depth, snow water equivalent, temperature, precipitation, albedo, dust, streamflow, and forecasted streamflow, sky coverage, temperature, and precipitation.

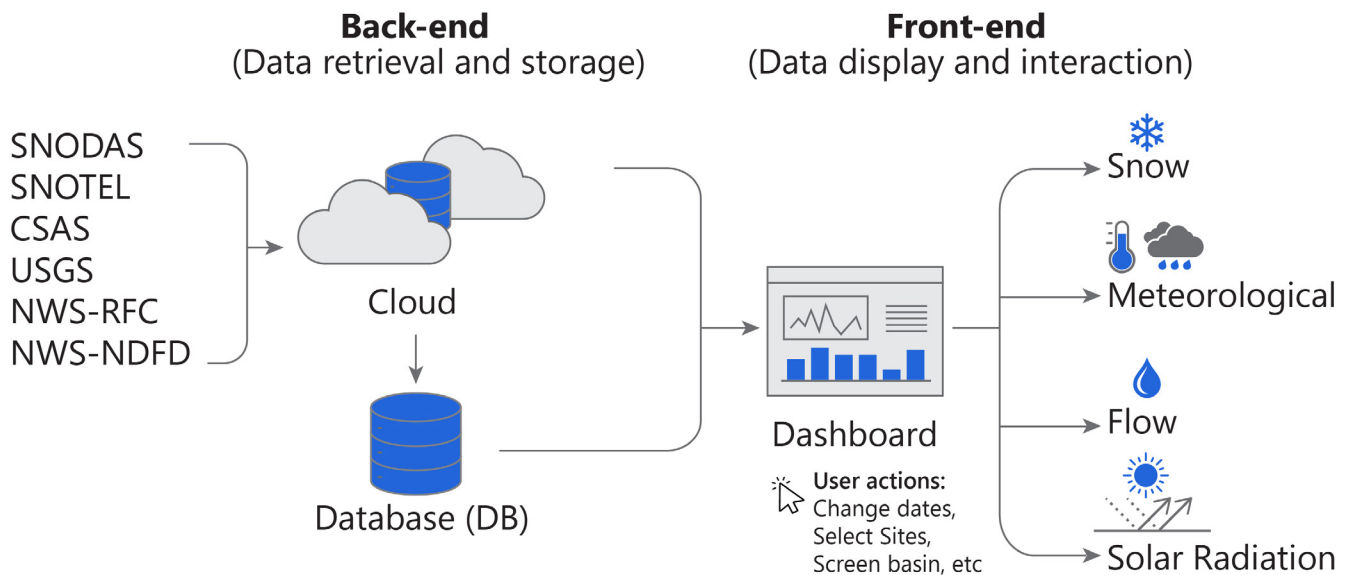


Figure 2. Schematic of the Snow-Hydrology Repo for Evaluation, Analysis, and Decision-making (SHREAD) Dashboard back-end and front-end interactions.

## Retrospective Analysis

Following the dashboard development, a retrospective analysis was conducted to test the improved tool. The analysis focused on water years 2012, 2017, and 2019. Water managers used SHREAD Dash to simulate the spring snowmelt season each year, analyzed the data, and made operational decisions. In each case, various combinations of datasets and display options were tested.

## Key Takeaways

The analysis concluded that SHREAD Dash was an improvement over the original tool. Key areas of benefit included flexibility, a user-friendly interface, inclusion of geospatial datasets, and confirmed the connection between dust and runoff peaks. The improved tool is currently being used for operational decision-making at WCAO.

## Future Uses

With successful testing and implementation, SHREAD Dash, or a similar tool, could be very useful to other Reclamation offices, particularly those with runoff dominated by snowmelt. The team will continue to support and improve SHREAD

Dash for WCAO, while actively pursuing future opportunities for funding and collaboration with other Reclamation area offices. SHREAD is available at: [https://github.com/usbr/shread\\_dash](https://github.com/usbr/shread_dash)

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## Additional Information



Useful Links for Applied Science:  
<https://www.usbr.gov/watersmart/appliedscience/index.html>



WaterSMART Website:  
<https://www.usbr.gov/watersmart>

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