Snow Product Name:	Real Time MODIS Snow Water Equivalent (SWE)	Airborne Snow Observatory	UA / SWANN Snow Data	National Snow Analysis
Is your data accessible via the web? If so, please provide the website:	http://instaar.colorado.edu/research/labs-groups/mountain-hydrology-group/page/37200/	https://nsidc.org/data/aso	There are two versions of this dataset: a research version of the dataset, and an experimental higher resolution and real-time product. The research dataset is available at https://nsidc.org/data/nsidc-0719. The near-realtime version can be accessed using a web visualization tool at https://climate.arizona.edu/snowview/.	https://www.nohrsc.noaa.gov
What is the extent of your snow data coverage (e.g., CONUS, Western U.S., a particular basin or state, etc.)?	Upper Colorado River basin (Southern Rockies), Sierra Nevada Mountains, Northern Rockies	Key basins in California and Colorado	CONUS	CONUS + portions of southern Canada to about 54 degrees latitude
What is the resolution of your dataset? If it is a lumped model, give us a sense of the spatial scale (e.g., watershed, county, etc.); if it is a distributed model, what are the grid cell dimensions?	500 m cell size	50 m SWE and Snow Depth; 3 m Snow Depth and Snow Cover Extent	The research dataset has a 4 km resolution. The higher resolution real time data has 1 km resolution.	30 arc seconds (~800 m)
How frequently is your data updated?	It depends on cloud cover, so average frequency is 3-4 days	Varies; weekly to several times per season	The 1 km data are generated from 1982-present, the 4 km data can be downloaded from 1982-2017 from the NSIDC.	hourly
Are historical data/simulations available for your product? If so, what is the extent of the historical record?	Yes, 2000-present day	Varies; 2013 - present	The 1 km data are generated from 1982-present, the 4 km data can be downloaded from 1982-2017.	The period of record for SNODAS is from October 2004 to the present.
Do you incorporate remotely sensed data into your product (e.g., satellite observations)? If so, what data and how often?	Yes, daily MODIS fractional snow-covered area	No	Not currently	MODIS snow covered area is used in our assimilations on a ~weekly basis.
Do you incorporate gage data (e.g., SNOTEL) into your product? If so, which networks and how often do you incorporate these data?	Yes, daily, western U.S. SNOTEL and California snow sensors, also CoCoRaHS snow depth and SWE	Yes, we use gage data to constrain snow densities for the Snow Depth to SWE conversion	We incorporate data from SNOTEL, COOP, and California Department of Water Resources stations on a daily basis.	We assimilate snow information from many networks, including SNOTEL and our own Airborne Survey program. Assimilations are performed typically 2x/week from October to May, and less frequently from June to September.
If you use observed gage data, briefly describe how you interpolate between observational points:	Daily gage data is input into a regression model as the dependent variable. See below for a description of the regression model.	NA	SWE, normalized by accumulated snowfall minus a modeled ablation is interpolated (krigged) between observation points, and then multiplied by gridded SWE estimates (generated using the same snowfall estimates and ablation model)	SNODAS assimilation uses an inverse distance weighted (IDW) interpolation grid. The weighting function for IDW does include elevation differences as well, which provides some resolution of terrain.
What are some pertinent citations that describe your snow data/model?	Schneider D. and N.P. Molotch. (2016). Real-time estimation of snow water equivalent in the Upper Colorado River Basin using MODIS-based SWE reconstructions and SNOTEL data. Water Resources Research, 52(10): 7892-7910.DOI: 10.1002/2016WR019067. Guan, B., N. P. Molotch, D. E. Waliser, S. M. Jepsen, T. H. Painter, and J. Dozier. (2013). Snow water equivalent in the Sierra Nevada: Blending snow sensor observations with snowmelt model simulations. Water Resources Research, Vol. 49, 5029–5046, doi: 10.1002/wrcr.2038. Molotch, N.P. (2009). Reconstructing snow water equivalent in the Rio Grande headwaters using remotely sensed snow cover data and a spatially distributed snowmelt model. Hydrological Processes, Vol. 23, doi: 10.1002/hyp.7206.	Painter, T. H., Berisford, D. F., Boardman, J. W., Bormann, K. J., Deems, J. S., Gehrke, F., … Winstral, A. (2016). The Airborne Snow Observatory: Fusion of scanning lidar, imaging spectrometer, and physically-based modeling for mapping snow water equivalent and snow albedo. Remote Sensing of Environment, 184, 139–152. https://doi.org/10.1016/j.rse.2016.06.018	X. Zeng., P. D. Broxton, N. Dawson, 2018, Snowpack Change from 1982-2016 over Continental United States, Geophysical Research Letters, 10.1029/2018GL079621. Dawson, N., P. D. Broxton, and X. Zeng, 2017: A new snow density parameterization for land data initialization. J. Hydrometeor., 18, 197-207, doi: 10.1175/JHM-D-16-0166.1. Broxton, P. D., X. Zeng, and N. Dawson, 2016: Why Do Global Reanalyses and Land Data Assimilation Products Underestimate Snow Water Equivalent? J. Hydrometeor., 17, 2743–2761, doi: 10.1175/JHM-D-16-0056.1.	https://www.nohrsc.noaa.gov/technology/pdf/WSC_2006.pdf
What is the best contact information if someone has questions regarding your snow data/model?	Noah Molotch, noah.molotch@colorado.edu, (303) 492-6151 or Leanne Lestak, leanne.lestak@colorado.edu, (303) 492-5802	Tom Painter, thomas.h.painter@airbornesnowobservatories.com or Kat Bormann, kathryn.j.bormann@jpl.nasa.gov or katbormann@gmail.com	Patrick Broxton, broxtopd@email.arizona.edu	Greg Fall, gregory.fall@noaa.gov or Carrie Olheiser, carrie.olheiser@noaa.gov
Briefly describe the methods used to create these data in a sentence or two.	We use a regression model inputing spatial independent variables containing physiographic (elevation, latitude, upwind mountain barriers, slope, etc.) information, and spatial historical daily SWE patterns (2000-2012) 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.	Full watershed scans from an airborne platform using a scanning lidar and an imaging spectrometer are combined with baseline (snow-free) data to extract snow depth and snow cover at very high resolution. Snow density estimates (model & gage data) are then used to convert snow depth to SWE.	These data are based on the interpolation snow data from thousands of in-situ snow stations from the SNOTEL network, a network maintained by the California Department of Water Resources, and the COOP network, applied to gridded SWE estimates based on PRISM data (Broxton et al., 2016). A physically-based snow density model (Dawson et al., 2017) is used to convert between snow depth and SWE in this dataset development. These data (which have a spatial resolution of 4 km) are then downscaled using machine learning of physiographic variables that is trained with airborne lidar snow data to generate higher resolution SWE estimates that account for smaller scale topographic and vegetation variability.	Differences between SNODAS SWE and snow depth and corresponding observations are converted to a gridded field and assimilation is performed using a nudging method in a repeated 6-hour model cycle.
What snow data metrics (e.g., SWE, aerial extent, depth, density, etc.) do you provide? For the rest of this survey, "snow data" will refer to the metrics listed here.	SWE depth (in), SWE volume (af), percent of snow-covered area, average percent of SWE, 500 m cell size raster product, JPG maps	SWE, snow depth, aerial extent	SWE, Snow Depth	SWE, depth, density, internal energy, melt, sublimation
What file format (or formats) is your data available in?	Excel tables, JPG maps and GeoTIFF raster files	GeoTIFF (.tiff)	NetCDF	Many formats are available. Archived data use a simple binary + header format, but operational products are distributed in GRIB, NetCDF and other formats.
Please describe any past or ongoing applications by water management agencies.	In the Sierra Nevada the CA-DWR and over 50 stakeholders in CA and NV use our reports and spatial data in operational forecasting, flood forecasting, dam management and irrigation management. In the Upper CO River basin and the Northern Rockies, the WY State Engineer's Office, CO Water Availability Task Force, and other water managers and forecasters are using our reports and spatial data for real time input to their forecasts and hind casting.	ASO has been a collaboration since its inception in 2012 with the California Department of Water Resources. The main water management agencies that use the data include California Department of Water Resources, Bureau of Reclamation, Denver Water, Colorado Water Conservation Board.	The 1 km data is being used by the Salt River Project in Arizona to support their snow monitoring.	The New York Department of Environmental Protection uses SNODAS extensively for water supply management.