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CARVE: L1 Daily Flight Path and Winds Data, Alaska, 2015

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Documentation Revision Date: 2017-02-22

Data Set Version: V1

Summary

This data set provides high-frequency wind speed and direction data for the C-23 Sherpa aircraft during airborne campaigns over the Alaskan and Canadian Arctic as part of the Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE). The data were collected in situ using the Aventech AIMMS-30 Airborne Wind Sensor onboard the aircraft and are presented at 1-second intervals throughout each flight. The Winds instrument was available for flights in year 2015 only. The measurements included in this data set are most useful when paired with the scientific data collected by other CARVE airborne instruments.

These measurements are one part of an innovative multi-instrument remote sensing payload flown for the CARVE investigation.

There are 60 data files in netCDF (*.nc) format; each file corresponds to one CARVE campaign flight in year 2015, but not all flights are represented.
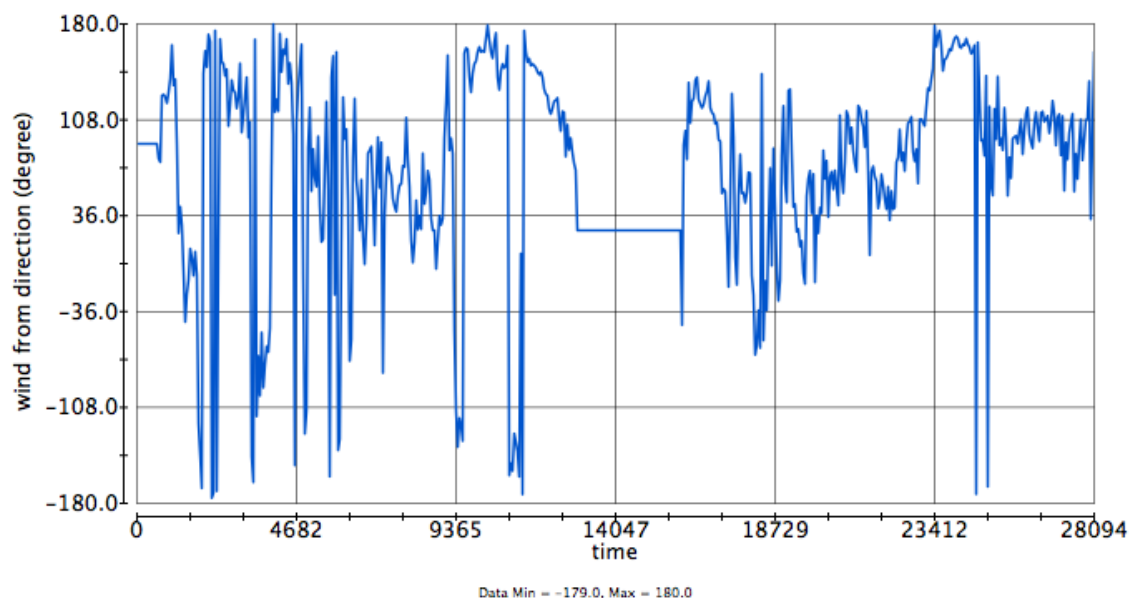

Figure 1: Wind direction recorded outside the C-23 Sherpa aircraft during a CARVE flight on May 6, 2015.

Citation

CARVE Science Team . 2017. CARVE: L1 Daily Flight Path and Winds Data, Alaska, 2015. ORNL DAAC, Oak Ridge, Tennessee, USA. http://dx.doi.org/10.3334/ORNLDAAC/1427

Table of Contents

1. Data Set Overview

Project: Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE)

The Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE) is a NASA Earth Ventures (EV-1) investigation designed to quantify correlations between atmospheric and surface state variables for Alaskan terrestrial ecosystems through intensive seasonal aircraft campaigns, ground-based observations, and analysis sustained over a 5-year mission. CARVE collected detailed measurements of greenhouse gases on local to regional scales in the Alaskan Arctic and demonstrated new remote sensing and improved modeling capabilities to quantify Arctic carbon fluxes and carbon cycle-climate processes. CARVE science fills a critical gap in Earth science knowledge and satisfies high priority objectives across NASA's Carbon Cycle and Ecosystems, Atmospheric Composition, and Climate Variability & Change focus areas as well as the Air Quality and Ecosystems elements of the Applied Sciences program. CARVE data also complements and enhances the science return from current NASA and non-NASA sensors.

Related Data:

A full list of CARVE data products is available at: https://carve.ornl.gov/dataproducts.html

2. Data Characteristics

Spatial Coverage: CARVE flights over the Alaskan and Canadian Arctic

Spatial Resolution: Point measurements

Temporal Coverage: 20150415 to 20151113

Temporal Resolution: The instrument was deployed on periodic flights from April to November 2015.

Study Area (coordinates in decimal degrees)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Alaska and Canadian Arctic	-168.069	-132.238	71.318	58.843

Data File Information

There are 60 files in NetCDF (*.nc) version 4 file format. Each file provides geolocation, altitude, wind speed and wind direction recorded at 1-second intervals during a single flight.

Table 1. CARVE file naming convention. Example file name: *carve_Winds_L1_A_b23_20150506_20160927025654.nc*

Name element	Example value	Units
Project name	*carve*	
Instrument	*Winds*	
Processing level	*L1_A*	

Build ID	*b23*	
Flight date	*20150506*	*yyyymmdd*
Processing date and time	*20160927025654*	*yyyymmddhhmmss*

Data variables

Each file contains 8 geolocation and time variables and an additional 4 science measurement variables, as described in Table 2.

Table 2. Data variables in each netCDF file. Fill value or missing data were set to -999.9 for all variables.

Variable name	Description	Units
Geolocation measurements		
center_lat	latitude of (aircraft sampling) footprint center	Decimal degrees North
center_lat_standard_error	uncertainty of latitude	Decimal degrees North
center_lon	longitude of (aircraft sampling) footprint center	Decimal degrees East
center_lon_standard_error	uncertainty of longitude	Decimal degrees East
geolocation_qc	geolocation status flag	0 = Success, 1 = Error
height	height of aircraft above ground	meters
height_standard_error	uncertainty of height	meters
time	time	seconds since 1980-1-6 0:0:0 UTC
Science Measurements		
direction	wind from direction	degrees
direction_qc	wind from direction status flag	0 = Valid, 1 = Out of Range, 2 = Error
speed	wind speed	meters per second

speed_qc	wind speed status flag	0 = Valid, 1 = Out of Range, 2 = Error

3. Application and Derivation

These data files contain high-frequency geolocation, time, height, wind speed and direction information for the C-23 Sherpa aircraft during CARVE flights in 2015. The CARVE project was designed to collect detailed measurements of important greenhouse gases on local to regional scales in the Alaskan Arctic and demonstrate new remote sensing and improved modeling capabilities to quantify Arctic carbon fluxes and carbon cycle-climate processes. The CARVE data provide insights into Arctic carbon cycling that may be useful in numerous applications.

4. Quality Assessment

Any questionable or erroneous data were flagged in the data files.

5. Data Acquisition, Materials, and Methods

CARVE Flights

These data represent one part of the data collected by the Carbon in Arctic Reservoirs Vulnerability Experiment (Miller et al. 2012). A C-23 Sherpa aircraft made frequent flights out of Fairbanks, Alaska between March and November over multiple years, observing the spring thaw, summer draw-down, and fall refreeze of the Arctic growing season. Flights concentrate observations on three study domains: the North Slope, the interior, and the Yukon River valley. North Slope flights cover regions of tundra and continuous permafrost and were anchored by flux towers in Barrow, Atqasuk, and Ivotuk. Flights to Prudhoe Bay characterize the CO2 and CH4 emissions from oil and natural gas processing plants. Flights over interior Alaska sample discontinuous permafrost, boreal forests, and wetlands. A complete list of CARVE flights can be found at: https://carve.ornl.gov/flights.html. Flight paths and atmospheric gas concentrations for CARVE surveys can be visualized through the CARVE Flight Data Visualization Tool (http://carve.ornl.gov/visualize) and are illustrated in Figure 2.
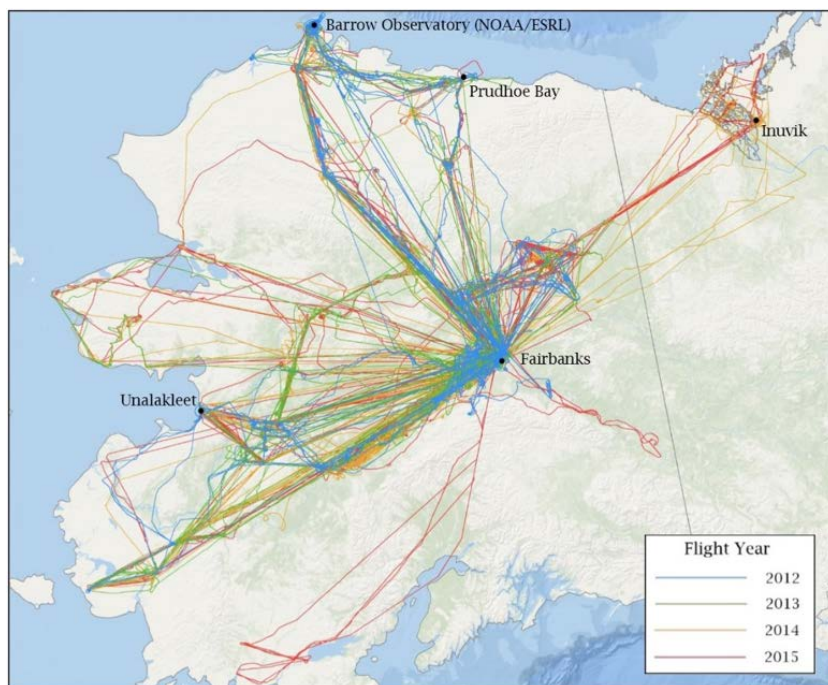

Figure 2. CARVE flights during 2012-2015 delivered measurements over continuous and discontinuous permafrost regimes.

The CARVE aircraft carried a remote sensing and atmospheric sampling payload consisting of the following instruments: a Fourier transform spectrometer (FTS), and an in situ gas analyzer suite (ISGA) with a gas analyzer and flask sampling system (see https://carve.ornl.gov/documentation.html). All instruments were controlled by a master computer system and UTC time stamped at 1 second intervals.

Aventech Winds Instrument

The Aventech Winds Instrument Level 1 products contain data in NetCDF 4 format detailing wind speed and direction along the flight path. The data comes from the Aventech AIMMS-30 Airborne Wind Sensor aboard the CARVE aircraft owned and operated by NASA. All data from a single flight day are

combined into a single Level 1 file. Records within a given file are recorded every second.

6. Data Access

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

CARVE: L1 Daily Flight Path and Winds Data, Alaska, 2015

Contact for Data Center Access Information:

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

7. References

Miller, C.E., Dinardo, S.J. et al. (2012). CARVE: The Carbon in Arctic Reservoirs Vulnerability Experiment.*, 2012 IEEE Aerospace Conference.* http://dx.doi.org/10.1109/AERO.2012.6187026

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