FireSense: UAS Vertical Profile Measurements, Fort Drum, NY, USA, 2024

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Documentation Revision Date: 2026-05-14

Dataset Version: 1

Summary

This dataset contains ten vertical atmospheric profiles collected in Upstate New York (Fort Drum) using a Unmanned Aircraft System (UAS) during the April 2024 solar eclipse. The data includes static air pressure, static air temperature, relative humidity, wind speed and direction, and data pertaining to the UAS. Acquired by a NASA LaRC Alta-X UAS under the FireSense project, these high-resolution observations of atmospheric state variables are critical for analyzing transport and mixing processes. This dataset offers key insights into how atmospheric structure evolves in response to the eclipse. The measurements were made between the surface and approximately 3.5 km Mean Sea Level (MSL). The data are provided in the International Consortium for Atmospheric Research on Transport and Transformation (ICARTT) format.

There are 10 data files in ICARTT V1.1 format with this dataset.

Figure 1. The NASA Alta X quadcopter sits in a field in Missoula, Montana, outfitted with a structure engineered at Langley Research Center to carry a radiosonde (top left) and an anemometer (top right) into the air. The UAS and its payload were part of the August 2024 FireSense campaign, which examined the applicability of using controllable, repeatable airborne measurements to more accurately predict fire and smoke behavior. Image Credit: NASA ARC/Milan Loiacono.

Citation

Pangle, P., and J. Fowler. 2026. FireSense: UAS Vertical Profile Measurements, Fort Drum, NY, USA, 2024. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/2486

Table of Contents

1. Dataset Overview

This dataset contains ten vertical atmospheric profiles collected in Upstate New York (Fort Drum) using a Unmanned Aircraft System (UAS) during the April 2024 solar eclipse. The data includes static air pressure, static air temperature, relative humidity, wind speed and direction, and data pertaining to the UAS. Acquired by a NASA LaRC Alta-X UAS under the FireSense project, these high-resolution observations of atmospheric state variables are critical for analyzing transport and mixing processes. This dataset offers key insights into how atmospheric structure evolves in response to the eclipse.

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Project: **FireSense**

The FireSense project aims to improve U.S. wildland fire management by working with operational agencies to refine and deliver NASA's unique Earth science and technological capabilities. FireSense focuses on four types of assessments to support decisions before, during, and after wildland fires: pre-fire fuel conditions, active fire dynamics, post-fire impacts and threats, and air quality forecasting. Each type of assessment is co-developed with wildland fire management stakeholders. Through co-development of technology and data-informed tools, FireSense is intended to enable a transition from reactive to proactive fire response by facilitating increased preparedness for and co-existence with fire. To accomplish this, the FireSense team collaborates with resource managers, policymakers, and stakeholders at all levels. Since the fall of 2023, FireSense has run an annual airborne and field component where the project team tests and develops improved capabilities and technologies for transfer to stakeholders. FireSense leverages multiple airborne instruments, including the MODIS/ASTER Airborne Simulator (MASTER), the Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR), the Airborne Visible/Infrared Imaging Spectrometer 3 (AVIRIS-3), the Scanning L-band Active Passive (SLAP), and the San Jose State University Wildfire Imaging System (SWIS).

Related Dataset

Pangle, P., and J. Fowler. 2026. FireSense: Balloon Vertical Profile Measurements, Fort Drum, NY, USA, 2024. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/2497

- Measurements collected through a balloon platform during the same solar eclipse from the same location.

Acknowledgements

This work was supported by the NASA FireSense Project. The University of New York-Albany provide data for the sounding comparisons, and Fort Drum (U.S. Army) provided access and airspace deconfliction.

2. Data Characteristics

Spatial Coverage: Fort Drum, New York, U.S.

Spatial Resolution: Irregular from the surface to <3.5 km MSL altitude

Temporal Coverage: 2024-04-08 (during a solar eclipse)

Temporal Resolution: 1 s

Study Area: Latitude and longitude are given in decimal degrees.

Region	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Fort Drum, New York, US	-75.5403	-75.54022	44.2476	44.2475

Data File Information

There are 10 files in ICARTT V1.1 (.ict) format (Aknan et al., 2013) in this dataset with ACVSNC (Atmospheric Composition Variable Standard Name Convention) (Silverman et al., 2023) standard variable names.

The no-data value is -9999.

The file naming convention is *FireSense-NewYork-FortDrum-UAS_ PROFILE_ <YYYYMMDDhhmmss>_<RX>.ict*, where

- *<YYYYMMDDhhmmss>* is the sampling start date-time in Coordinated Universal Time (UTC) (e.g., "20240408041215")
- <RX> is the data revision number (e.g., "R0")

Example file name: *FireSense-NewYork-FortDrum-UAS_PROFILE_20240408041215_R0.ict*

Table 1. Variables in the ICARTT data files

Variable Name	Units	Description
P	hPa	Static air pressure
T	degrees C	Static air temperature
RH	percent	Relative Humidity over water
Tu_Cap	degrees C	Instrument/intermediate Variable
Range	m	Instrument/intermediate Variable
Vertical_Speed	$m\ s^{-1}$	Instrument/intermediate Variable

Horizontal_Speed	m s^{-1}	UAS horizontal speed
Longitude	degrees east	Longitude of measurement
Latitude	degrees north	Latitude of measurement
Altitude	m	Altitude of measurement
Wind_Speed	m s^{-1}	Wind Speed by Graw. The FireSense team recommends that this measurement should be treated as provisional
Wind_Direction	degrees	Wind Direction by Graw. The FireSense team recommends that this measurement should be treated as provisional
Pitch	degrees	Pitch of UAS
Roll	degrees	Roll of UAS
v	m s^{-1}	Northward Wind Component by Trisonica Sphere
u	m s^{-1}	Eastward Wind Component by Trisonica sphere
w	m s^{-1}	Vertical Wind Component by Trisonica Sphere
corrected_wind_speed	m s^{-1}	Corrected wind speed by Trisonica sphere. The FireSense team recommends that TriSonica wind speed measurements should be used in quantitative analysis
corrected_wind_direction	degrees	Corrected wind direction by Trisonica sphere. The FireSense team recommends that TriSonica wind direction measurements should be used in quantitative analysis

3. Application and Derivation

High-temporal-resolution vertical profiles acquired during the solar eclipse offer valuable insights into the influence of solar radiation on atmospheric structure, which is essential for characterizing atmospheric transport and mixing dynamics.

4. Quality Assessment

The FireSense team recommends TriSonica wind speed and wind direction measurements should be used in quantitative analysis. The Graw wind measurement should be treated as provisional. It is also noted that the FireSense team conducted comparisons against lidar and balloon sondes to verify the uncertainty specification provided by the manufacturer. The uncertainty values cited below are based on manufacturer specifications:

Graw Radiosonde DFM-17

- Temperature Accuracy: <0.2 degrees C
- Pressure Uncertainty: <1 hPa
- Relative Humidity Uncertainty: <3%
- Wind Speed Uncertainty: <0.1 m s^{-1}
- Wind Direction Uncertainty: <1 degree

LI-560 TriSonica® Sphere Ultrasonic Anemometer

- Wind Speed accuracy as a function of wind speed: +/- 1 m s^{-1} (0 - 10 m s^{-1}), +/- 1% (11 - 30 m s^{-1}), and +/- 2% (31-50 m s^{-1})

5. Data Acquisition, Materials, and Methods

Site selection was made based on location along the total solar eclipse path, as well as having project permissions that provided access to restricted airspace with a high enough ceiling to allow for flight deconfliction and full Planetary Boundary Layer (PBL) sampling. Additionally, there was a need for enough space to provide launch capabilities of reference sensors for validation efforts.

The vertical profiles of the atmospheric state variables were measured by two instruments mounted on the NASA LaRC Alta X UAS (N567NU, Figure 1). The measurements were made between the surface and approximately 3.5 km MSL. The instruments involved were:

- Graw Radiosonde DFM-17 responsible for pressure, temperature, and relative humidity measurements.
- LI-560 TriSonica® Sphere Ultrasonic Anemometer responsible for the 3-D wind measurements (i.e., u, v, and w).

6. Data Access

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

FireSense: UAS Vertical Profile Measurements, Fort Drum, NY, USA, 2024

Contact for Data Center Access Information:

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

7. References

Aknan, A., Chen, G., Crawford, J., and E. Williams. 2013. ICARTT File Format Standards V1.1. NASA Earth Science Data and Information Systems Standards Coordination Office. https://www.earthdata.nasa.gov/s3fs-public/imported/ESDS-RFC-019-v1.1_0.pdf

Graw Radiosonde DFM-17: https://www.graw.de/products/radiosondes/radiosonde-dfm-17

LI-560 TriSonica® Sphere Ultrasonic Anemometer: https://www.licor.com/products/trisonica/LI-560-sphere

Pangle, P., and J. Fowler. 2026. FireSense: Balloon Vertical Profile Measurements, Fort Drum, NY, USA, 2024. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/2497

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