Near Real-Time MODIS/Terra L3 Global Daily 500m SIN Grid Snow Cover, Grain Size, and Dust Radiative Forcing, Version 1
Technical Reference

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Overview

The NSIDC NASA DAAC has been in development of the MODIS Snow Covered Area and Grain-size (MODSCAG) and MODIS Dust Radiative Forcing in Snow (MODDRFS) products previously produced at the NASA Jet Propulsion Laboratory (JPL). The MODSCAG (Painter et al, 2009) and MODDRFS (Painter et al, 2012) algorithms are being operationalized and will produce a single data product called the Near Real-Time MODIS/Terra L3 Global Daily 500m SIN Grid Snow Cover, Grain Size, and Dust Radiative Forcing (MODSCGDRF_NRT).

These data are provided in GeoTiff format, and the data are released by region.

File Information

File Format

Previous data from JPL included both binary and GeoTIFF files. Binary files contained information from the algorithm for nearly all pixels, while the GeoTIFF format was masked to exclude water and data gaps. The NSIDC MODSCGDRF_NRT product only includes the masked data in GeoTIFF format.

File Naming Convention

MODSCGDRF_NRT_parameter_tileID_MOD09GANRT061_YYYYMMDD_V01.0.tif

With the following parameter names:

- SNOW (for snow fraction)
- GS (for optical snow grain size from SCAG)
- VEG (for vegetation fraction)
- ROCK (for rock fraction)
- ICE (for ice fraction)
- SHADE (for shade fraction)
- DELTAVIS (for snow darkening in visible wavelengths)
- RF (for radiative forcing in visible wavelength)
- drfsGS (for optical snow grain size from the DRFS algorithm)

Temporal Coverage

Data processing began on 19 October 2023 and continues through the present.

Data are not available for the following periods:

- 10/21/23 - 10/31/23

- 12/18/23 - 12/25/23

Key Changes and Expected differences between JPL and NSIDC DAAC output

Processing

The NSIDC DAAC uses the original MODSCAG code developed at the University of California Santa Barbara and the University of Utah which differs from the MODSCAG code used by JPL. The NSIDC DAAC uses the MODDRFS code from JPL.

JPL previously created a canopy adjusted snow cover layer that converted viewable snow cover from the satellite to on the ground snow cover. The new MODSCGDRF data produces observed snow cover, not adjusted snow cover. Users can derive this using the vegetation fraction and viewable snow cover using the following equation (Rittger et al, 2013 equation 6).

snow on the ground= SNOW / (1 - VEG) Equation 1

While this equation is published, JPL previously used an unpublished method. To the best of our knowledge, their conversion set snow on the ground equal to 1 if vegetation fraction was greater than 0.1 and SNOW observed is greater than 0.2. However, this approach was never publicly validated. Rittger (et al 2020) show that Equation 1 works well except for the densest forests.

Absence of RMSE and quality bits

The MODSCGDRF_NRT product does not include these variables in the GeoTIFF format.

MODSCAG

Data from MODSCAG include snow fraction, snow grain size, vegetation fraction, rock fraction, and ice fraction (previously named “other fraction” at JPL). Analysis of tile h08v05, covering California's Sierra Nevada and the Basin and Range area in Nevada, was performed to understand the differences in output for snow surface properties including snow fraction and snow grain size. We analyzed 15 clear sky near-nadir images between January 1 and August 30, 2023. There are considerable differences across the variables. They are initially thought to be caused by the need to further minimize the RMSE resulting in a more accurate selection of model output (see Painter et al 2009). Table 1 shows mean differences for the 15 image dates we analyzed.

MODDRFS

Data from MODDRFS include snow darkening known as delta vis (change in visible snow albedo or snow darkening), radiative forcing, and a NDGSI based grain size. Analysis of tile h08v05, which covers California's Sierra Nevada and the basin and range in Nevada, was performed to understand the differences in output for snow surface properties including snow darkening and radiative forcing. Our analysis shows this data is consistent. The known difference is that NSIDC DAAC does not spatially interpolate data to fill small clusters of no data. Table 1 shows mean differences for the 15 image dates we analyzed.

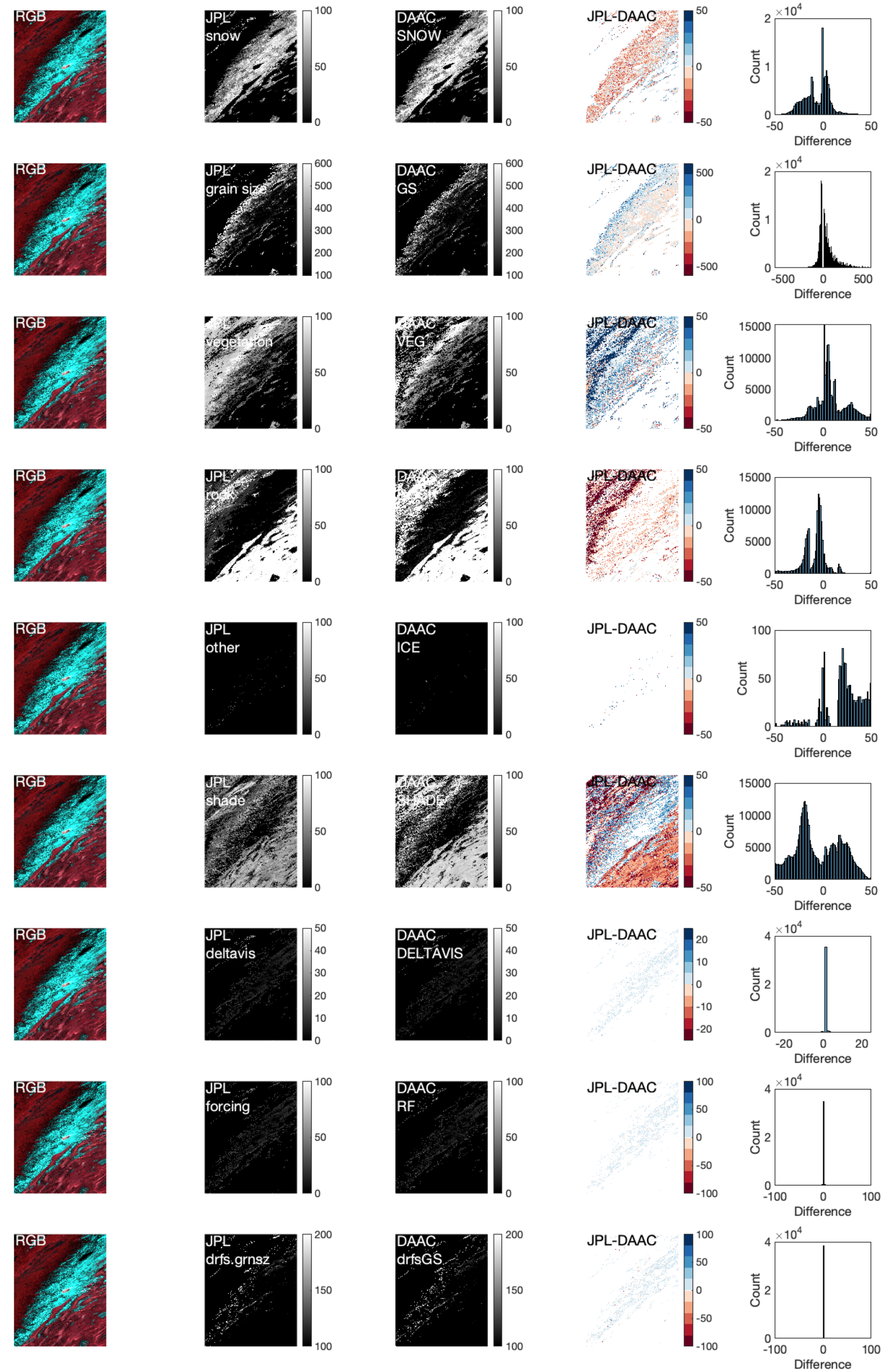

Figure 1: Differences in JPL MODSCAG and MODDRFS and NSIDC DAAC MODSCGDRF layers in mid-winter, January 25, 2023. Images show data from tile h08v05, a close-up of central Sierra Nevada in California.

The first column shows the same false color RGB image. Snow appears as the cyan color. Each row represents a parameter as described under the File Naming Convention section: SNOW, GS, VEG, ROCK, ICE, SHADE, DELTAVIS, and RF.

The second and third columns show the JPL images and NSIDC DAAC images. The fourth column shows differences in JPL data and NSIDC DAAC data.

The fifth column shows histograms of the differences. Zero differences are not displayed in histograms.

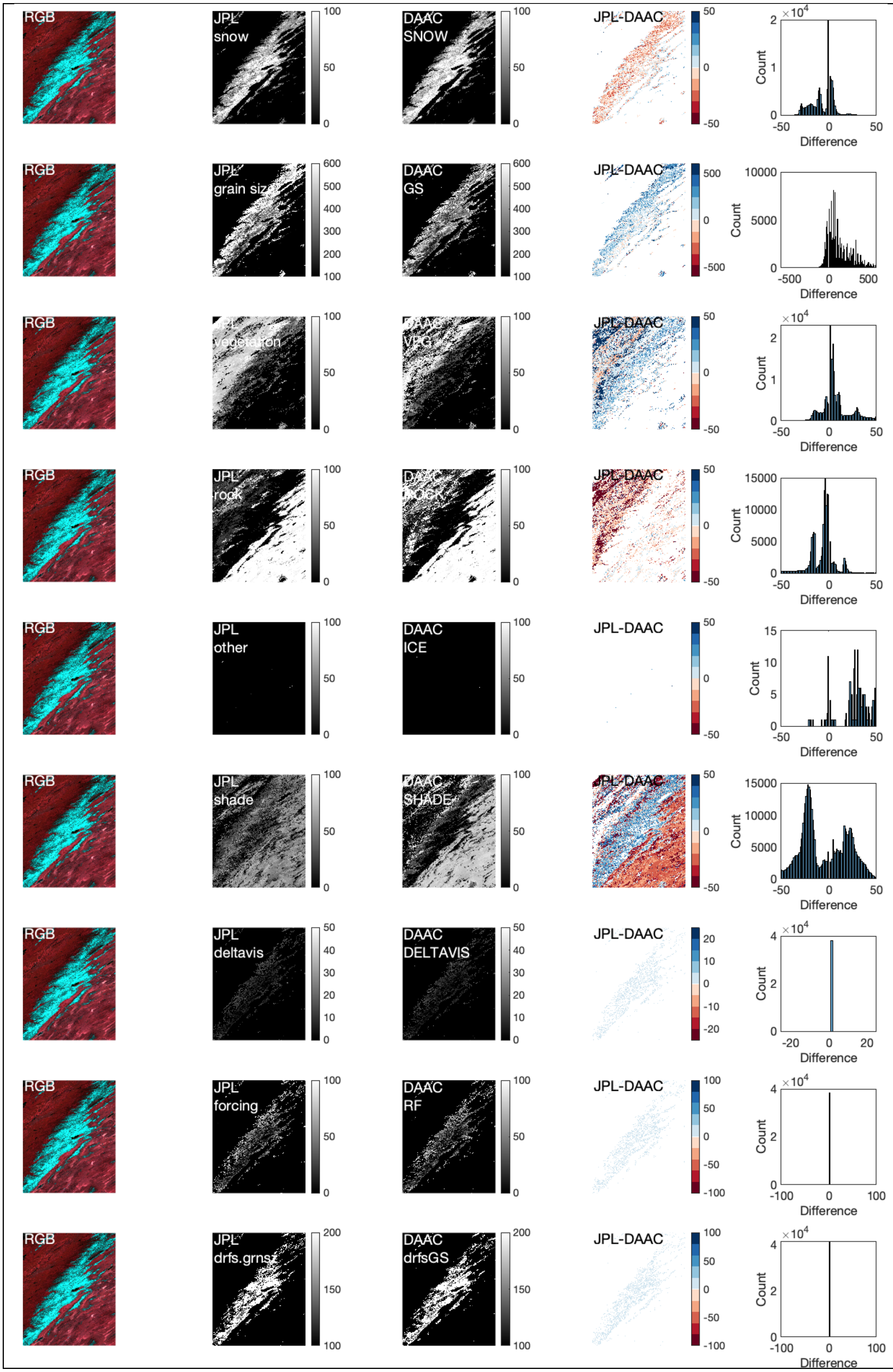

Figure 2: Differences in JPL MODSCAG and MODDRFS and NSIDC DAAC MODSCGDRF layers in early spring April 9, 2023. See Figure 1 for complete description.

Table 1: Statistical differences in all layers for 15 clear sky, near-nadir dates. Difference shown as JPL minus NSIDC DAAC.										
Image #	**Date**	**Mean difference**								
		SNOW	GS	VEG	ROCK	ICE	SHADE	DELTVIS	RF	drfsGS
1	1/18/2023	-4	22	11	-16	31	-2	3	2	-7
2	1/25/2023	-7	57	22	-28	26	-10	3	2	-9
3	3/2/2023	-1	47	15	-21	19	5	2	1	-4
4	3/16/2023	-4	108	15	-20	10	-6	2	3	-14
5	4/4/2023	4	18	13	-20	17	-7	1	1	1
6	4/9/2023	-7	143	18	-23	31	-9	1	1	1
7	4/26/2023	-8	135	13	-17	44	-10	1	1	1
8	4/28/2023	-10	193	14	-17	52	-13	1	1	1
9	5/12/2023	-7	235	9	-13	67	-11	1	1	1
10	5/15/2023	-7	172	19	-21	41	-12	1	1	1
11	6/3/2023	-9	238	18	-20	57	-13	1	1	1
12	6/29/2023	-6	229	10	-16	90	-12	1	1	1
13	7/4/2023	-4	163	12	-18	74	-11	1	1	1
14	7/6/2023	-3	123	7	-14	68	-11	1	1	1
15	7/11/2023	-2	93	14	-19	10	-13	1	1	1

References

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