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## ABOVE: Passive Microwave-derived Annual Snowoff Date Maps, 1988-2018

### Get Data

Documentation Revision Date: 2022-02-21

Dataset Version: 1.1

### Summary

This dataset provides annual maps of the snowoff (SO) date from 1988-2018 across Alaska and parts of Far East Russia and northwest Canada at a resolution of 6.25 km. SO date is defined as the last day of persistent snow and was derived from the MEaSUREs Calibrated Enhanced-Resolution Passive Microwave (PMW) EASE-Grid Brightness Temperature (Tb) Earth System Data Record (ESDR) product. The spatial domain was intended to match MODIS Alaska Snow Metrics and extend its temporal fidelity beyond the MODIS era. SO date estimates were compared to snow depth measurements collected at SNOTEL stations across Alaska and to three SO datasets derived from MODIS, Landsat, and the Interactive Multisensor Snow and Ice Mapping System (IMS). The data from 1988-2016 included a coastal mask removing coastal pixels due to potential water contamination from coarse brightness temperature observations (Dersken et al., 2012). There is not a coastal mask for the 2017-2018 data. The full data are included, and data users should be aware that coastal values can be adversely affected by adjacent water bodies.

There are 32 total files in GeoTIFF (.tif) format, one file for every year from 1988-2018 and a fractional water mask file (applies to the 1988-2016 data only).

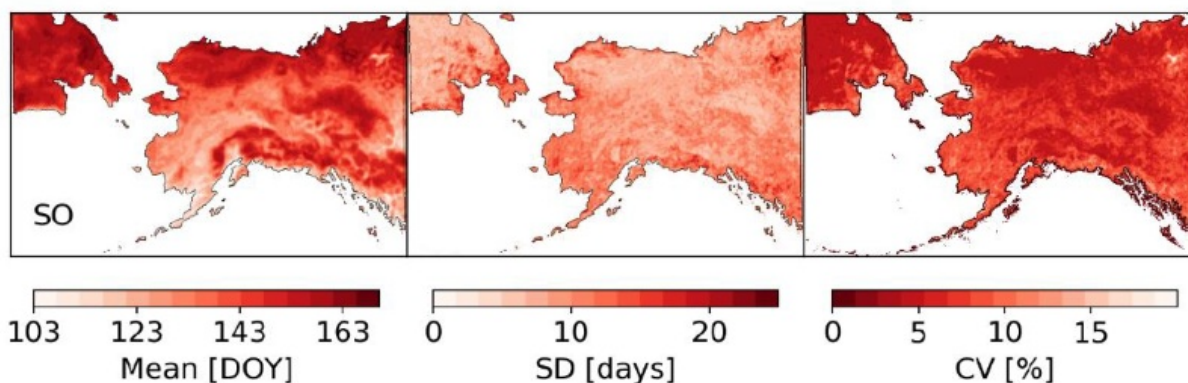


Figure 1. Summary statistics for the snowoff date from 1988-2016 across the study domain: mean (left), standard deviation (middle), and coefficient of variation (right). Dates expressed as day of year (DOY).

### Citation

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## 1. Dataset Overview

This dataset provides annual maps of the snowoff (SO) date from 1988-2018 across Alaska and parts of Far East Russia and northwest Canada at a resolution of 6.25 km. SO date is defined as the last day of persistent snow and was derived from the MEaSUREs Calibrated Enhanced-Resolution Passive Microwave (PMW) EASE-Grid Brightness Temperature (Tb) Earth System Data Record (ESDR) product. The spatial domain was intended to match MODIS Alaska Snow Metrics and extend its temporal fidelity beyond the MODIS era. SO date estimates were compared to snow depth measurements collected at SNOTEL stations across Alaska and to three SO datasets derived from MODIS, Landsat, and the Interactive Multisensor

**Project:** [Arctic-Boreal Vulnerability Experiment \(ABoVE\)](#)

The Arctic-Boreal Vulnerability Experiment (ABoVE) is a NASA Terrestrial Ecology Program field campaign based in Alaska and western Canada between 2016 and 2021. Research for ABoVE links field-based, process-level studies with geospatial data products derived from airborne and satellite sensors, providing a foundation for improving the analysis and modeling capabilities needed to understand and predict ecosystem responses and societal implications.

**Related Publication:**

Pan, C. G., P. B. Kirchner, J. S. Kimball, and J. Du. 2020. A long-term passive microwave snowoff record for the Alaska region 1988-2016. *Remote Sensing* 12:153. <https://doi.org/10.3390/rs12010153>

**Related Datasets:**

Pan, C.G., P.B. Kirchner, J.S. Kimball, Y. Kim, and J. Du. 2018. ABoVE: Rain-on-Snow Frequency and Distribution during Cold Seasons, Alaska, 2003-2016. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/1611>

**Acknowledgments:**

This work was funded by NASA's ABoVE program (grant NNX15AT74A).

## 2. Data Characteristics

**Spatial Coverage:** Alaska, USA, Northwest Canada, and Far Eastern Russia

**ABoVE Reference Locations**

Domain: Core ABoVE

Grid cell: Ah000-001v000-001

**Spatial Resolution:** 6.25 km

**Temporal Coverage:** 1988-01-01 to 2018-12-31

**Temporal Resolution:** annual

**Study Area:** (all latitudes and longitudes given in decimal degrees)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Alaska, Canada, Russia	-180	180	90	37.97873056

**Data File Information**

There are 32 total data files in GeoTIFF (.tif) format. This includes 31 snowoff data files, one for every year within the period of record (1988-2018) and one file that provides a fractional water (FW) mask for the study area for the 1988-2016 period. A coastal mask removing coastal pixels due to potential water contamination from coarse brightness temperature observations is not included for 2017 and 2018. The full data are provided. Data users should be aware that coastal values can be adversely affected by adjacent water bodies.

**Data File Naming Convention:** ABoVE.snowoff.YYYYAh000-001v000-001.XXX.tif, where:

YYYY is the calendar year of the measurements, and XXX indicates the data product version format (xxx). All data are version \*.001.

All data are provided in the ABoVE grid. The filename includes the ABoVE grid designation (Ah000-001v000-001).

A represents the reference grid name.

h000-001 indicates that the data cover the horizontal tiles from 0-1 in the A reference grid.

v000-001 indicates that the data cover the vertical tiles from 0-1 in the A reference grid.

Example file name: ABoVE.snowoff.1988Ah000-001v000-001.001.tif

**Table 1.** File names and descriptions

Filename	Units	Description
ABoVE.snowoff.YYYYAh000-001v000-001.XXX.tif	DOY	Thirty-one files. Values represent the snowoff date reported in day of year (DOY). The no-data value is 0. The projection is EPSG 102001 (Standard ABoVE, Canada_Albers_Equal_Area_Conic). There are 629 columns and 652 rows.
FW_snowoff_mask.tif	0-1000	One file. Values represent fractional water (FW) and was used as a mask during analyses for the period 1988-2016. The no-data value is -999. The projection is EPSG 102006 (Alaska_Albers_Equal_Area_Conic). There are 563 columns and 354 rows.

## 3. Application and Derivation

Snowoff (SO) date is suitable for documenting the spatial-temporal impacts of SO variability in ecosystem services, wildlife movements, and hydrologic processes across the ABoVE domain.

## 4. Quality Assessment

PMW-derived SO estimates were compared to snow depth measurements collected at 31 SNOTEL stations across Alaska (<https://wcc.sc.egov.usda.gov/reportGenerator/>). The data were positively correlated (0.66-0.92) and the mean absolute error was between 2 and 10 days.

PMW-derived SO estimates were also compared to three SO datasets derived from MODIS (Lindsay et al., 2015), Landsat (Macander and Swingley 2017), and Interactive Multisensor Snow and Ice Mapping System. On average, 75% of the study area had residuals between -10 and 10 days. The PMW tended to overestimate SO at high elevations and across the North Slope and underestimated SO in the interior region and into southwest Alaska.

## 5. Data Acquisition, Materials, and Methods

Snowoff date was derived from the MEaSUREs Calibrated Enhanced-Resolution Passive Microwave (PMW) EASE-Grid Brightness Temperature (Tb) Earth System Data Record (ESDR) product (Brodzik et al., 2018) daily 19V (K-band) and 37V (Ka-band) channel frequencies (Brodzik et al., 2018). Tb observations were collected from both the SMM/I and SSMIS sensors. Before the launch of SSMIS in 2006, SSM/I was used then transitioned to SSMIS. Calibration comparisons between the two sensors have found comparable observations.

First, the average difference between Tb measured by the 19V and 37V channels during the month of June was calculated annually. The SO date was then identified as the day with the lowest Tb difference value following the start of snowmelt for the year, and a Tb difference value lower than the average observed in June. This approach could not be used to determine the SO date along shorelines, but shorelines cover between 2-3% of the study domain per year. For these areas, gradient ratio polarization (GRP) (Dolant et al., 2016, Pan et al., 2018) was used. The GRP detected the annual SO date as the day with the lowest 4-day running mean of GRP across the year.

Each annual grid was smoothed using a bilinear interpolation with a 3 x 3 moving window, and the grids were masked by FW (1988-2016 data only) to identify pixels that experience higher FW or high seasonal FW variability, which likely influences the SO date. The explicit spatial domain was intended to match the MODIS Alaska Snow Metrics (Lindsay et al., 2015) and extend its temporal fidelity beyond the MODIS era.

See Pan et al. (2020) for more details of this analysis.

## 6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

[ABoVE: Passive Microwave-derived Annual Snowoff Date Maps, 1988-2018](#)

Contact for Data Center Access Information:

- E-mail: [uso@daac.ornl.gov](mailto:uso@daac.ornl.gov)
- Telephone: +1 (865) 241-3952

## 7. References

- Brodzik, M.J., D.G. Long, M.A. Hardman, A. Paget and R. Armstrong. 2018. MEaSUREs Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR, Version 1. Boulder, CO: NASA National Snow and Ice Data Center Distributed Active Archive Center. <https://doi.org/10.5067/MEASURES/CRYOSPHERE/NSIDC-0630.001>
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- Pan, C. G., P. B. Kirchner, J. S. Kimball, and J. Du. 2020. A long-term passive microwave snowoff record for the Alaska region 1988-2016. *Remote Sensing* 12:153. <https://doi.org/10.3390/rs12010153>

## 8. Dataset Revisions

Product Version	Release Date	Revision Notes
1.1	2020-02-21	Data for 2017 and 2018 were added. A coastal mask removing coastal pixels due to potential water contamination from coarse brightness temperature observations is not included for these 2 years. The full data are provided, and it is recommended that data users be aware that coastal values can be adversely affected by adjacent water bodies
1	2020-01-09	Data for 1988-2016 and includes a coastal mask removing coastal pixels due to potential water contamination from coarse brightness temperature observations

Partners

Data Publication Timeline

Airborne Data Visualizer

Detailed Submission

Soil Moisture Visualizer

Guidelines

Land - Water Checker

