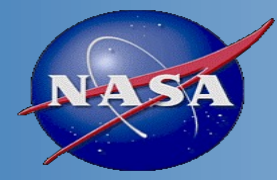# Co-production of snow cover and snow albedo at sub-pixel scale with analysis, uncertainty, and data distribution in near real-time

Karl Rittger, Mark Serreze, Mary J. Brodzik, Mark Raleigh, McKenzie Skiles, Keith Musselman, Sebastien Lenard, Thomas H. Painter, Jeff Dozier, Ned Bair, Timbo Stillinger, and the NSIDC team

Project description

- Funded through NASA Terra Aqua Suomi to provide snow surface properties for MODIS and VIIRS

- Products include snow cover fraction, snow surface albedo, and snow radiative forcing

- Analyze, distribute, and share with researchers, applications groups, and the public

- Balance scalability with accuracy for potential global production

- Estimate daily uncertainty using higher resolution HLS

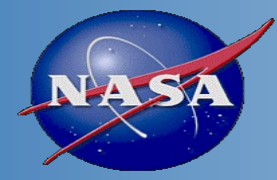- Analyze long term MODIS – VIIRS continuity

July 2022 – July 2023

- Updated baseline data based on SCAG and DRFS models to address known issues

- Redesigned Snow Today website to improve usability, access, and visibility to general public/media

- Developed a new interactive web application with many features

- Introduced flexibility to expand coverage globally

- Published first three Snow Today Articles

- Published 4 peer reviewed studies of validation, use in regional snow simulation, snow darkening, and application to wildfire impact on snow melt

July 2023 – July 2024

- Transition to SPIReS data processing and analysis

- Transition from MODIS Terra only to MODIS Terra (2001-) & VIIRS NPP (2012-)

- Process North America and Greenland addressing scalability

- Use HLS to estimate uncertainty regularly for representative areas

- Assess range of differences for snow surface properties across MODIS Terra and VIIRS NPP

- Continue baseline SCAG/DRFS production for continuity during transition (separately funded)
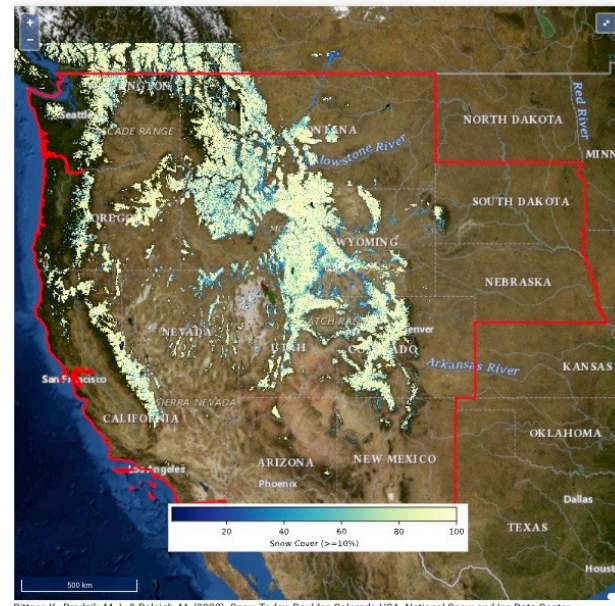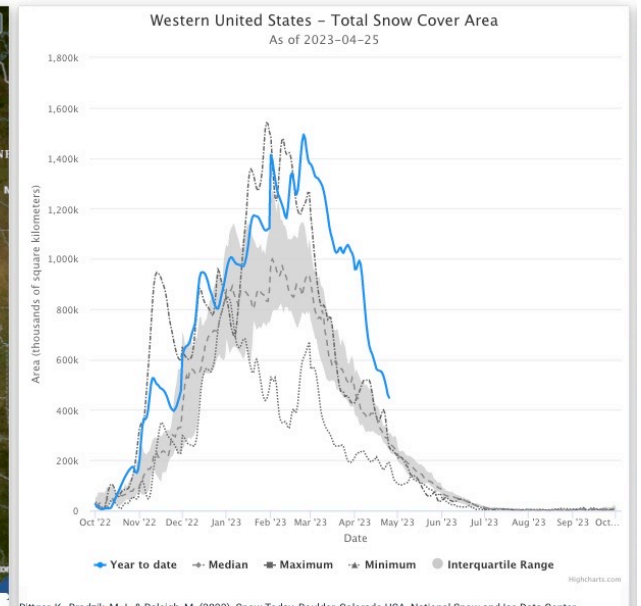
- **Configure variables:**
  - maps and summary plots of snow cover, snow duration, snow albedo and snow radiative forcing

- **Select a Basemap:**
  - 8 options

- **Select a Region:**
  - State, HUC2, and HUC4

- **SWE overlay:**
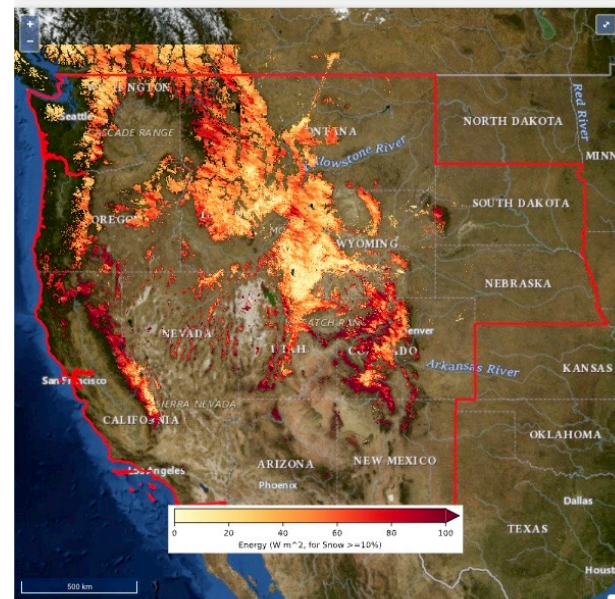 - amount, change, and percent of normal
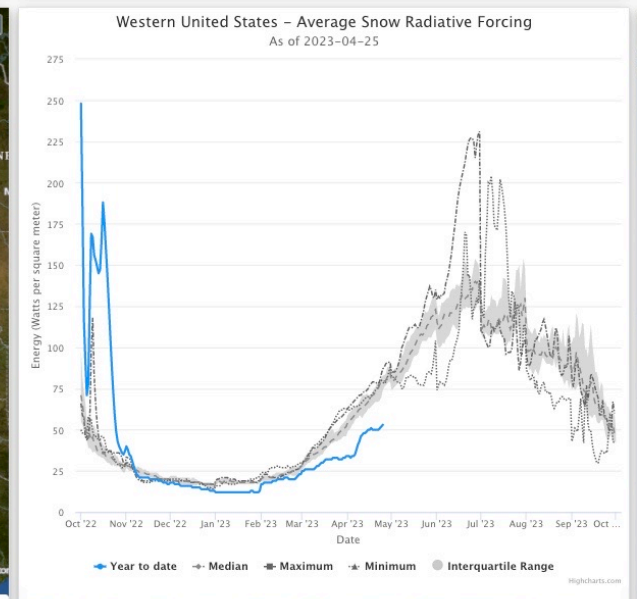
Monthly Insights

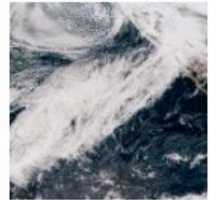Our scientific data analysis articles are published during the winter and spring months of the snow season. Select an article below to learn more about how snow conditions changed across time.

Filter by: YEAR ▾   **Apply**

February 08, 2023

Atmospheric rivers strike again and again

A series of atmospheric rivers significantly increased snow-covered area and snow water equivalent in the California Sierra Nevada, and to a lesser extent the delivery of snow inland to Nevada, Utah, and Colorado. Snow-covered area for the western United States was 125 percent of average for January with above average snow cover in most regions.
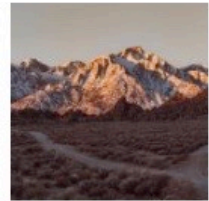
March 08, 2023

Snow falls high in the West

Continuing the trend of recent months, the western United States received significant snowfall in February 2023, helping to improve drought conditions in the West. Despite dominance of a La Niña conditions, current snowpack patterns resemble those characteristic of El Niño years.
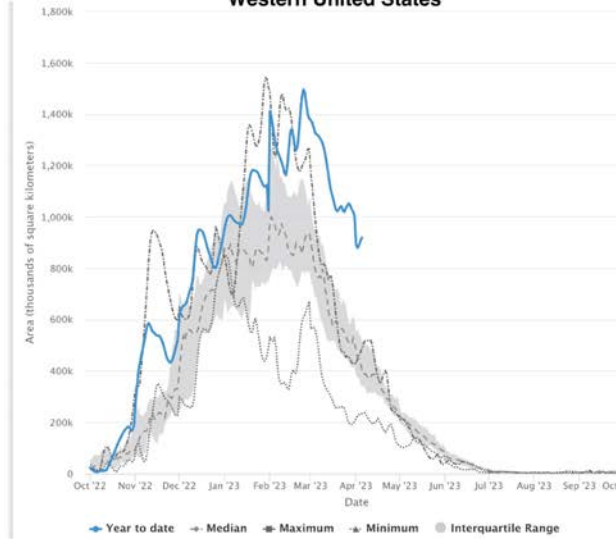
April 12, 2023

Breaking snow records

Extensive snow cover in the western United States continued in March 2023, surpassing the 2019 record high by 11 percent and doubling last year's average and the 23-year-satellite record average for snow-covered area for March.
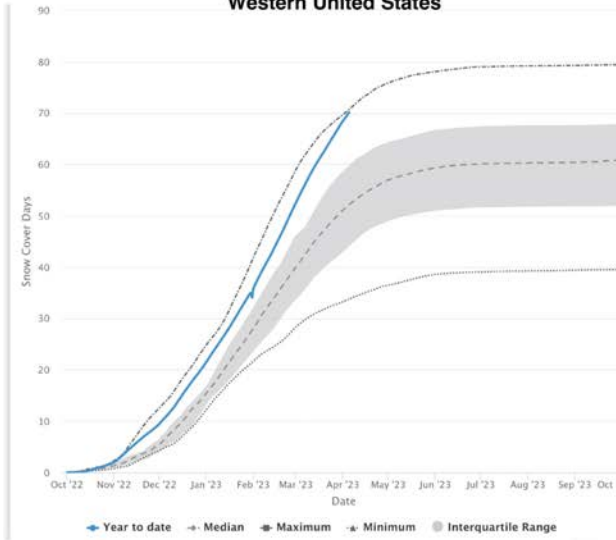
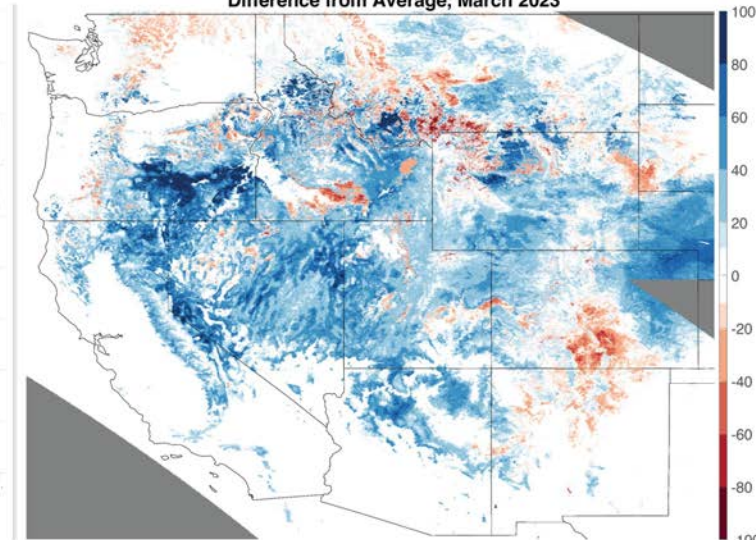

Total Snow-Covered Area — Western United States

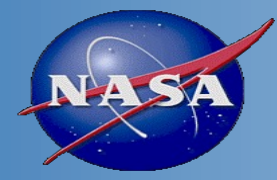Snow Cover Percent — Difference from Average, March 2023
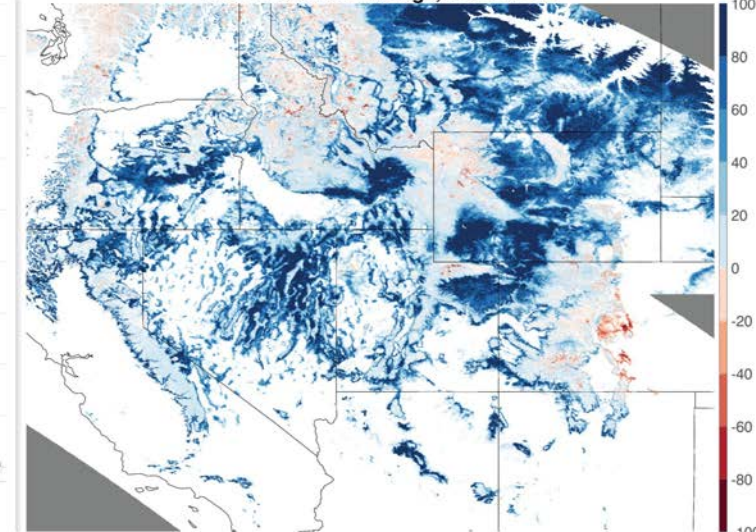
Average Snow Cover Days — Western United States

Snow Cover Days — Difference from Average, March 2023

Karl Wetlaufer, **West of Rifle**

Jeff Derry, **Red Mt Pass.**

Steve Hunter, **City of Aspen**
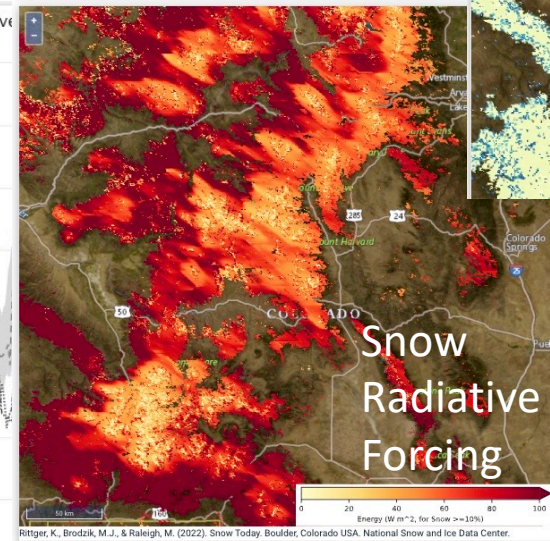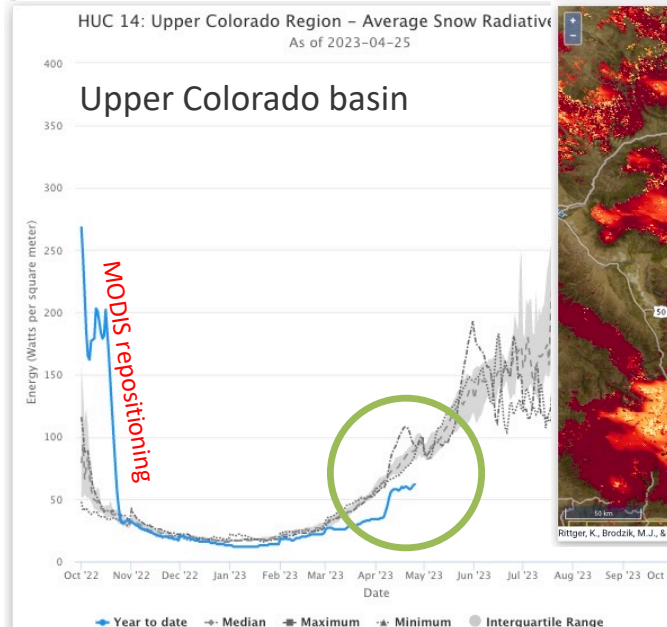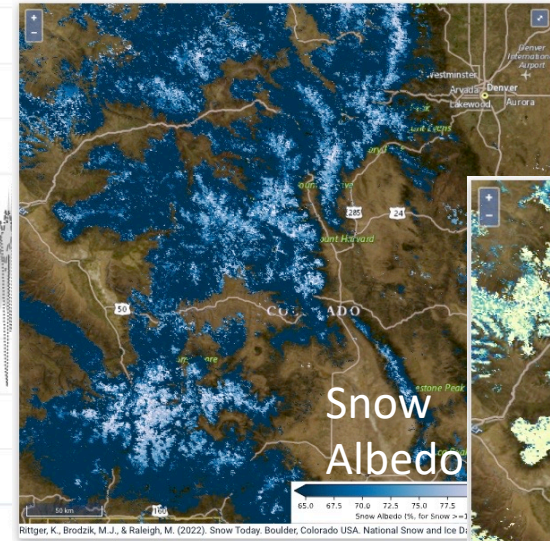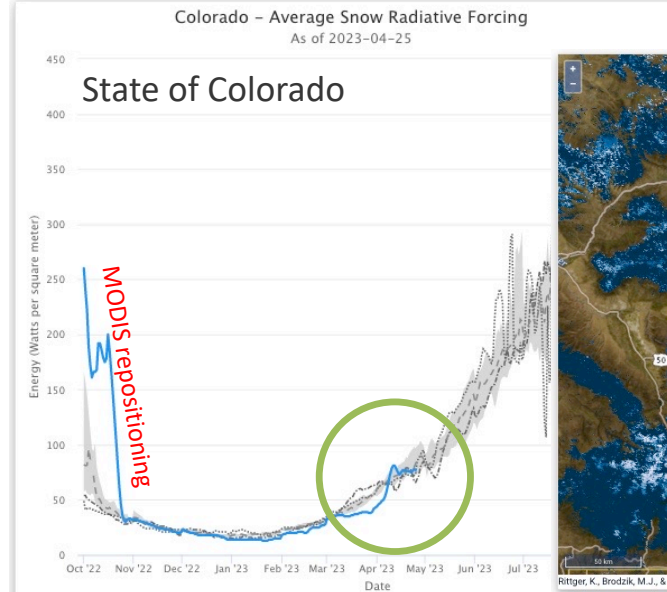
This event turned out to be widespread and a nasty event in terms of the amount of dust deposited on a relatively pristine snowpack that has essentially reached maximum accumulation. It just takes one bad dust event to change things – this one dust event is going to change the characteristics of snow melt and runoff for the duration of spring dramatically. – Jeff Derry

http://www.codos.org/codosupdates/april062023

Colorado – Average Snow Radiative Forcing
As of 2023-04-25

State of Colorado

MODIS repositioning

HUC 14: Upper Colorado Region – Average Snow Radiative
As of 2023-04-25

Upper Colorado basin

MODIS repositioning

Snow Albedo

Snow Radiative Forcing

Snow cover fraction

Rifle

Aspen

Red Mt Pass

Snow cover — fsca 15-Jun-2019

Dust conc. — dust conc, ppmw

Grain radius — grain radius, μm

Albedo — albedo

SPIReS: subpixel measurement of snow properties for multi or hyperspectral sensors.

- Snow Covered Area
- Physical properties of the snowpack
  - Contaminant Concentration
  - Snow grain size
  - Snow albedo

Planned tiles this project
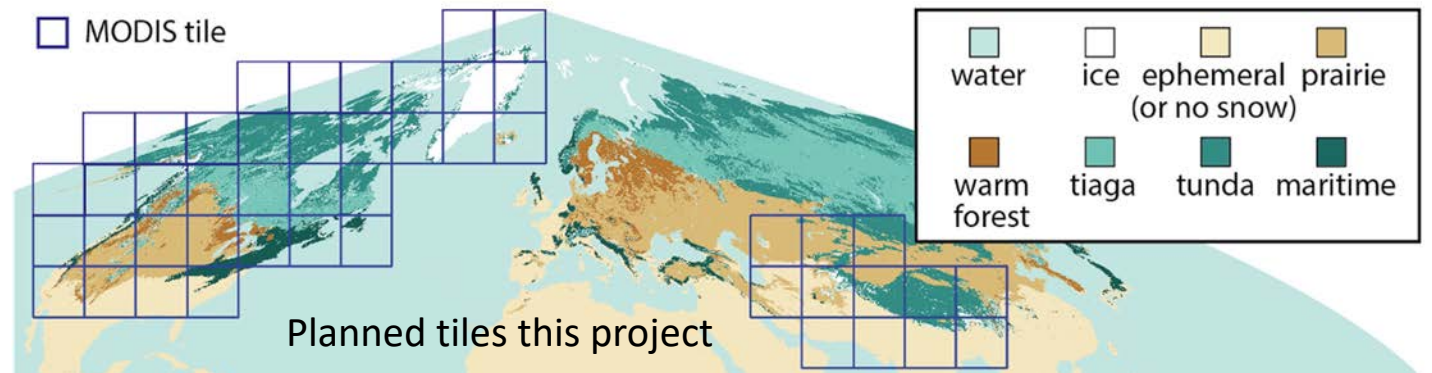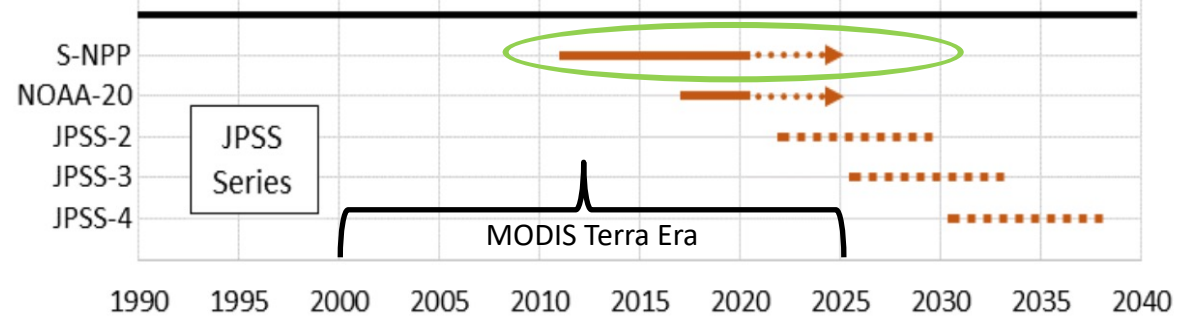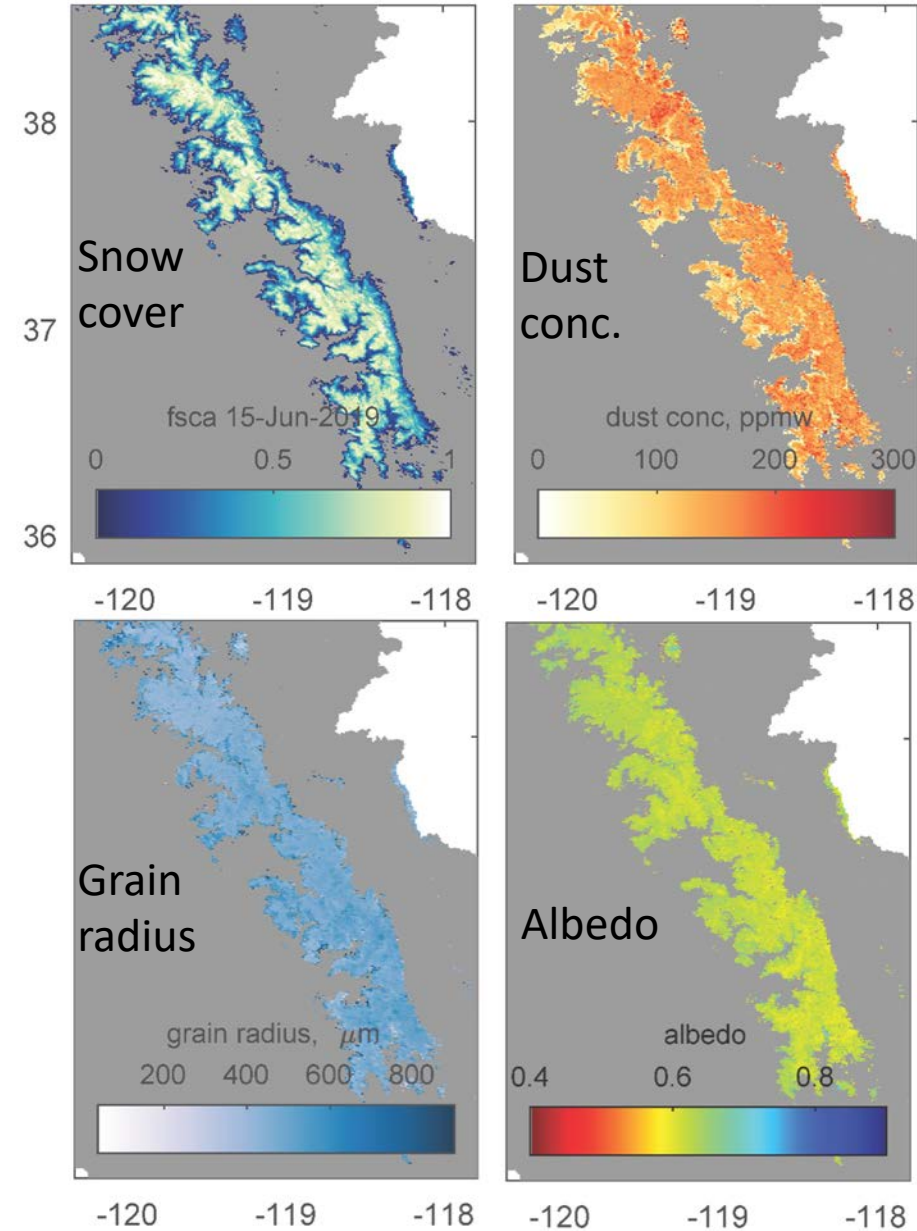
Recent publications

- Comparing snow mapping methods to airborne lidar 3m snow maps

  Stillinger, T., **Rittger, K.,** Raleigh, M.S., Michell, A., Davis, R.E., & Bair, E.H. (2023). Landsat, MODIS, and VIIRS snow cover mapping algorithm performance as validated by airborne lidar datasets. *The Cryosphere, 17,* 567-590, https://doi.org/10.5194/tc-17-567-2023

- Evaluating modeled snow simulations

  Hao, D., Bisht, G., **Rittger, K.,** Stillinger, T., Bair, E., Gu, Y., & Leung, L.R. (2023). Evaluation of E3SM land model snow simulations over the western United States. *The Cryosphere, 17,* 673-697, https://doi.org/10.5194/tc-17-673-2023

- Assessing the impacts of wildfire on snow duration and snow albedo

  Hatchett, B.J., Koshkin, A.L., Guirguis, K., **Rittger, K.,** Nolin, A.W., Heggli, A., Rhoades, A.M., East, A.E., Siirila-Woodburn, E.R., Brandt, W.T., Gershunov, A., & Haleakala, K. (2023). Midwinter dry spells amplify post-fire snowpack decline. *Geophysical Research Letters, 50,* e2022GL101235. https://doi.org/10.1029/2022GL101235

- Investigating snow darkening

  Huang, H., Qian, Y., He, C., Bair, E.H., & **Rittger, K.** (2022), Snow albedo feedbacks enhance snow impurity-induced radiative forcing in the Sierra Nevada. *Geophysical Research Letters, 49,* e2022GL098102, https://doi.org/10.1029/2022GL098102