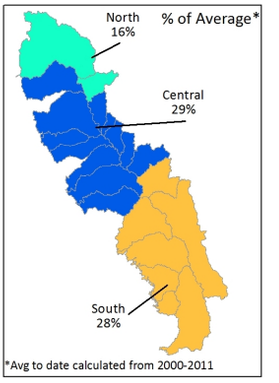
Applied Sciences Program
NASA Earth Science

Real-Time Spatial Estimates of Snow-Water Equivalent (SWE)

Sierra Nevada Mountains, California

March 13, 2020



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Summary of current conditions

The regional summary map above shows the mean SWE above 5000' elevation for three major regions of the Sierra Nevada. As of March 13, regional average SWE remained below average across the Sierra, with percent of average SWE ranging from 16% in the north, 29% in the central and 28% in the southern Sierra. Detailed SWE maps (in JPG format) and summaries of SWE (in Excel tables) by individual basin and elevation band are also provided in the report. There is unusually low or no SWE at elevations below 7000 ft. for this time of year. This may explain our lower basin average SWE estimates compared to the long-term average values being reported by snow pillow stations.

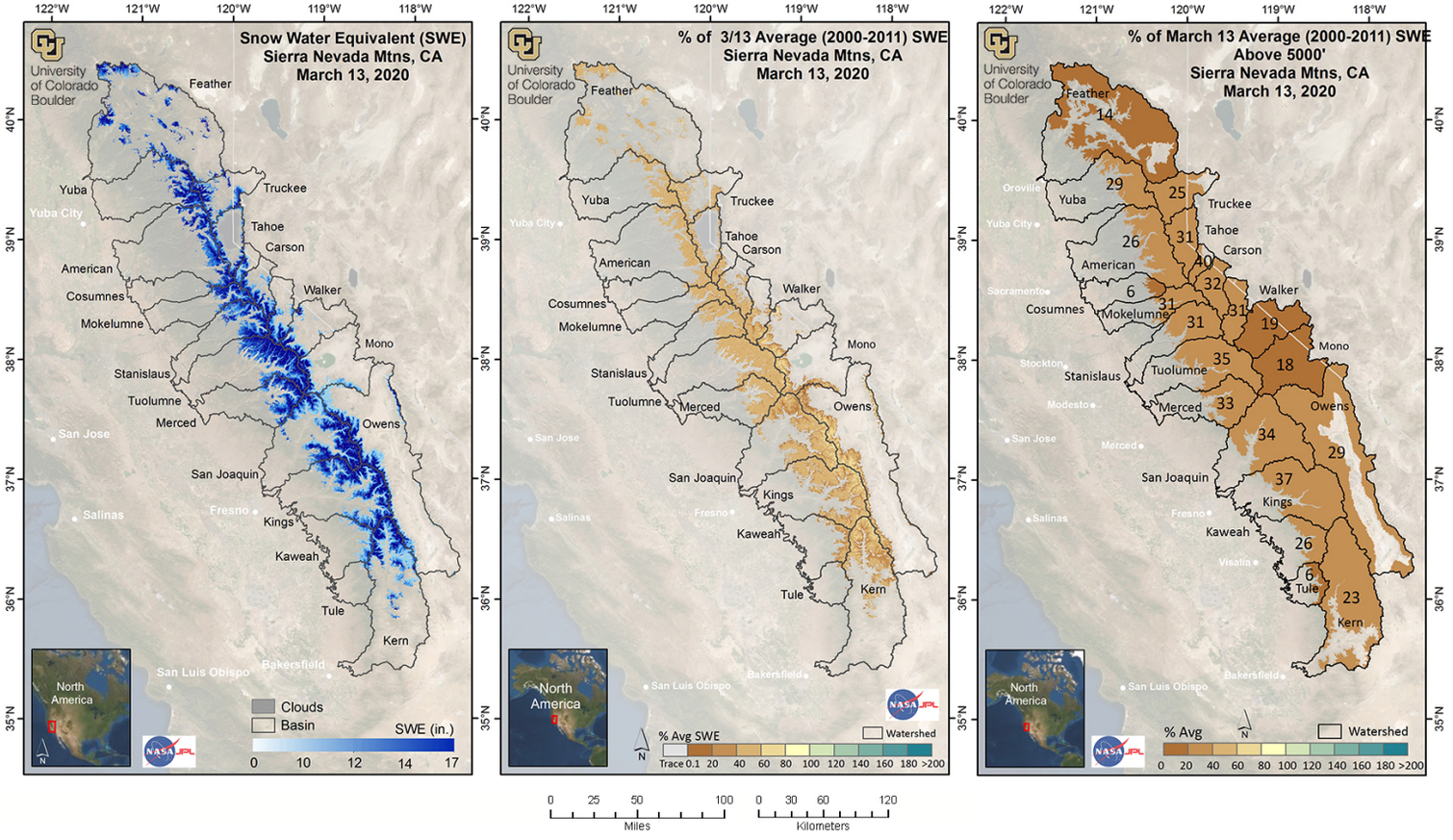

Figure 1. Estimated SWE and % of Average SWE across the Sierra Nevada. SWE amounts for March 13, 2020 (left), percent of average (2000-2011) SWE for March 13, 2020 for the Sierra Nevada, calculated for each pixel (middle) and basin-wide (right). Basin-wide percent of average is calculated across all model pixels >5000' elevation. Our snow line this year is at a higher elevation than average. Low elevation summaries of SWE, percent of average and percent of snow-covered area are much lower most likely because of the high snow line this year.

About this report

This is an experimental research product that provides near-real-time estimates of snow-water equivalent (SWE) at a spatial resolution of 500 m for the Sierra Nevada in California from mid-winter through the melt season. The report is released within a week of the date of data acquisition at the top of the report. A similar report covering the Intermountain West is available and is distributed to water managers in Colorado, Utah and Wyoming.

The spatial SWE analysis method for the Sierra Nevada uses the following data as inputs:

- In-situ SWE from all operational CA snow gage sensor sites and CoCoRaHS SWE values when available and applicable
- MODSCAG fractional snow-covered area (fSCA) data from recent cloud-free MODIS satellite images
- Physiographic information (elevation, latitude, upwind mountain barriers, slope, etc.)
- Historical daily SWE patterns (2000-2014) retrospectively generated using historical MODSCAG data and an energy-balance model that back-calculates SWE given the fSCA time-series and meltout date for each pixel

For more details on the estimation method see the *Methods* section below. Please be sure to read the *Data Issues / Caveats* section for a discussion of persistent challenges or flagged uncertainties of the SWE product.

Data availability for this report

92 snow gage sites in the Sierra Nevada network were recording SWE values out of a total of 114 sites, 22 were offline and 4 were recording zero SWE (shown in red and yellow, respectively, in Figure 6, left map).

The value of spatially explicit estimates of SWE

Snowmelt makes up the large majority (~60-85%) of the annual streamflow in the Sierra Nevada. The spatial distribution of snow-water equivalent (SWE) across the landscape is complex. While broad aspects of this spatial pattern (e.g., more SWE at higher elevations and on north-facing exposures) are fairly consistent, the details vary a lot from year to year, influencing the magnitude and timing of snowmelt-driven runoff.

SWE is operationally monitored at just over a hundred snow gage sensor sites spread across the Sierra Nevada, providing a critical first-order snapshot of conditions, and the basis for runoff forecasts from the CA DWR, NRCS, and NOAA. However, conditions at snow sensor sites (e.g., percent of normal SWE) may not be representative of conditions in the large areas between these point measurements, and at elevations above and below the range of the sensor sites. The spatial snow analysis creates a detailed picture of the spatial pattern of SWE using snow sensors, satellite, and other data, extending beyond the snow sensor sites to unmonitored areas.

Interpreting the spatial SWE estimates in the context of SNOTEL

The spatial product estimates SWE for every pixel where the MODSCAG product identifies snow-cover. Comparatively, snow sensor samples 8-20 points per basin within a narrower elevation range. Thus, the basin-wide percent of average from the spatial SWE estimates is not directly comparable with the snow sensor basin-wide percent of average. A better comparison might be made with the % of average in the elevation bands (Table 2) that contain snow sensor sites.

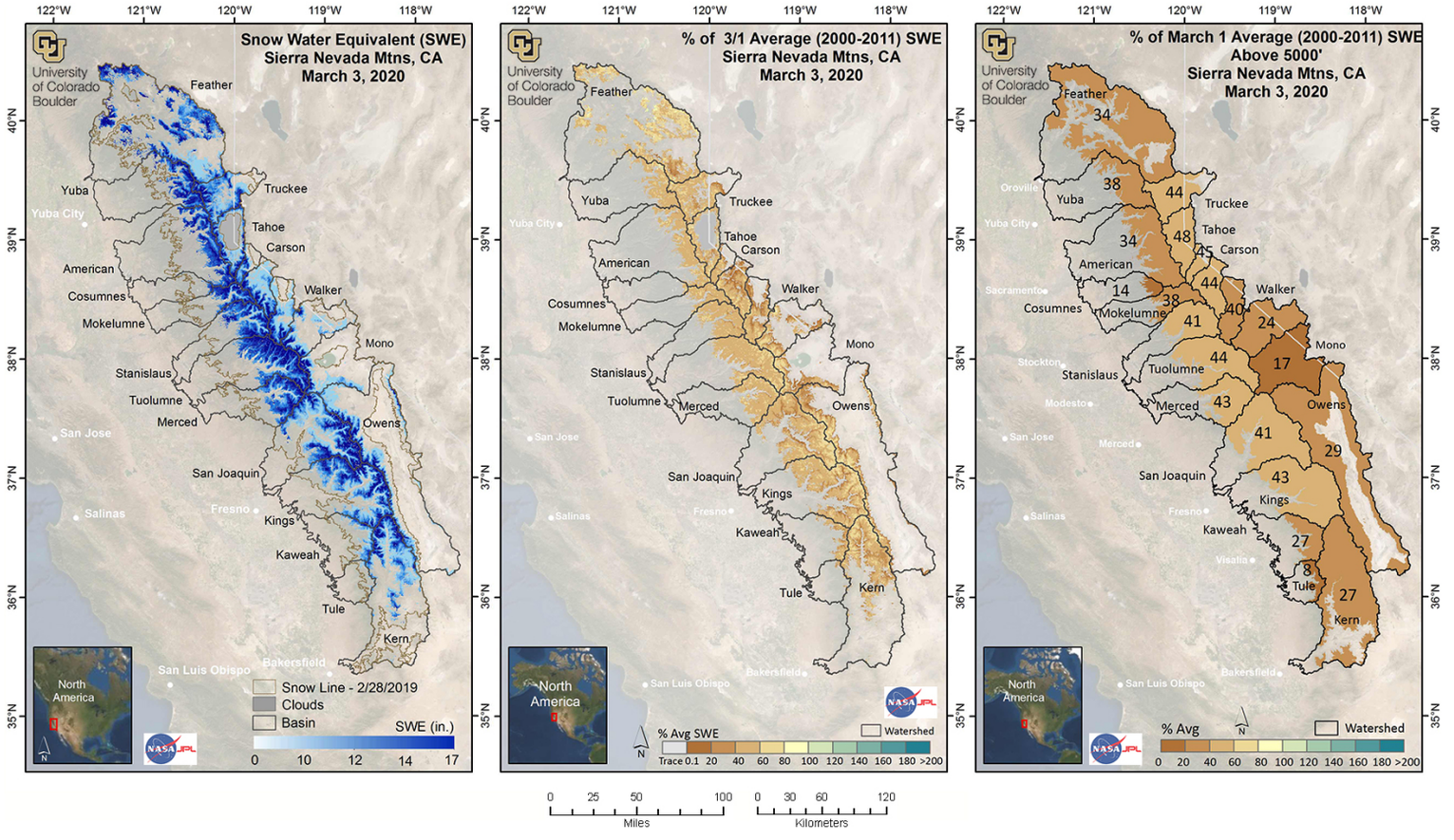

Figure 2. Estimated SWE and % of Average SWE across the Sierra Nevada. SWE amounts for March 3, 2020 (left), percent of average (2001-2011) SWE for March 3, 2020 for the Sierra Nevada, calculated for each pixel (middle) and basin-wide (right). Basin-wide percent of average is calculated across all model pixels >5000' elevation.

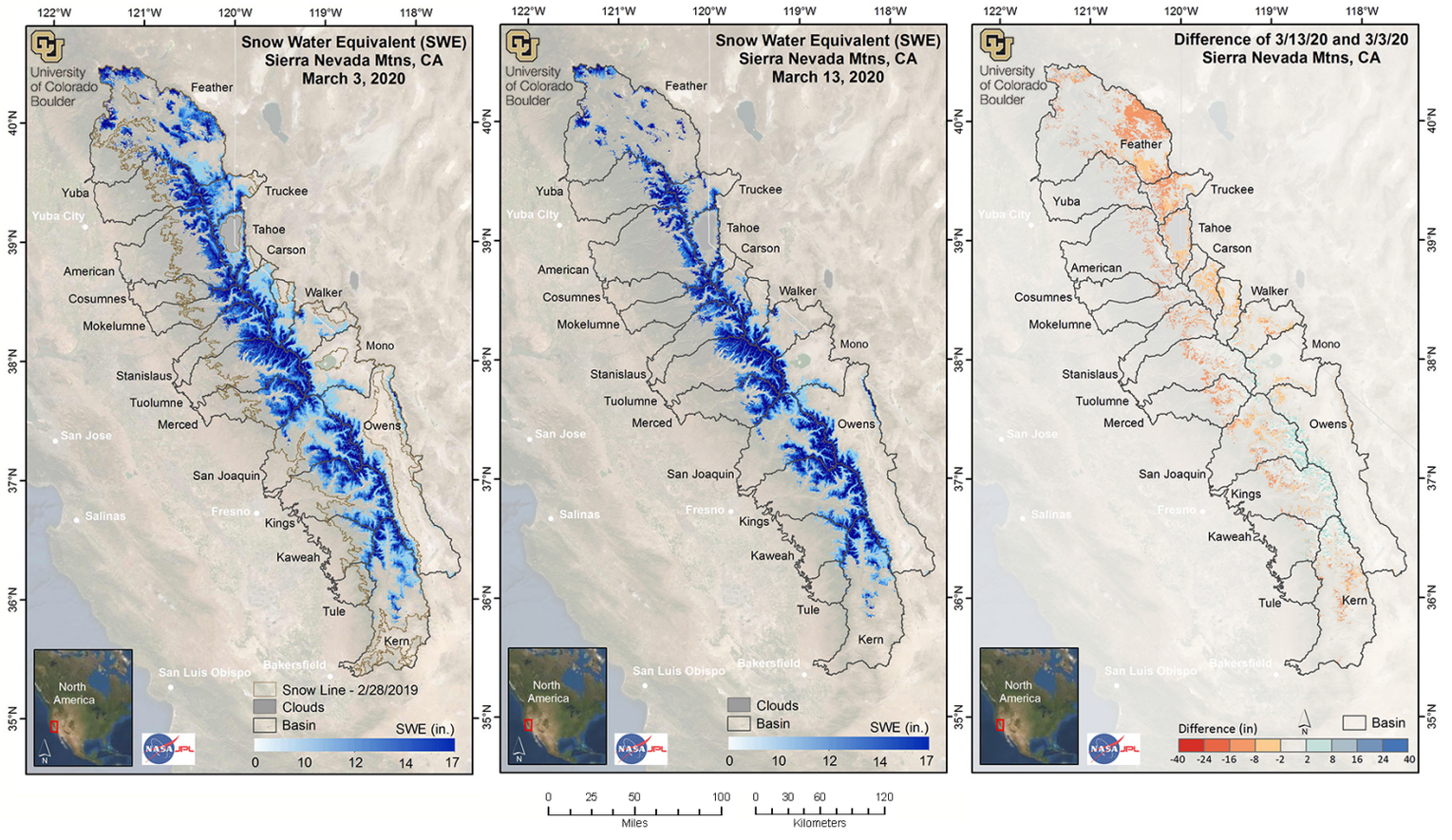

Figure 3**. **Estimated SWE across the Sierra Nevada, March 13, 2020. SWE amounts for March 3rd (left), March 13th (middle) and the difference between March 13th and March 3rd (right).

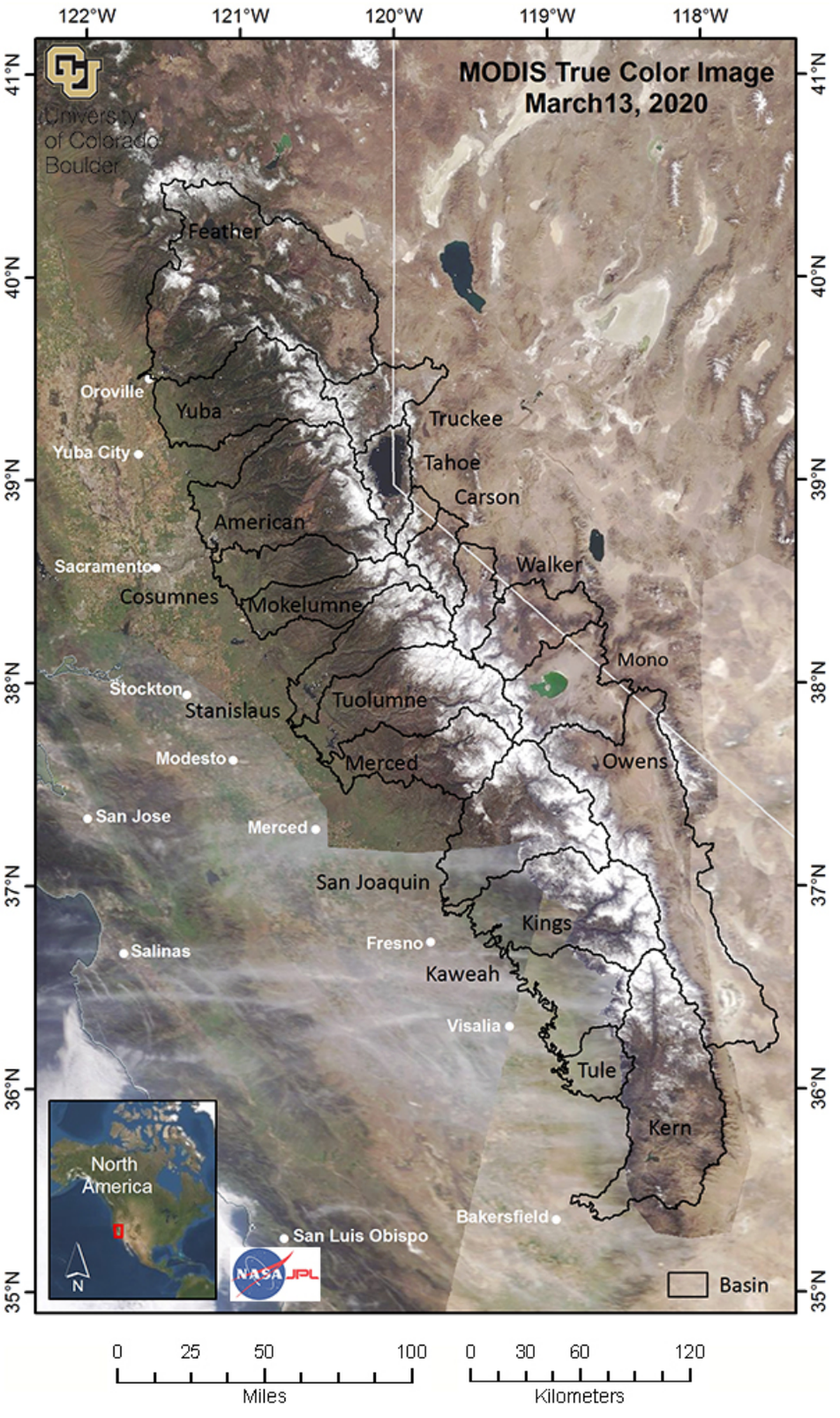

Figure 4. MODIS image, Sierra Nevada. A mostly cloud-free true color composite MODIS image, used for the March 13, 2020 regression model run.

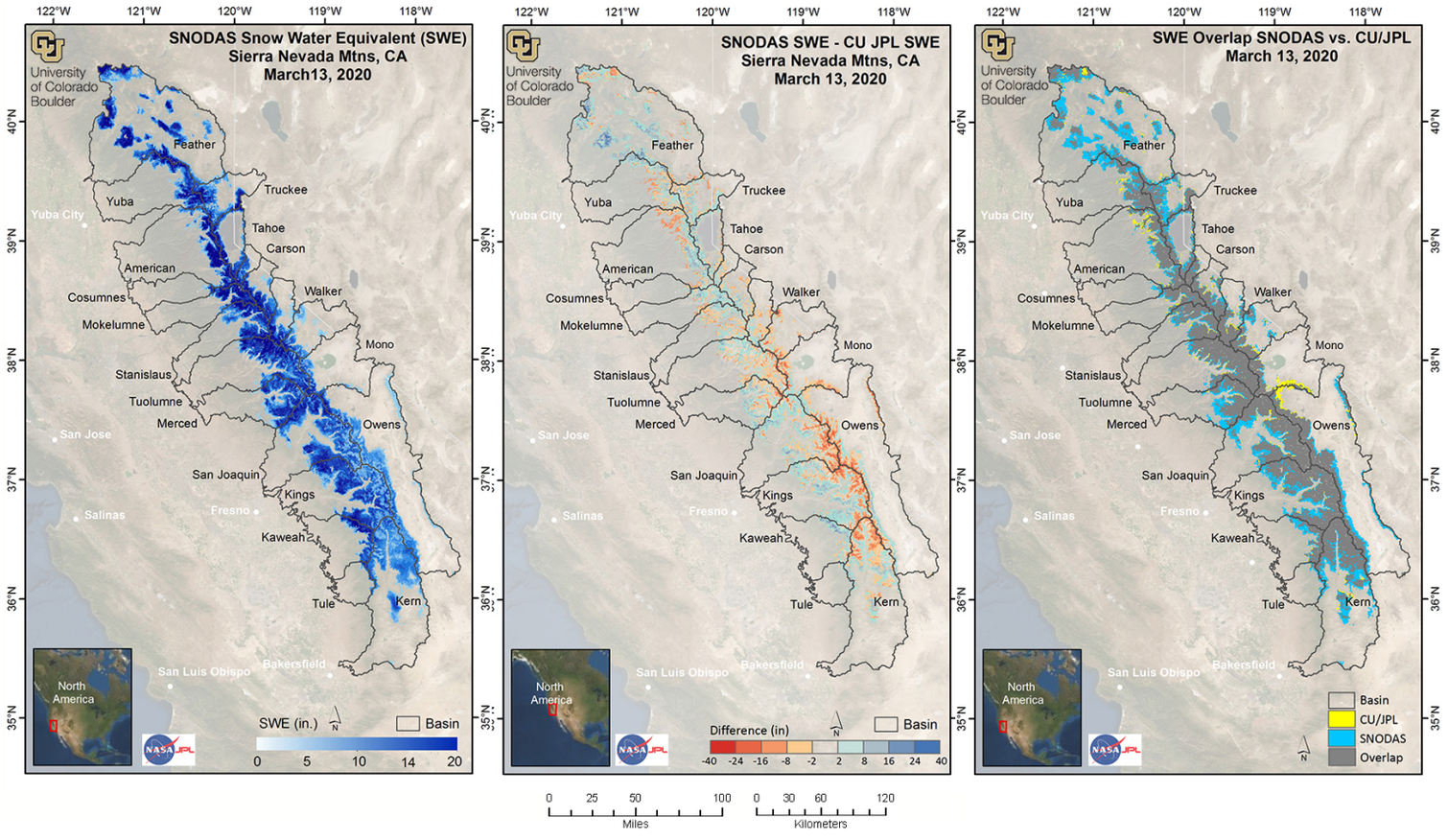

Figure 5. Comparison of CU/JPL regression SWE product and SNODAS SWE for the Sierra Nevada. The map on the left shows estimated SWE for March 13th from the NOAA National Weather Service's National Operational Hydrologic Remote Sensing Center (NOHRSC) SNOw Data Assimilation System (SNODAS). The middle map shows the difference between the March 13th SNODAS SWE estimate and CU/JPL regression SWE estimate. Red pixels denote areas where SNODAS SWE is less than CU/JPL SWE and blue pixels show areas where SNODAS SWE is higher than CU/JPL SWE. The map on the right shows the snow-cover extent of SNODAS and CU/JPL SWE estimates. Yellow pixels show where the location of CU/JPL snow extends beyond the location of the SNODAS snow extent. Blue pixels show where the SNODAS snow extends beyond the CU/JPL snow extent. Gray areas indicate regions where both products agree on the snow-cover extent.

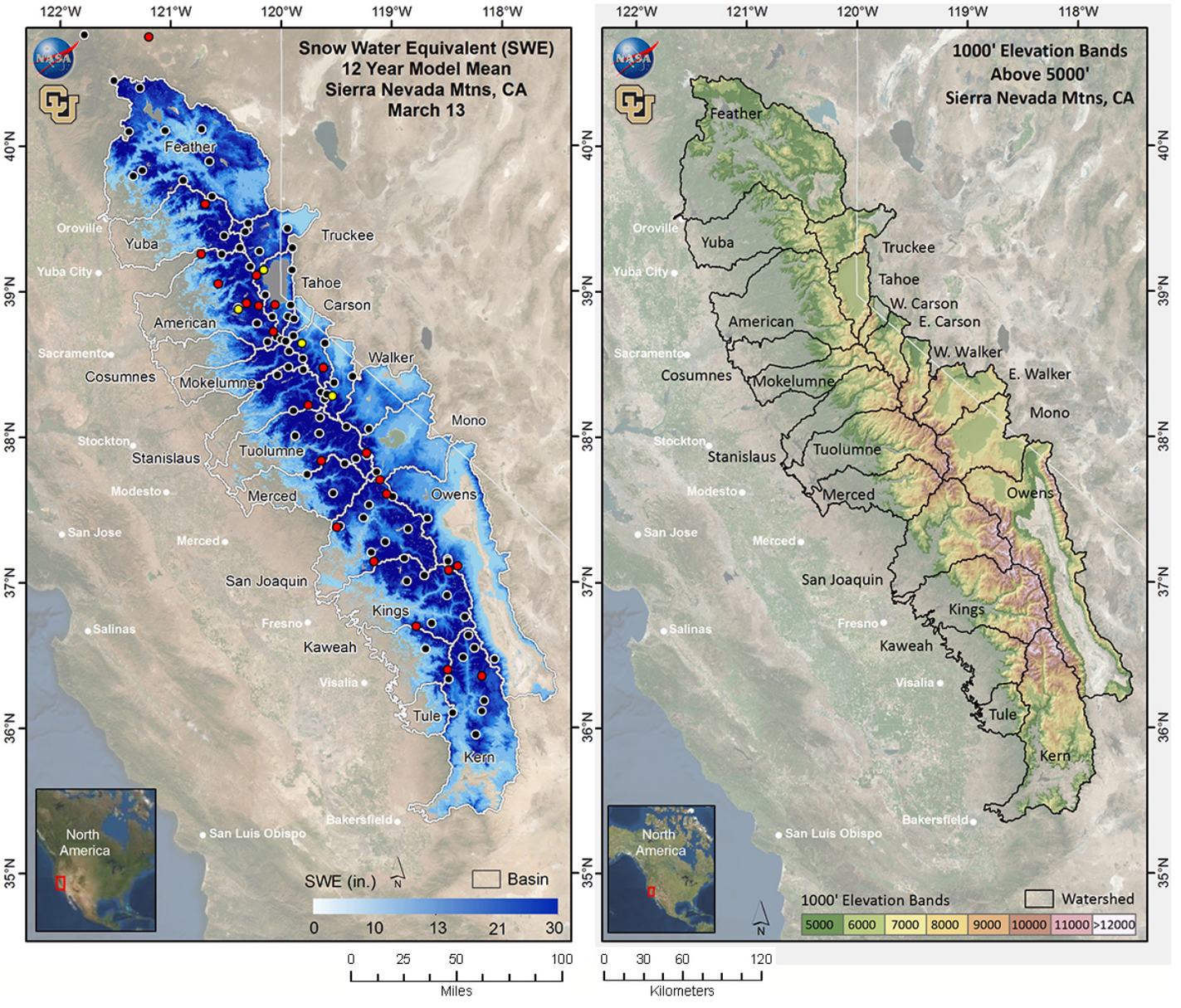

Figure 6. Historical average March 13th and Elevation Bands for the Sierra Nevada. Average SWE (2000-2011) for March 13th (left), and the Banded Elevation map (right) identifies basins used in this report (black boundaries) and 1000' elevation bands (colored shading) that match those used in Table 1 and Table 2. Map on left shows snow gage sensor sites recording SWE on March 13th (black), sites that were offline are shown in red and sites recording zero SWE are shown in yellow.

Methods

The spatial SWE estimation method is described in Schneider and Molotch (2016). The method uses linear regression in which the dependent variable is derived from the operationally measured in situ SWE from all online snow sensor sites in the domain. The snow sensor SWE observations are scaled by the fractional snow-covered area (fSCA) across the 500 m pixel containing that snow sensor site before being used in the linear regression model. The fSCA is a near-real-time cloud-free MODIS satellite image which has been processed using the MODIS Snow Cover and Grain size (MODSCAG) fractional snow-covered area algorithm program (Painter, et. al. 2009, snow.jpl.nasa.gov).

The following independent variables (predictors) enter into the linear regression model:

- Physiographic variables that affect snow accumulation, melt, and redistribution, including elevation, latitude, upwind mountain barriers, slope, and others. See Figure 2 in Schneider and Molotch (2016) for the full set of these variables.
- The historical daily SWE pattern (1985-2016) retrospectively generated using historical MODSCAG data, and an energy-balance model that back-calculates SWE given the fractional Snow-Covered Area (fSCA) time series and meltout date for each pixel. See Margulis, et. al., 2016 for details. (For computational efficiency, only one image from either the 1st or 15th of each month during the 1985-2016 period that best matches the real-time SNOTEL-observed pattern is selected as an independent variable.)

The real-time regression model for this date has been validated by cross-validation, whereby 10% of the SNOTEL data are randomly removed and the model prediction is compared to the measured value at the removed SNOTEL stations. This is repeated 30 times to obtain an average R-squared value, which denotes how closely the model fits the SNOTEL data. During development of this regression method, the model was also validated against independent historical SWE data collected in snow surveys at 9 locations in Colorado, and an intensive field survey in north-central Colorado.

Data Issues/Caveats for* March 13, 2020 – *IMPORTANT – READ THIS!

- DENSE FOREST COVER – Dense forest cover at lower elevations where snow-cover is discontinuous can cause the satellite to underestimate the snow-cover extent, leading to underestimation of SWE.
- ANOMALOUS SNOW PATTERNS – Anomalous snow years or snow distributions may cause SWE error due to the model design to search for similar SWE distributions from previous years. If no close seasonal analogue exists, the model is forced to find the most similar year, which may result in error.

List of All Known Data Issues/Caveats

- RECENT SNOWFALL – There are occasionally problems with lower-elevation SWE estimates due to recent snowfall events that result in extensive snow-cover extending to valley locations where measurements are not available. This scenario results in an over-estimation of lower- elevation SWE.
- LIMITED SNOW PILLOW DATA – When snow at the snow pillow sites melts out, but remains at higher elevations, the model tends to underestimate SWE at the under-monitored upper elevations. This issue typically occurs late in the melt season, resulting in less accurate SWE prediction at higher elevations compared to earlier in the snow season.
- CLOUD COVER – Cloud cover can obscure satellite measurements of snow-cover. While careful checks are made, occasionally the misclassification of clouds as snow or *vice versa* may result in the mischaracterization of SWE or bare-ground.
- LOW LOOK ANGLE – When a satellite does not pass directly over a region but the area is still included within the satellite sensor's field of view, this is referred to as a low "look angle". The resulting image has lower effective resolution – this "blurry" MODSCAG data still contains useful information but may lead to overestimation of SWE near the margins of the snow-cover extent.
- POOR QUALITY SNOTEL DATA – Although data QA/QC is performed, occasional SNOTEL sensor malfunction may result in localized SWE errors.
- ANOMALOUS SNOW PATTERNS – Anomalous snow years or snow distributions may cause SWE error due to the model design to search for similar SWE distributions from previous years. If no close seasonal analogue exists, the model is forced to find the most similar year, which may result in error.
- DENSE FOREST COVER – Dense forest cover at lower elevations where snow-cover is discontinuous can cause the satellite to underestimate the snow-cover extent, leading to underestimation of SWE.

Table 1. Estimated SWE by basin. *The basin-wide SWE values and averages, are across all pixels at elevations >5000'. Shown are March 3rd percent of March 1st average SWE, March 13th percent of March 13th average SWE (between 2000-2011 as derived from the regression model), March 3rd mean SWE, March 13th mean SWE, March 13th percent of snow-covered area, March 13th water volume (acre-feet), the change in SWE between March 3rd and March 13th, the area (mi^2) inside each basin that contains data pixels (not including cloud-covered pixels, lakes or other satellite no data pixels), March 3rd snow pillow data, and March 13th snow pillow data for those areas collected, summarized for each basin. The last column shows March 13th mean SWE from SNODAS*.*

Basin	3/3/20 % 3/1 Avg.	3/13/20 % 3/13 Avg.	3/3/20 SWE (in)	3/13/20 SWE (in)	3/13/20 % SCA	3/13/20 Vol (af)	3/3 thru 3/13/20 Chg. in SWE (in)	Area (mi2) > 5000'	3/3/20 Pillows	3/13/20 Pillows	3/13/20 SNODAS* (in)
Feather	34	14	5.9	2.7	21.0	326,616	-3.2	2,251.8	15.5 (8)	11.6 (8)	4.5
Yuba	38	29	8.2	6.9	49.8	202,660	-1.4	553.7	17.4 (2)	17.5 (3)	7.8
American	34	26	7.1	6.0	45.1	271,015	-1.1	850.3	13.5 (10)	10.2 (8)	6.0
Cosumnes	14	6	2.3	1.2	9.8	6,148	-1.0	94.5	NA	NA	1.6
Mokelumne	38	31	8.1	7.3	54.9	131,520	-0.8	336.1	15.9 (1)	15.3 (1)	8.7
Stanislaus	41	31	8.6	7.4	57.9	233,727	-1.2	590.9	15.3 (5)	15.5 (6)	7.3
Tuolumne	44	35	9.2	8.4	60.5	430,774	-0.8	958.9	11.7 (6)	10.6 (6)	7.5
Merced	43	33	8.4	7.2	55.0	215,669	-1.3	565.1	12.2 (3)	9.9 (3)	7.5
San Joaquin	41	34	7.8	7.4	58.4	502,517	-0.4	1,269.5	10.6 (8)	8.2 (7)	6.5
Kings	43	37	7.9	7.8	64.4	518,599	-0.2	1,253.9	13.3 (6)	13.6 (6)	7.2
Kaweah	27	26	4.3	4.3	45.1	74,368	0.0	322.8	2.8 (1)	0.4 (1)	6.4
Tule	8	6	0.9	0.7	7.9	4,846	-0.2	136.1	9.7 (1)	2.6 (1)	2.0
Kern	27	23	3.8	3.5	32.2	336,217	-0.4	1,824.0	8.6 (7)	7.7 (7)	2.7
Truckee	44	25	8.1	4.9	37.8	154,253	-3.3	591.5	11.6 (6)	10.7 (6)	5.1
Tahoe	48	31	9.1	6.6	32.0	118,064	-2.5	337.1	11.2 (8)	9.3 (6)	7.7
W Carson	45	40	7.6	7.0	60.7	49,673	-0.6	132.2	14.7 (2)	13.7 (2)	6.8
E Carson	44	32	7.5	5.7	47.1	129,109	-1.8	426.8	10.1 (5)	9.3 (4)	5.5
W Walker	40	31	5.9	4.9	41.3	118,319	-1.1	456.9	10 (5)	9.4 (5)	3.9
E Walker	24	19	3.0	2.3	19.1	102,616	-0.7	846.1	5.4 (1)	5.7 (1)	1.3
Mono	17	18	2.1	2.0	18.3	112,119	-0.1	1,070.8	6.6 (1)	7.1 (1)	1.0
Owens	29	29	2.5	2.6	31.7	315,871	0.1	2,258.4	6.9 (4)	7.2 (4)	1.6

* This is a comparison to the SNODAS (SNOw Data Assimilation System) nationwide product from the National Weather Service.

Table 2. Estimated SWE by basin and elevation band. *Elevation bands begin at 5000' and extend past the highest point in the basin. Note that the area of the highest 2-5 bands is typically much smaller than the lower bands. Shown are March 3rd percent of March 1st average SWE, March 13th percent of March 13th average SWE (between 2000-2011 as derived from the regression model), March 3rd mean SWE, March 13th mean SWE, March 13th percent of snow-covered area, March 13th water volume (acre-feet), the change in SWE between March 3rd and March 13th, the area (mi^2) inside each basin that contains data pixels (not including cloud-covered pixels, lakes or other satellite no data pixels), March 3rd snow pillow data, and March 13th snow pillow data for those areas collected, summarized for each 1000' elevation band inside each basin. The last column shows March 13th mean SWE from SNODAS*.*

Basin	Elevation Band	3/3/20 % 3/1 Avg.	3/13/20 % 3/13 Avg.	3/3/20 SWE (in)	3/13/20 SWE (in)	3/13/20 % SCA	3/13/20 Vol (af)	3/3 thru 3/13/20 Chg. in SWE (in)	3/13/20 Area (mi2)	3/3/20 Pillows	3/13/20 Pillows	3/13/20 SNODAS* (in)
Feather	5000-6000'	20	6	3.2	0.9	8.5	66,968	-2.2	1,345.6	20.6 (1)	20 (1)	2.6
	6000-7000'	47	20	9.3	4.4	33.9	181,274	-4.9	775.5	13.4 (5)	11.6 (5)	6.5
	7000-8000'	61	42	14.2	11.1	75.2	74,528	-3.1	125.9	14.6 (1)	13.9 (1)	11.6
	8000-9000'	57	45	16.5	15.2	91.2	3,846	-1.3	4.7	NA	NA	12.8
Yuba	5000-6000'	9	3	1.6	0.7	6.2	7,444	-0.9	202.6	NA	NA	2.2
	6000-7000'	47	33	10.6	8.2	63.9	99,870	-2.4	228.3	16.5 (2)	15.8 (2)	9.0
	7000-8000'	57	50	14.6	14.4	96.4	91,099	-0.1	118.2	21.7 (1)	21 (1)	14.5
	8000-9000'	56	49	16.9	17.6	100.0	4,248	0.7	4.5	NA	NA	18.4
American	5000-6000'	5	2	0.8	0.3	3.0	5,160	-0.5	313.5	1.7 (2)	0 (2)	0.1
	6000-7000'	39	25	8.3	6.0	48.6	89,250	-2.4	281.0	18.2 (2)	16.1 (1)	3.2
	7000-8000'	54	46	12.8	11.9	90.5	111,478	-0.9	176.0	15 (4)	12.5 (4)	14.9
	8000-9000'	56	48	15.0	15.0	96.9	56,524	0.1	70.6	16.2 (2)	16.3 (2)	19.2
	9000-10,000'	56	47	16.7	17.4	100.0	8,603	0.7	9.3	NA	NA	17.0
Cosumnes	5000-6000'	1	0	0.1	0.0	0.0	0	-0.1	62.8	NA	NA	0.1
	6000-7000'	23	8	4.4	1.9	16.6	2,528	-2.5	24.8	NA	NA	2.2
	7000-8000'	57	37	13.4	9.7	74.0	3,620	-3.7	7.0	NA	NA	13.6
Mokelumne	5000-6000'	1	0	0.1	0.0	0.1	35	-0.1	88.1	NA	NA	0.0
	6000-7000'	23	12	4.6	2.6	26.8	9,476	-2.0	68.3	NA	NA	2.1
	7000-8000'	53	43	12.0	10.8	87.5	52,361	-1.2	90.9	NA	NA	13.8
	8000-9000'	56	49	14.5	14.4	97.7	61,537	-0.1	80.1	15.5 (1)	15.3 (1)	17.5
	9000-10,000'	59	51	16.7	17.3	100.0	8,110	0.7	8.8	NA	NA	15.4
Stanislaus	5000-6000'	2	0	0.3	0.0	0.3	171	-0.2	112.4	NA	NA	0.0
	6000-7000'	29	15	5.8	3.3	31.3	24,613	-2.5	140.1	16.3 (1)	15.2 (1)	2.0
	7000-8000'	50	37	10.9	8.9	78.2	72,364	-2.0	152.4	18.5 (2)	16.8 (2)	9.4
	8000-9000'	55	46	13.2	12.6	95.1	79,804	-0.6	118.3	18.2 (2)	17.8 (2)	14.1
	9000-10,000'	55	47	14.9	15.4	99.5	44,369	0.5	54.1	7.1 (1)	8.3 (1)	14.7
	10,000-11,000'	56	48	16.2	17.2	100.0	12,137	1.0	13.3	NA	NA	10.9
	> 11,000'	62	52	17.3	18.1	100.0	269	0.8	0.3	NA	NA	4.5
Tuolumne	5000-6000'	0	0	0.0	0.0	0.0	0	0.0	179.2	NA	NA	0.0
	6000-7000'	20	4	3.8	0.8	8.2	6,141	-3.0	146.9	0.7 (1)	0.6 (1)	0.6
	7000-8000'	47	32	10.2	7.7	67.7	63,953	-2.5	156.6	12.3 (2)	10.9 (2)	7.8
	8000-9000'	53	45	12.3	11.8	93.4	108,328	-0.5	172.6	11.9 (2)	11.2 (2)	11.6
	9000-10,000'	56	49	14.1	14.5	98.5	141,133	0.4	182.9	11.8 (2)	12.1 (2)	14.8
	10,000-11,000'	61	54	15.9	16.9	98.8	82,595	1.0	91.6	NA	NA	11.5
	11,000-12,000'	65	59	16.8	18.3	100.0	25,544	1.5	26.2	NA	NA	5.7
	> 12,000'	69	62	18.2	20.2	100.0	3,079	2.0	2.9	NA	NA	3.1
Merced	5000-6000'	0	0	0.0	0.0	0.0	0	0.0	75.1	NA	NA	0.2
	6000-7000'	12	2	1.9	0.3	3.6	1,368	-1.6	82.8	NA	NA	1.6
	7000-8000'	40	20	8.2	4.5	42.9	33,696	-3.7	141.9	NA	NA	7.9
	8000-9000'	53	42	11.7	10.6	87.1	70,053	-1.1	124.4	12.9 (2)	12.2 (2)	10.9
	9000-10,000'	56	48	13.3	13.5	97.5	63,740	0.2	88.3	NA	NA	13.4
	10,000-11,000'	58	51	15.1	16.1	97.8	33,841	1.0	39.5	NA	NA	9.5
	11,000-12,000'	62	54	16.8	18.2	98.2	11,191	1.4	11.5	NA	NA	5.0
	> 12,000'	67	58	19.1	20.8	100.0	1,780	1.7	1.6	NA	NA	3.5

Basin	Elevation Band	3/3/20 % 3/1 Avg.	3/13/20 % 3/13 Avg.	3/3/20 SWE (in)	3/13/20 SWE (in)	3/13/20 % SCA	3/13/20 Vol (af)	3/3 thru 3/13/20 Chg. in SWE (in)	3/13/20 Area (mi2)	3/3/20 Pillows	3/13/20 Pillows	3/13/20 SNODAS* (in)
San Joaquin	5000-6000'	0	0	0.0	0.0	0.0	0	0.0	144.7	NA	NA	0.0
	6000-7000'	10	1	1.5	0.1	2.5	1,193	-1.4	185.6	4.9 (3)	4.1 (2)	1.3
	7000-8000'	28	14	4.9	2.7	36.9	31,853	-2.2	220.6	8.5 (2)	6.1 (2)	4.7
	8000-9000'	42	32	8.1	7.2	79.0	77,472	-1.0	203.0	NA	NA	10.1
	9000-10,000'	51	44	11.3	11.4	94.6	126,553	0.1	207.3	11.8 (1)	11.4 (1)	12.6
	10,000-11,000'	56	51	13.4	14.6	97.6	124,860	1.2	160.8	12 (1)	12.2 (1)	10.3
	11,000-12,000'	64	58	15.7	17.4	96.6	110,927	1.7	119.3	NA	NA	5.2
	> 12,000'	69	63	17.6	19.7	100.0	29,660	2.2	28.2	NA	NA	2.3
Kings	5000-6000'	0	0	0.0	0.0	0.1	0	0.0	104.3	NA	NA	0.0
	6000-7000'	6	1	0.8	0.2	3.6	1,203	-0.6	133.0	NA	NA	0.6
	7000-8000'	26	13	4.3	2.3	33.5	21,003	-2.0	173.9	NA	NA	4.8
	8000-9000'	39	29	7.2	6.0	69.4	69,971	-1.3	219.7	NA	NA	10.8
	9000-10,000'	48	41	10.0	9.9	90.9	116,384	-0.1	220.9	12.9 (3)	12 (3)	12.7
	10,000-11,000'	54	49	11.7	12.6	97.3	130,394	0.9	193.8	13.6 (3)	15.1 (3)	10.5
	11,000-12,000'	61	56	13.9	15.4	97.7	127,611	1.5	155.1	NA	NA	5.2
	> 12,000'	69	63	16.5	18.4	99.5	52,035	1.9	53.1	NA	NA	2.9
Kaweah	5000-6000'	0	0	0.0	0.0	0.5	0	0.0	64.0	NA	NA	0.0
	6000-7000'	1	2	0.2	0.2	6.0	576	0.0	58.4	0.5 (1)	0.4 (1)	1.0
	7000-8000'	13	12	2.2	2.1	34.3	6,751	-0.1	60.3	NA	NA	5.9
	8000-9000'	34	27	6.4	5.7	74.0	17,511	-0.6	57.3	NA	NA	11.3
	9000-10,000'	46	39	9.4	9.5	93.6	22,006	0.1	43.4	NA	NA	14.2
	10,000-11,000'	53	46	12.1	12.8	98.7	20,979	0.7	30.7	NA	NA	11.4
	11,000-12,000'	56	48	13.2	14.2	97.6	6,390	1.0	8.4	NA	NA	6.1
	> 12,000'	60	49	13.6	13.9	100.0	155	0.3	0.2	NA	NA	4.5
Tule	5000-6000'	0	0	0.0	0.0	0.0	0	0.0	54.3	NA	NA	0.0
	6000-7000'	0	0	0.0	0.0	0.5	38	0.0	39.6	NA	NA	0.1
	7000-8000'	7	4	1.2	0.7	10.3	848	-0.6	23.9	5.7 (1)	2.6 (1)	3.3
	8000-9000'	20	13	3.9	2.8	31.9	2,009	-1.1	13.7	NA	NA	9.2
	9000-10,000'	39	31	8.3	7.8	76.9	1,884	-0.5	4.5	NA	NA	12.4
	10,000-11,000'	43	36	9.0	9.0	100.0	67	0.0	0.1	NA	NA	11.2
Kern	5000-6000'	0	0	0.0	0.0	0.0	0	0.0	304.8	NA	NA	0.0
	6000-7000'	0	0	0.0	0.0	0.2	159	0.0	378.8	NA	NA	0.0
	7000-8000'	7	2	1.0	0.4	6.8	6,838	-0.7	347.5	0.1 (1)	0.7 (1)	0.9
	8000-9000'	29	17	5.0	3.4	45.4	58,413	-1.6	325.8	8.3 (2)	6.8 (2)	4.7
	9000-10,000'	42	32	8.0	6.8	76.3	70,361	-1.1	193.4	12.7 (1)	13.1 (1)	7.6
	10,000-11,000'	52	46	10.8	11.3	96.4	80,553	0.6	133.3	7.6 (2)	7.7 (2)	6.9
	11,000-12,000'	61	56	13.6	14.9	97.9	75,194	1.3	94.8	11 (1)	11.4 (1)	5.2
	> 12,000'	70	64	16.4	18.4	98.5	44,699	2.0	45.6	NA	NA	3.5

Basin	Elevation Band	3/3/20 % 3/1 Avg.	3/13/20 % 3/13 Avg.	3/3/20 SWE (in)	3/13/20 SWE (in)	3/13/20 % SCA	3/13/20 Vol (af)	3/3 thru 3/13/20 Chg. in SWE (in)	3/13/20 Area (mi2)	3/3/20 Pillows	3/13/20 Pillows	3/13/20 SNODAS* (in)
Truckee	5000-6000'	18	0	2.2	0.0	0.4	271	-2.2	134.8	NA	NA	0.1
	6000-7000'	42	14	7.8	2.7	25.2	37,435	-5.1	264.2	10.5 (4)	8.9 (4)	3.8
	7000-8000'	55	42	12.2	10.3	78.4	76,076	-1.9	139.1	NA	NA	8.5
	8000-9000'	57	48	14.1	13.8	96.3	31,822	-0.3	43.4	9.9 (1)	12.1 (1)	15.3
	9000-10,000'	60	49	16.1	16.1	100.0	8,229	0.1	9.6	NA	NA	17.5
	10,000-11,000'	63	53	18.3	18.8	100.0	419	0.5	0.4	NA	NA	14.5
Tahoe	6000-7000'	32	6	4.8	1.0	5.2	7,343	-3.7	132.3	6.3 (3)	0 (1)	2.0
	7000-8000'	51	34	9.9	7.4	64.7	45,056	-2.5	114.2	12.6 (4)	11.5 (4)	9.3
	8000-9000'	58	47	13.9	12.9	89.7	50,122	-1.0	72.7	10.4 (1)	9.9 (1)	13.9
	9000-10,000'	59	51	16.0	16.2	99.2	14,723	0.3	17.0	NA	NA	13.9
	10,000-11,000'	62	55	17.2	18.4	100.0	820	1.2	0.8	NA	NA	10.7
W. Carson	5000-6000'	1	0	0.1	0.0	0.0	0	-0.1	26.7	NA	NA	0.0
	6000-7000'	6	1	0.7	0.1	4.0	55	-0.6	14.1	NA	NA	0.2
	7000-8000'	44	34	8.2	6.6	76.7	14,867	-1.5	42.0	NA	NA	8.0
	8000-9000'	56	49	12.6	12.3	95.4	23,827	-0.3	36.3	14.2 (2)	13.7 (2)	11.3
	9000-10,000'	59	53	15.0	15.5	99.4	9,888	0.5	11.9	NA	NA	12.1
	10,000-11,000'	62	55	15.9	16.4	100.0	1,036	0.5	1.2	NA	NA	10.5
E. Carson	5000-6000'	11	0	0.9	0.0	0.0	0	-0.9	68.9	NA	NA	0.0
	6000-7000'	23	1	3.0	0.2	4.0	861	-2.8	95.8	0.3 (1)	0 (1)	0.1
	7000-8000'	43	23	7.7	4.3	50.7	25,822	-3.4	111.6	9.6 (1)	NA	4.3
	8000-9000'	57	47	12.3	11.4	91.4	62,534	-1.0	103.1	13 (3)	12.4 (3)	11.7
	9000-10,000'	59	52	14.9	15.3	98.9	29,675	0.4	36.4	NA	NA	14.2
	10,000-11,000'	61	52	16.6	17.4	99.4	10,006	0.8	10.8	NA	NA	11.8
	> 11,000'	64	54	18.1	18.9	75.0	211	0.8	0.2	NA	NA	8.1
W. Walker	5000-6000'	0	0	0	0	0	0	0.0	81.7	NA	NA	0.0
	6000-7000'	9	0	0.9	0.0	0.1	1	-0.9	72.9	NA	NA	0.0
	7000-8000'	24	5	3.4	0.7	16.1	3,687	-2.7	102.7	1.7 (1)	0 (1)	0.3
	8000-9000'	45	32	8.2	6.1	73.2	28,694	-2.1	88.6	8.7 (1)	8.8 (1)	4.6
	9000-10,000'	57	49	13.1	13.2	97.5	54,645	0.1	77.8	12.3 (3)	12.8 (3)	12.8
	10,000-11,000'	63	56	16.5	17.6	98.9	28,657	1.0	30.5	NA	NA	11.1
	> 11,000'	67	59	17.7	18.6	92.7	2,635	1.0	2.7	NA	NA	6.0
E. Walker	5000-6000'	0	0	0.0	0.0	0.0	0	0.0	23.2	NA	NA	0.0
	6000-7000'	0	0	0.0	0.0	0.0	0	0.0	222.3	NA	NA	0.0
	7000-8000'	5	1	0.6	0.1	2.6	946	-0.5	268.6	NA	NA	0.0
	8000-9000'	22	10	3.4	1.6	22.4	16,344	-1.8	197.1	NA	NA	1.1
	9000-10,000'	51	40	10.0	8.5	72.0	37,108	-1.5	81.5	5.5 (1)	5.7 (1)	6.3
	10,000-11,000'	66	61	15.3	16.3	96.7	36,540	0.9	42.1	NA	NA	6.8
	11,000-12,000'	74	68	17.9	19.3	96.9	11,366	1.4	11.0	NA	NA	3.8
	> 12,000'	74	70	18.7	20.9	100.0	312	2.2	0.3	NA	NA	2.8
Mono	6000-7000'	0	0	0.0	0.0	0.6	0	0.0	321.2	NA	NA	0.0
	7000-8000'	2	0	0.2	0.0	2.6	1,045	-0.1	418.6	NA	NA	0.0
	8000-9000'	17	12	2.5	1.7	33.4	16,778	-0.8	186.8	NA	NA	0.5
	9000-10,000'	45	38	8.1	7.7	86.1	26,862	-0.4	65.3	NA	NA	5.6
	10,000-11,000'	60	55	13.5	14.4	97.3	37,399	0.9	48.5	7 (1)	7.1 (1)	9.5
	11,000-12,000'	69	63	16.8	18.5	98.7	25,539	1.7	25.9	NA	NA	6.0
	> 12,000'	70	64	17.6	19.5	100.0	4,495	1.9	4.3	NA	NA	3.0
Owens	5000-6000'	0	0	0	0	0	0	0.0	446.8	NA	NA	0.0
	6000-7000'	0	0	0	0	2	0	0.0	423.5	NA	NA	0.0
	7000-8000'	4	2	0.4	0.1	7.8	3,275	-0.2	485.0	NA	NA	0.2
	8000-9000'	14	10	1.4	1.1	45.0	15,586	-0.4	270.1	NA	NA	2.0
	9000-10,000'	25	22	3.3	3.1	72.8	32,101	-0.2	196.7	8.4 (3)	7.7 (3)	4.8
	10,000-11,000'	45	40	7.3	7.6	88.8	82,342	0.3	202.5	9.1 (2)	9.6 (2)	5.7
	11,000-12,000'	61	57	11.9	13.1	95.8	105,826	1.2	151.3	NA	NA	3.9
	> 12,000'	73	68	15.5	17.5	98.7	76,742	2.0	82.4	NA	NA	2.4

* This is a comparison to the SNODAS (SNOw Data Assimilation System) nationwide product from the National Weather Service.

Location of Reports and Excel Format Tables

ftp://snowserver.colorado.edu/pub/fromLeanne/forCADWR/Near_Real_Time_Reports/

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