ASO L4 Lidar Snow Water Equivalent 50m UTM Grid, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Painter, T. 2018. *ASO L4 Lidar Snow Water Equivalent 50m UTM Grid, Version 1.* [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/M4TUH28NHL4Z. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/ASO_50M_SWE

National Snow and Ice Data Center

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1 DATA DESCRIPTION

This data set is a collection of 50 m resolution snow water equivalent (SWE) maps, measured by the Airborne Snow Observatory (ASO), a coupled imaging spectrometer and scanning lidar system created by NASA/JPL. The imaging spectrometer is used to quantify spectral albedo, broadband albedo, and radiative forcing by dust and black carbon in snow. The scanning lidar measures snow depth using the differential altimetry approach of subtracting snow-free gridded elevation data from snow-covered gridded elevation data (Deems et al., 2013). The original 3 m snow depth measurements, which are provided in the *ASO L4 Lidar Snow Depth 3m UTM Grid* data set, were used to aggregate the 50 m gridded snow depth data in the *ASO L4 Lidar Snow Depth 50m UTM Grid* data set. To infer the SWE data presented here, the 50 m snow depth data were combined with snow density modeled by *iSnobal*, a raster-distributed, physically-based energy-balance model.

1.1 Parameters

The data product featured in this data set is SWE in meters. An example is shown in Figure 1.

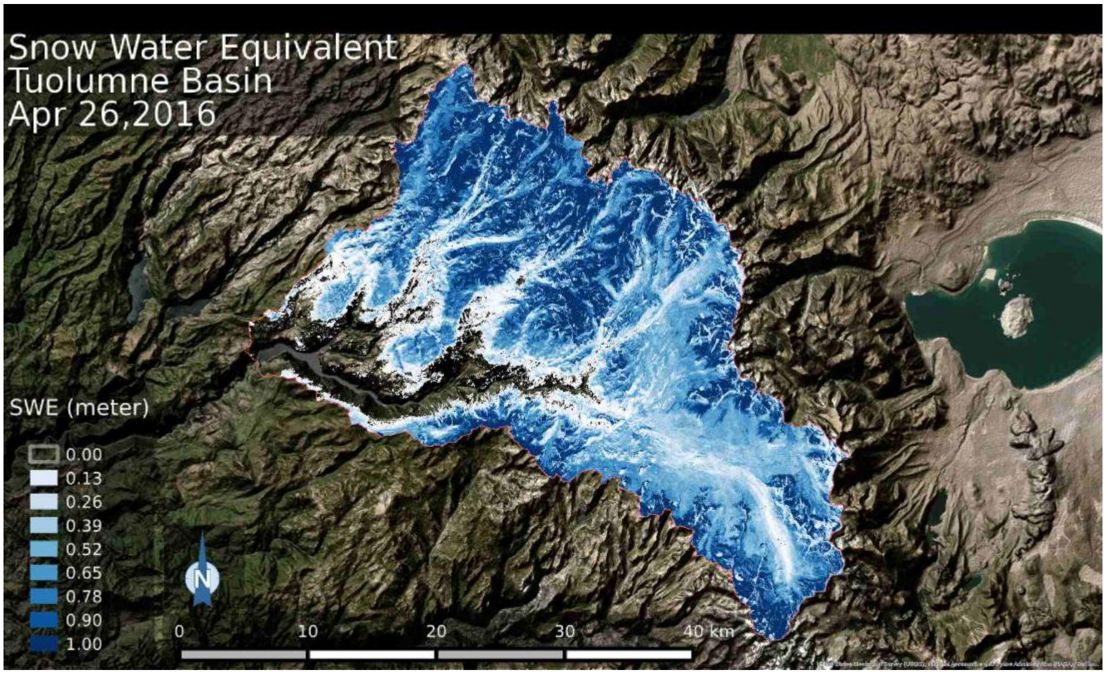

Figure 1. SWE (in meters) in the Tuolumne Basin, California, on 26 April 2016. Image courtesy of NASA/JPL Airborne Snow Observatory.

1.2 File Information

1.2.1 Format

Data are provided as GeoTIFF (.tif) formatted files. Each GeoTIFF file is paired with an associated XML file, which contains additional metadata. Data for some study sites are also available as Portable Network Graphic (.png) files.

1.2.2 Naming Convention

Data files are named after the following naming convention and as described in Table 1.

```
ASO_50M_SWE_CCSCBC_YYYMMDD.ext
```

Example file name:

```
ASO_50M_SWE_USWAOL_20160208.tif
```

Table 1. File Naming Convention

File Designator	Description
ASO_50M_SWE	Data set ID
CC	Two digit country code, e.g. US = United States
SC	Two digit US state code, e.g. WA = Washington
BC	Two digit basin (site) code, e.g. OL = Olympic Mountains. See the ASO basins spreadsheet for a list of basins and basin codes.
YYYYMMDD	Data acquisition date
.ext	File extension: .tif, .tif.xml, or .png

1.3 Spatial Information

1.3.1 Coverage

Spatial coverage for this data set includes several basins listed in the ASO basins spreadsheet. Figure 2 depicts four California basins as an example.

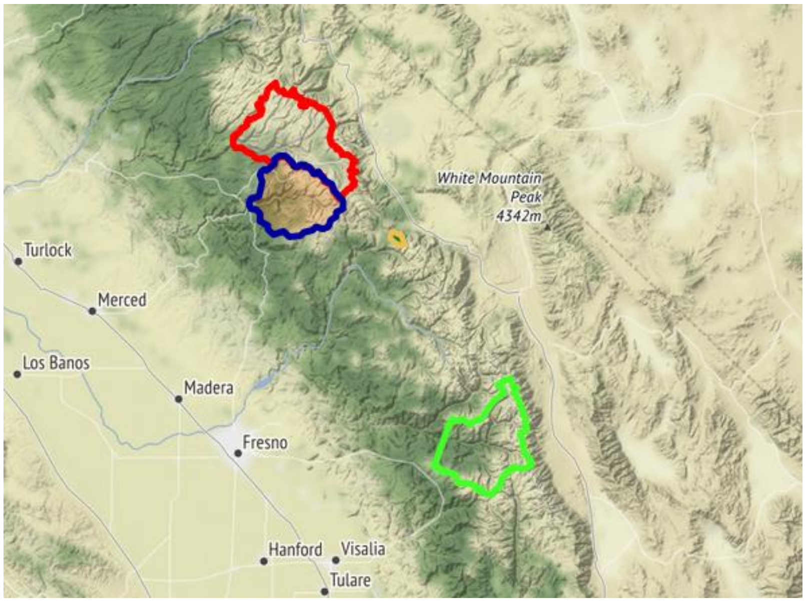

Figure 2. ASO California basins: Tuolumne Basin (red), Merced Basin (blue), Lake Basin (orange), and Kings Basin (green). Image courtesy of NASA/JPL Airborne Snow Observatory.

1.3.2 Resolution

50 m x 50 m grid

1.3.3 Geolocation

- Datum: WGS84 Ellipsoidal
- UTM zones: 10N, 11N, 12N, 13N
- EPSG codes: 32610, 32611, 32612, 32613

1.4 Temporal Information

1.4.1 Coverage

3 April 2013 to 16 July 2019

ASO Snow-Off campaigns typically occur between August and October, while the Snow-On campaigns are typically conducted between February and June.

1.4.2 Resolution

Varies by seasonal campaigns. In general, given the rapidly changing nature of snow cover presence, depth, and surface properties that modulate its melt, ASO flies target basins on a weekly basis from mid-winter through complete snowmelt.

2 DATA ACQUISITION AND PROCESSING

2.1 Processing

The reader is referred to Painter et al. (2016) for details on the processing steps used to generate these data.

2.2 Quality, Errors, and Limitations

The reader is referred to Painter et al. (2016) for more information on the quality of the data.

2.3 Instrumentation

2.3.1 Lidar System

The Riegl LMS-Q1560 airborne laser scanner (ALS) measures surface elevations, from which snow depths are calculated. The Q1560 uses dual lasers at 1064 nm wavelength, each with a 60° scan angle (±30° across-nadir) and a 14° angle relative to the cross-track axis, producing an up to 8° fore/aft look angle (off-nadir in the along-track direction). A 1064 nm wavelength system is used because of its relatively small laser penetration depth in snow and relatively high snow reflectance at that wavelength, as well as greater penetration through vegetation canopies.

Note: Current processing uses some data from the CASI 1500 imaging spectrometer data to discriminate processing steps, but the bulk of the snow depth information, from which the SWE data are derived, comes from the Riegl Q1560 airborne laser scanner.

The required level of geolocation accuracy is achieved through the use of a single lidar-integrated Trimble Applanix POS/AV 510 GPS and Inertial Measurement Unit (IMU). The IMU has angular uncertainties of 0.005° in roll, 0.005° in pitch, and 0.008° in true heading after post-processing, and a resultant attitude uncertainty of 0.011°.

For more detailed information see Deems et al. (2013) and Painter et al. (2016).

3 VERSION HISTORY

Table 2. Version History Summary

Version	Release Date	Description of Changes
1	June 2018	Initial release

1.1	February 2024	Minor version update • Added flights from CA and CO basins (24 March 2014 to 2 June 2015) • Added .png file format for some data

4 RELATED DATA SETS

ASO L4 Lidar Snow Depth 3m UTM Grid

ASO L4 Lidar Snow Depth 50m UTM Grid

NASA SnowEx data sets at NSIDC

5 RELATED WEBSITES

Airborne Snow Observatory Project at NASA/JPL

SnowEx Project at NASA

6 CONTACTS AND ACKNOWLEDGMENTS

6.1 Contacts

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6.2 Acknowledgments

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7 REFERENCES

Deems, J. S., Painter, T. H., & Finnegan, D. C. (2013). Lidar measurement of snow depth: a review. Journal of Glaciology, 59(215), 467–479. https://doi.org/10.3189/2013jog12j154

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

8 DOCUMENT INFORMATION

8.1 Publication Date

May 2018

8.2 Date Last Updated

February 2024