

==Data Set Information==

Data Set Title: 15-min Snow Depth Observations from NASA SnowEx 2017

Data Format: CSV

Data Description:

Provided within are continuous 15-min snow depth observations from two arrays of Judd Communications Ultrasonic Depth Sensors. These data were measured at two locations on Grand Mesa, CO, USA during NASA's 2017 SnowEx campaign: 1) TLS K footprint in the West Mesa Study Site (SXX); 2) TLS N footprint in the East Mesa Study Site (SXXN). Sensors were positioned within each study site to represent three primary vegetation conditions: 1) open-canopy; 2) canopy-edge; 3) closed-canopy. A total of 10 and 7 sensors recorded usable data at SXX and SXXN, respectively for the campaign from the beginning of the snow season in November 2016 through the end of the snow season in June 2017. Observations were subjected to a quality control, infilling, and smoothing procedure in order produce the final continuous dataset.

These data can be used for a variety of purposes, including, but not limited to: model forcing, calibration, and validation; evaluation of airborne and satellite remote sensing products; and analysis of vegetation effects on snow accumulation and ablation.

Input Data Source: ?

Data Volume: 23.9

Data Usage Constraints:

Please note that 4 levels of data are provided (raw, quality controlled, infilled, and smoothed) and it is up to the user to identify which is appropriate for their usage.

Flags were generated for the quality control and infill levels to denote the action performed. The flags are as follows:

- 1 = Observation removed because of vegetation effects
- 2a = Observation failed maximum/minimum threshold
- 2b = Observation failed rate of change threshold
- 3a = Missing observation filled using linear interpolation (gap \leq 24 h)
- 3b = Missing observation filled using spline interpolation (gap $>$ 24 h)
- 4 = Observation failed visual inspection, was removed manually and infilled with linear interpolation
- 5a = Filled from beginning of snow season (2017-11-18 10:30 MST) to date of first usable observation using linear interpolation
- 5b = Filled from beginning of snow season (2017-11-18 10:30 MST) to date of first usable observation using average depth values of working sensors scaled to the first usable observation

For this dataset, depth values were smoothed using a 6 h moving average filter where each observation in the 3 h window before and after the observation was given equal weight. Other smoothing approaches are available and can be performed on the infilled data.

The following sensors had their offsets adjusted in processing so that depth = 0 cm when there was no snow on the ground (all offset corrections were $<$ 15 cm):

SXK1, SXK2, SXK3, SXK4, SXK5, SXK7, SXK8, SXK9, SXK10,
SXN1, SXN4, SXN8, SXN9, SXN10

The percentage of infilled observations varied considerably by sensor, from 1.7% to 64.0%. The mean and median percentage of infilled observations per sensor were 14.5% and 9.0%, respectively. All sensors but SXK5 and SXN3 had fewer than 18.6% infilled observations.

Parameters:

datetime_MST = Mountain Standard Time datetime (format = YYYY-mm-dd HH:MM:SS)

sensor_num = sensor number

depth_raw_cm = raw snow depth (cm)

depth_qc_cm = quality controlled snow depth (cm)

depth_qc_flag = flag indicating quality control method

depth_fill_cm = infilled snow depth (cm)

depth_fill_flag = flag indicating infill method

depth_smooth_cm = smoothed snow depth (cm)

Data Collection Methods:

Judd Communications Ultrasonic Depth Sensors were programmed to take observations every 15 minutes. The sensors send out an ultrasonic pulse and record the two-way travel time. Snow depth is computed within the program by dividing the air-temperature-corrected speed of sound by 1/2 the two-way travel time.

Snow depth data were stored on Campbell Scientific CR1000 dataloggers, which were powered by solar panels with a battery backup.

Add data set coverage:

==Data Set Coverage==

Temporal Coverage: Start Date: 2016-11-01

Temporal Coverage: End Date: 2017-06-17

Temporal Resolution: 15 minute

Spatial Coverage: N: 39.03430447, S: 39.02755193, E:

-107.9335668, W: -108.0545976

Spatial Resolution: Judd Communications Ultrasonic Depth Sensors have a 22° beam width and a nominal accuracy of ±1 cm. Data are reported to the nearest 0.1 cm.

Data Processing Steps:

Raw observations were subjected to a multi-part quality control, infilling, and smoothing procedure, as follows:

- 1) Data were first visually inspected and observations were removed to exclude periods of vegetation influence (i.e., grass growth in the sensor footprint)
- 2) Observations were then removed if they exceeded a maximum/minimum threshold.
- 3) Data points with a change in depth greater/less than ±5 cm per 15 min. were removed.
- 4) Sensor offsets were corrected to correspond to 0 cm during snow-free periods.
- 5) Data gaps were infilled using linear (≤ 24 h) and spline interpolation (> 24 h) between the previous and following observations.

- 6) Visual inspection and then removal of spurious data points passing the previous checks.
- 7) Linear interpolation of values removed in step 6.
- 8) For sensors whose observations were affected by vegetation during the fall snow-free season, depth was reconstructed by averaging the non-affected sensors' depth values and then scaling them to match the first usable observation of the vegetation-affected sensor.
- 9) Data were smoothed using a 6 h moving average filter.

==Data Set Ingest==

Ingest Method: Push by provider

==Additional Information==

References About the Data:

Molotch, N. P., Brooks, P. D., Burns, S. P., Litvak, M., Monson, R. K., McConnell, J. R., & Musselman, K. (2009). Ecohydrological controls on snowmelt partitioning in mixed-conifer subalpine forests. *Ecohydrology*, 2(2), 129-142.

(Citation has information about similar snow depth sensor arrays and represents a potential application.)

References Using the Data:

Related URLs: