Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ) Campaign Level User Guide

Document Change Log

Revision	Date	Affected Portions and Description
V1	August 12, 2024	All, original release

This document applies to FIREX-AQ data products that are archived at the Atmospheric Science Data Center (ASDC), at NASA Langley Research Center.

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Introduction:

The Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ) campaign was an intensive, multi-organizational study of the tropospheric chemistry and composition of smoke from open fires in the United States that intended to improve the understanding of the integrated impact of fires on air quality and climate. FIREX-AQ aimed to expand knowledge of the factors controlling emissions from wildfires and agricultural fires in the United States, and to gain understanding of the processes occurring during the evolution of the fire plumes. The overarching goals of the campaign were to provide measurements of trace gas, aerosol, and emissions for wild, agricultural, and prescribed fires in great detail; to relate these measurements to fuel and fire conditions at the point of emission; to evaluate the conditions determining plume rise; and to follow plumes downwind to understand the chemical/physical transformations and air quality impacts of the smoke. The research of FIREX-AQ contributed to an understanding of the impact of fire smoke on weather and global air quality. FIREX-AQ also contributed to the improvement of the estimation of fire emissions and of satellite technology in characterizing fires.

Completed in September 2019, FIREX-AQ utilized a combination of instrumented aircraft, ground-based stationary and mobile instrumentation, and satellites. Detailed fire plume sampling was carried out by the NASA DC-8 aircraft, which had a comprehensive instrument payload capable of measuring over 200 trace gas species, as well as aerosol microphysical, optical, and chemical properties to characterize fire plumes. Remote sensing of the plumes was conducted using Differential Absorption Lidar (DIAL) and High Spectral Resolution Lidar (HSRL). The DC-8 aircraft completed 23 science flights, including 15 flights from Boise, Idaho and 8 flights from Salina, Kansas. NASA's ER-2 completed 11 flights to support the objectives of the campaign. The ER-2 payload was made up of 8 remote-sensing instruments and provided critical fire information including fire temperature, fire plume heights, and vegetation/soil albedo information. Additional airborne plume sampling was carried out by the NOAA-Chem Twin Otter and NOAA-MET Twin Otter. The ground-based mobile labs and sites provided in-situ measurements of aerosol microphysical and optical properties, aerosol chemical compositions, and trace gas species.

Citation:

How to Cite ASDC Data

DOI Citation Formatter

Keywords:

NASA, NOAA, ASDC, Earth Science, Atmosphere, Aerosols, Atmospheric Chemistry, Air Quality, Trace Gas, Biomass Burning, Wildfires, Geographic Information Systems, Carbon Cycle/Carbon Budget Models, Emissions, Forest Fire Science, Fire Disturbance, Cropland, Agricultural Lands, *Prescribed Burns/Fires, Pasture, Forest Plantation, Silviculture, Shrubland/Scrub, Grasslands, Land Use/Land Cover Classification, LIDAR*

Disclaimer:

The findings from FIREX-AQ are in a continual state of research, modification, and analysis. The information contained in this user guide may be subject to change after initial release. This user guide will continue to be updated as new data products become available; however, a reasonable latency should be expected.

Dataset Overview:

FIREX-AQ data products consist of observational products, derived products (including fire information and emission estimates), and satellite products that have been subset to the region of interest. The data from these categories have been grouped into data products, or collections based on platform, variable classification, and observation type (i.e., remote sensing versus in-situ). The variables within these collections have been summarized in the "Collection Details" section. To ensure the responsible scientific use of FIREX-AQ data products, data users are strongly encouraged to carefully study the file headers and to directly consult the instrument and science principal investigators (PIs) with questions. Additionally, data users should acknowledge the data source and offer co-authorship to relevant instrument and science PIs if data contributes to the scientific findings. DOIs are given at the mission level and the collection level. DOIs and citations are available at the links provided in the tables in the "Collections Details" section.

Observational Data Products:

The primary FIREX-AQ observation objective was to characterize the composition and vertical structure of fire plumes. This objective was achieved by deploying a combination of in-situ and remote sensing instruments on aircraft and surface platforms. The in-situ measurements provided a comprehensive characterization of trace gases, aerosol properties, and meteorological conditions, which can be used to assess fire emissions and plume evolution. The remote sensing measurements were mainly used to gauge fire location, fire characteristics, and plume structure. The observational data products from FIREX-AQ have been placed into groups based on the platform acquiring the measurements, the variables measured, and the type of observation (i.e., remote sensing versus in-situ), which have been further detailed in the subsections below.

The in-situ measurements are typically reported in time series (such as measurements as a function of sampling time[s]). The sampling location is given by the platform geographic coordinates. The fire and ecosystem burned locations are geographically accurate and have been determined using a combination of satellite and ground-based data. For airborne measurements, the aircraft navigational parameters are provided as an independent data product.

All ER-2 remote sensing data are geolocated. The ER-2 aircraft navigation and attitude data are available in FIREXAQ_MetNav_AircraftInSitu_ER2_Data_1, which is detailed in Table 22 in this document.

Instruments

Observational data were collected from a variety of instruments. A brief instrument description and, where applicable, measurement caveats can be found in the metadata embedded in the data files or in a descriptive document uploaded alongside the files. The instrument acronyms for each data product are also given in the acronym list at the end of this document. Further details can be obtained in referenced literature or by contacting the instrument team.

Measurement Uncertainty and Measurement Comparison

Measurement uncertainties are often reported as metadata embedded in the file headers or reported in a descriptive document uploaded alongside the files. While accuracy and precision estimates are given separately for some measurements, only overall uncertainties are provided for the others. Users are advised to contact the principal investigator responsible for the instrument when using precision and accuracy to estimate overall uncertainties if the information is not provided in the file header; the conventional method of using quadrature sum in this estimation may not always be appropriate.

In many instances during FIREX-AQ, multiple instruments and/or techniques measured the same mission-critical parameter (e.g., CH_2O, NO_2) to ensure the quality and availability of the data product, resulting in overlapping measurements for the same parameter. Measurement comparisons investigate these overlapping measurements of one parameter across multiple instruments and techniques to assess measurement consistency. The level of measurement consistency found during measurement comparison serves as one indicator of measurement uncertainty. The goal of measurement comparison is to quantify differences in overlapping measurements to guide users to the data appropriate for their needs.

Data Flags

The most common data flags used in the FIREX-AQ observational data products are for missing data and detection limits. Missing data flags indicate that the instruments were not recording data. Detection limit data flags indicate that the sampling condition was either below the lower detection limit or above the upper detection limit. These flags are defined in the metadata file header. Other flags can be found in various data files to indicate the instrument operational status (such as if dilution was applied or a thermal denuder was applied). There are two sampling event flags used in FIREX-AQ data products. Cloud flags indicate when the DC-8 aircraft encountered clouds and the physical state of the clouds. Smoke flags serve as identifiers for fire plumes with fire sources, fuels, and smoke age estimates. Two flags are present in the

Aerodyne Mobile Laboratory dataset indicating when the vehicle was at the ground site, and when the instruments sampled from the Potential Aerosol Mass (PAM) inlet.

DC-8 Observational Data Products

NASA's DC-8 aircraft conducted 23 science flights during FIREX-AQ. The main period of the DC-8 deployment lasted from 15 July to 5 September 2019 and consisted of 150 flight hours. The general sampling strategy involved high-altitude flight segments above fire smoke dedicated to the use of remote sensing instruments and low altitude flight segments within fire smoke dedicated to plume sampling. The measurements from instruments onboard the DC-8 are archived in multiple collections that represent in-situ and remote sensing measurements of aerosol properties, trace gases, cloud droplet properties, actinic flux, and photolysis coefficients. To better characterize the fire plumes, there are several instruments reporting at 1 Hz and higher frequencies. Additional details are summarized in Tables 11-18.

The DC-8 sampled more than 500 individual plumes from over 100 fires. Table 1 links each flight to the names and fuel types of the fires from which smoke plumes were observed. More detailed plume sampling events are summarized in the derived data product FIREXAQ-FIREFLAG-TABULARDATA_ANALYSIS_20190724_R10_THRU20190905.zip, which provides sampling time periods and smoke flag code for each plume transect as well as fire locations. More detailed information for each fire can be found at the Inciweb hyperlink provided (where applicable). These tables can enable users to locate data related to specific smoke plumes collected from the DC-8. The data products themselves also include additional fire information, such as fire status and fuel types.

The MODIS/ASTER Airborne Simulator (MASTER) instrument data collected onboard the DC-8 is housed at the Oak Ridge National Laboratory (ORNL). Please visit the following link to access the data at ORNL: MASTER FIREX-AQ Dataset.

Table 1: DC-8 Fire Sampling Summary[1]

Flight Date(s)	Fire Name	Fuel Type
8/12/19, 8/13/19	Castle	Ponderosa pine, two-needle pinyon, Utah juniper forest
8/6/19	Horsefly	Subalpine fir, lodgepole pine, whitebark pine, Engelmann spruce forest
7/30/19	Left Hand Fire	Grand fir, Douglas fir and forest, ponderosa pine/oceanspray forest
8/2/19	Lick Creek	Grand fir, Douglas fir and forest

[1] Information regarding the fires sampled by specific platforms during FIREX-AQ is in a state of continual evolution; the information in Tables 1-9 may be subject to change as more data products become available.

Flight Date(s)	Fire Name	Fuel Type
8/2/19	Mica Creek	Grand fir, Douglas fir and forest
7/29/19	North Hills	Idaho fescue, bluebunch wheatgrass grassland, ponderosa pine savanna, Douglas fir, Pacific ponderosa pine/oceanspray forest
8/2/19	Ridgetop	Bluebunch wheatgrass, bluegrass grassland
8/15/19	Saber	Understory grass and litter primarily from ponderosa pine, two-needle pinyon, Utah juniper forest
7/24/19, 7/25/19	Shady	Timber litter and shrubs under Douglas fir, Pacific ponderosa, lodgepole pine/oceanspray forest
7/24/19	Sheep	Sagebrush shrubland with grasses
8/15/19, 8/16/19	Sheridan	Pinyon, Utah juniper forest
8/12/19	Springs	Ponderosa pine, Jeffery pine forest
7/30/19	Tucker	Sagebrush, greasewood shrubland with open grass
8/3/19, 8/6/19, 8/7/19, 8/8/19	Williams Flats	Ignited in primarily Idaho fescue, bluebunch wheatgrass grassland, expanded to primarily Douglas fir, Pacific ponderosa pine/oceanspray forest

ER-2 Observational Data Products

NASA's ER-2 aircraft provided information about emissions from wildfires and agricultural fires using an airborne remote sensing suite. The ER-2 aircraft, based at NASA Armstrong Flight Research Center (AFRC) in Palmdale, CA, participated in FIREX-AQ for approximately 70 science flight hours with one engineering flight on 1 August and 11 science flights from 2 August to 19 August 2019. The 2 August flight was dedicated to instrument science check-out, calibration, and data tests. The ER-2 acted as a high-altitude research aircraft that carried satellite simulator instruments to characterize both fires and fire plumes and provided a link between in-situ and satellite observations. The ER-2 flew at approximately ~20 km altitude and had dedicated flight hours to coordinate with the DC-8 and NOAA Twin Otter aircraft. Coordination with the DC-8 was archived on 6 August 2019 over the Williams Flats Fire and 16 August 2019 over the

Sheridan Fire. Coordination with the NOAA Chem Twin Otter was archived on 20 and 21 August over the Little Bear and Ikes fires. The data products related to the ER-2 are grouped in multiple collections that represent each remote sensing instrument, measured aerosol and cloud properties, trace gases, fire location, fire characteristics, and in-situ meteorological and navigational measurements. These data products are summarized in Tables 22-26.

Table 2 links each flight to the names and types of the fires observed from the ER-2. This table can be used to search for data related to specific fires collected from the ER-2.

Table 2: ER-2 Fire Sampling Summary

Flight Date(s)	Fire Name(s)	Fuel Type
8/15/19	Boulin	Ponderosa pine, two-needle pinyon, Utah juniper forest
8/15/19, 8/16/19, 8/20/19, 8/21/19	Castle	Ponderosa pine, two-needle pinyon, Utah juniper forest
8/2/19	Dixon	Red fir forest
8/16/19, 8/20/19, 8/21/19	Ikes	Ponderosa pine, two-needle pinyon, Utah juniper forest
8/20/19, 8/21/19	Little Bear	White fir, gable oak forest, ponderosa pine savanna
8/2/19	Mill	Scrub oak chaparral shrubland, California black oak woodland
8/15/19, 8/16/19, 8/21/19	Sheridan	Pinyon, Utah juniper forest
8/13/19	Springs	Ponderosa pine, Jeffry pine forest
8/15/19	Trumbull	Pinyon, Utah juniper and ponderosa pine forest with timber and grass understory
8/6/19, 8/7/19, 8/8/19	Williams Flats	Ignited in primarily Idaho fescue, bluebunch wheatgrass grassland, expanded to primarily Douglas fir, Pacific ponderosa pine/oceanspray forest

ER-2 data products from the AirMSPI, AVIRIS-C, CPL, and eMAS instruments are housed separately at different locations, which are detailed in Table 3 below. Table 3 outlines the principal investigator and data location for each instrument and provides related satellite information for each instrument to provide relevant information for sampling location.

Table 3: Summary of ER-2 Instruments, Data Locations, and Satellite Information

Instrument	Principal Investigator	Data Location and dataID (where applicable)	Satellite Analogs	Nominal Spatial Resolution @ ER-2 Cruise	Nominal Swath @ ER-2 Cruise
AirMSPI	Dave Diner	ASDC: AirMSPI_FIREX-AQ_Terrain-projected_Georegistered_Radiance_data_6[2]	MISR, MAIA	10m	10km
AVIRIS-C	Robert Green	NASA JPL AVIRIS Data Portal AVIRIS Data at ORNL	EMIT, SBG	20m	11km
CPL	Matthew McGill	ASDC: FIREXAQ_AerosolCloud_AircraftRemoteSensing_ER2_CPL_Data_1	CALIPSO	20m along track 30 m vertical	N/A
eMAS	Steve Platnick	NASA ARC	MODIS, VIIRS, ABI	50m	37km
GCAS	Scott Janz	ASDC: FIREXAQ_TraceGas_Aircraft_ER2_GCAS_Data_1	TROPOMI, TEMPO	500m	16km
NAST-I	Allen Larar	ASDC: FIREXAQ_AircraftRemoteSensing_ER2_NASTI_Data_1	AIRS, CrIS	2600m	40km
S-HIS	Joe Taylor	ASDC: FIREXAQ_AircraftInSitu_ER2_SHIS_Data_1	AIRS, CrIS	2000m	40km

[2] This data is archived at the ASDC, within the AirMSPI collections as AirMSPI_FIREX-AQ_Terrain-projected-Georegistered_Radiance_data_6. AirMSPI is an airborne prototype instrument that has been involved in numerous sub-orbital campaigns, such as ORACLES, ACEPOL, and SEAC4RS.

The ER-2 coordinated with multiple satellite overpasses over fire/smoke including flying on and along the tracks of multiple satellites to test performance of satellite retrievals as a function of viewing angle. Table 4 below lists ER-2/satellite coordination during the campaign.

Table 4: Summary of ER-2 and Satellite Coordination

Flight Date	Satellite Name(s)	ER-2 Sampling Time (UTC)
8/2/2019	TROPOMI	21:30
8/6/2019	TERRA	19:10
	TROPOMI	20:10
	CALIPSO	21:15
	NOAA-20	21:50
8/7/2019	TROPOMI	19:50
	Terra	20:42
	TROPOMI	21:30
	Aqua	21:33
8/8/2019	METOP-A	17:30
	METOP-C	18:11
	TERRA on track	18:54
	TROPOMI	20:00
	NOAA-20 on track	20:22
	AQUA	20:38
	CALIPSO on track	20:46
	Suomi-NPP	21:40
	ICET-2 on track	20:56
	ISS (under ECOSTRESS)	N/A
8/12/2019	TERRA	18:34
8/15/2019	TERRA	19:04
	SUOMI-NPP	20:39
	TROPOMI	20:40
	AQUA	20:41
8/16/2019	TROPOMI	20:25
8/19/2020	METOP-C	17:47
8/20/2019	SUOMI-NPP	20:46
	TROPOMI	20:50
	AQUA	21:00
8/21/2019	SUOMI-NPP	20:27
	TROPOMI	20:30

NOAA Chemistry Twin Otter Observational Data Products

NOAA's Chemistry Twin Otter aircraft conducted 40 science flights during FIREX-AQ. The Chemistry Twin Otter deployment lasted from July 29 to September 5 and consisted of 91.5 flight hours. The general sampling strategy was low altitude flight segments dedicated to plume sampling. And typically completed two or three flights per day. The aircraft was based in Boise, Idaho and Cedar City, Utah, but landed and refueled in regional airports throughout the western U.S. The data products from instruments onboard the NOAA Chemistry Twin Otter include in-situ measurements of aerosol properties, trace gases, photolysis coefficients, and meteorology. These are available in time-aligned files that are organized by instrument. Most instruments report data at 1 Hz. The Chemistry Twin Otter sampled 10 identified fires. Table 5 links each flight to the names and fuel types of fires from which smoke plumes were observed. Additional collection information is available in Tables 31-35.

Table 5: Chemistry Twin Otter Fire Sampling Summary

Flight Date(s)	Fire Name(s)	Fuel Type
8/24/19, 8/25/19, 8/27/19, 8/28/19, 9/3/19, 9/4/19	204 Cow	Douglas fir, Pacific ponderosa pine/oceanspray forest
9/4/19	Canyon 66	Douglas fir, Pacific ponderosa pine/oceanspray forest
8/20/19, 8/21/19	Castle	Ponderosa pine, two-needle pinyon, Utah juniper forest
8/5/19	Goose	Sagebrush shrubland, post prescribed burn
8/9/19, 8/16/19, 8/17/19	Granite Gulch	Whitebark pine/subalpine fir forest, Douglas fir, Pacific ponderosa pine/oceanspray forest
8/9/19	HK163	Douglas fir, Pacific ponderosa pine/oceanspray forest, Ponderosa pine savanna
8/20/19, 8/21/19	Little Bear	White fir, gamble oak forest, ponderosa pine savanna
8/9/19	Nethker	Douglas fir, Pacific ponderosa pine/oceanspray forest, subalpine fir, lodgepole pine, whitebark pine, Engelmann spruce forest

Flight Date(s)	Fire Name(s)	Fuel Type
9/5/19	Smith Knob	Showy sedge, black alpine sedge grassland, Douglas fir, Pacific ponderosa/oceanspray forest

NOAA Meteorology Twin Otter Observational Data Products

NOAA's Meteorology Twin Otter aircraft also conducted plume sampling during FIREX-AQ, with the deployment spanning a month from July 15 to August 15 2019. Based in Boise, ID, flights were dedicated to characterizing the spatial structure and temporal evolution of the input wind field, the dynamics associated with plume rise, injection height and downwind transport of the plume. The aircraft flew above the plume when possible, in order to provide complete vertical coverage of dynamics and aerosol concentration throughout the plume. The data products from instruments onboard the NOAA-MET Twin Otter include remote sensing measurements of fire radiative power, wind profiles, and aerosol backscatter intensity (*information courtesy of NOAA CSL*). Information about the fires sampled by the NOAA-MET Twin Otter is listed in Table 6 below and details about the NOAA-MET Twin Otter collection are available in Table 36.

More information about the fires listed in the table can be found courtesy of the NOAA CSL: NOAA-Met Twin Otter Flight Info.

Table 6: Meteorology Twin Otter Fire Sampling Summary

Flight Date(s)	Fire Name	Fuels (inciweb, NWCG, News)
7/29/19, 7/30/19, 8/1/19	Barren Hills	Grand fir, Douglas fir forest
7/30/19	Beeskove	Douglas fir, Pacific ponderosa pine/oceanspray forest
7/29/19, 7/30/19	Crab	Subalpine fir, lodgepole pine, whitebark pine, Engelmann spruce forest
8/5/19	Goose	Sagebrush shrubland, post prescribed burn
8/7/19	Granite Gulch	Whitebark pine/subalpine fir forest, Douglas fir, Pacific ponderosa pine/oceanspray forest
8/9/19	HK163	Douglas fir, Pacific ponderosa pine/oceanspray forest, ponderosa pine savanna
8/3/19	Lizzy	Pasture/Barren

7/27/19	Milepost 97	Douglas fir, madrone-tanoak forest
8/9/19, 8/10/19, 8/11/19	Nethker	Douglas fir, Pacific ponderosa pine/oceanspray forest, subalpine fir, lodgepole pine, whitebark pine, Engelmann spruce forest
8/1/19, 8/2/19	Nevada Mountain	Douglas fir, Pacific ponderosa pine/oceanspray forest
7/26/19, 7/29/19, 8/1/19, 8/2/19, 8/3/19	Shady	Timber litter and shrubs under Douglas fir, Pacific ponderosa lodgepole pine/oceanspray forest
7/24/19	Sheep	Sagebrush shrubland with grasses

Ground Site Observational Data Products

FIREX-AQ ground sites provided continuous, surface-based measurements. Ground site data were collected from several sites within the period of 28 July to 29 August 2019. Location information is embedded in the data products. These measurements are specifically useful in assessing the impact of wildfires on the surface (nose level) through smoke and haze, which is crucial to air quality. The data products related to these ground sites are summarized in Table 21.

A ground site was established at the McCall Activity Barn at Brundage Mountain in McCall, Idaho. The McCall Activity Barn served as an important ground site during FIREX-AQ, and various buildings, vehicles, and shipping containers housed instrumentation from numerous teams at the site, such as the Aerodyne Mobile Laboratory (AML) which is detailed in the following section, the NSF Mobile Lab, and the LCSC VOC group. Additionally, the AErosol RObotic NETwork (AERONET) contributed ground site data from the Distributed Regional Aerosol Gridded Observation Network (DRAGON-FIREX-AQ 2019); data from this network are available on the NASA GSFC AERONET website.

Table 6 links ground site sampling periods to the names and fuel types of the fires from which smoke plumes were observed. This table can be used to search for data related to specific fires collected at the McCall, Idaho ground site.

Table 7: Distributed Regional Aerosol Gridded Observation Network (DRAGON) 2019 Fire Sampling Summary

Observation Date	Fire Name	Fuel Type
8/23/19, 8/24/19, 8/25/19, 8/26/19, 8/27/19, 8/28/19	204 Cow	Douglas fir, Pacific ponderosa pine/oceanspray forest
8/8/19	CCC Fire	Douglas fir, Pacific ponderosa pine/oceanspray forest
8/20/19, 8/21/19	Granite Gulch	Whitebark pine/subalpine fir forest and Douglas fir, Pacific ponderosa pine/oceanspray forest
8/10/19, 8/11/19, 8/12/19, 8/13/19, 8/14/19, 8/15/19, 8/16/19, 8/17/19, 8/19/19, 8/22/19, 8/23/19, 8/24/19	Nethker	Douglas fir, Pacific ponderosa pine/oceanspray forest, subalpine fir, lodgepole pine, whitebark pine, Engelmann spruce forest
7/25/19, 7/26/19, 7/27/19	Pipeline	Sagebrush shrubland, exotic species
7/29/19	Shady	Timber litter and shrubs under Douglas fir, Pacific ponderosa, lodgepole pine/oceanspray forest
8/4/19, 8/5/19, 8/6/19, 8/7/19, 8/8/19	Williams Flats	Ignited in primarily Idaho fescue-bluebunch wheatgrass grassland and expanded to primarily Douglas fir, Pacific ponderosa pine/oceanspray

Ground Mobile Observational Data Products

Three instrumented mobile platforms were involved in FIREX-AQ. These mobile platforms were deployed at optimal locations for plume sampling and were capable of limited plume chasing. Just as they were for ground sites, measurements from mobile platforms were used in conjunction with airborne data to provide temporal contextual information and to better assess the impact of plumes on surface air quality.

Aerodyne Research, Inc. (ARI) deployed the Aerodyne Mobile Laboratory (AML) from 6 August to 28 August 2019 from a McCall, ID base location to investigate fire-impacted valley towns. From this base, AML also traveled to more distant fires across the western portion of the FIREX-AQ campaign. Data from the AML includes a comprehensive suite of trace gas and particulate measurements. Merged AML data is reported on a 1-minute time base for all instruments, though most instruments measured at 1Hz intervals. 1Hz data is available from individual instrument PIs as indicated in the descriptive document firexaq-AMLGAS_MOBILE_QA_R1.docx, which provides information about the measurements, data, and sampling locations of AML. Table 8 outlines the fires from which plumes were observed and the fuel types of the fires. Table 28 provides details on the data collected using AML.

The Langley Aerosol Research Group Experiment (LARGE) group deployed the NASA Langley Mobile Laboratory (MACH 2) from a Boise, ID base between 21 July and 28 August 2019 sampling 8 fires in 6 states across the western domain of FIREX-AQ. MACH 2 studied aerosol and trace gas measurements related to wildfires and the interactions of aerosols and trace gases. Table 9 outlines the fires from which smoke plumes were observed and the fuel types of the fires. Table 29 provides details on the data collected from MACH 2.

The California Air Resources Board (CARB) Mobile Laboratory studied the interactions between urban and wildfire emissions in California from 15 August to 4 November 2019. Table 10 outlines the fires from which smoke plumes were observed and the fuel types of the fires. Table 27 provides details on the data collected using CARB.

FIREX-AQ's ground mobile coverage also included a mission-deployed temporary AErosol RObotic NETwork (AERONET) ground mobile laboratory. The Aerodyne Mobile Laboratory (AML) was based from McCall, ID. Additionally, AERONET deployed a mobile laboratory equipped with DRAGON instrumentation that sampled fires from 25 July through 28 August; however, the data from the DRAGON mobile laboratory is housed separately.

Navigational and locational data are embedded with other data products in this category. The data products related to ground-based mobile measurements are summarized in Tables 27-29. Tables 8-10 provide details for the fires from which smoke plumes were observed from the MACH 2, the CARB Mobile Laboratory, and the Aerodyne Mobile Laboratory. These tables can be used to search for data related to specific fires observed from the mobile laboratories.

Table 8: Aerodyne Mobile Laboratory 2019 Fire Sampling Summary by Observation Date

Observation Date	Fire Name	Fuel Type
8/25/19, 8/26/19	204 Cow	Douglas fir, Pacific ponderosa pine/oceanspray forest
8/20/19, 8/21/19, 8/22/19	Castle	Ponderosa pine, two-needle pinyon, Utah juniper forest
8/20/19, 8/21/19, 8/22/19	Ikes	Ponderosa pine, two-needle pinyon, Utah juniper forest

Observation Date	Fire Name	Fuel Type
8/9/19, 8/28/19	Nethker	Douglas fir, Pacific ponderosa pine/oceanspray forest, subalpine fir, lodgepole pine, whitebark pine, Engelmann spruce forest
8/27/19, 8/28/19	Prescribed	Prescribed understory burn, litter primarily from Douglas fir, Pacific ponderosa pine/oceanspray forest

Table 9: MACH 2 Fire Sampling Summary

Observation Date	Fire Name	Fuel Type
8/26/19, 8/27/19	204 Cow	Douglas fir, Pacific ponderosa pine/oceanspray forest
8/2/19	Black Diamond	Subalpine fir, lodgepole pine, whitebark pine, Engelmann spruce forest
8/22/19, 8/23/19	Castle	Ponderosa pine, two-needle pinyon, Utah juniper forest
8/20/19, 8/21/19	Little Bear	White fir, gamble oak forest, ponderosa pine savanna
8/9/19, 8/10/19, 8/11/19, 8/12/19, 8/14/19, 8/15/19, 8/16/19	Nethker	Douglas fir, Pacific ponderosa pine/oceanspray forest, subalpine fir, lodgepole pine, whitebark pine, Engelmann spruce forest
7/28/19, 7/29/19	Shady	Timber litter and shrubs under Douglas fir, Pacific ponderosa, lodgepole pine/oceanspray forest
7/21/19, 7/22/19, 7/25/19	Vader	Timber litter from primarily mature lodgepole pine forest

Observation Date	Fire Name	Fuel Type
8/3/19, 8/4/19, 8/5/19, 8/6/19, 8/7/19	Williams Flats	Ignited in primarily Idaho fescue-bluebunch wheatgrass grassland and expanded to primarily Douglas fir, Pacific ponderosa pine/oceanspray forest

Table 10: CARB Mobile Laboratory Fire Sampling Summary

Observation Date	Fire Name	Fuel Type
8/15/19, 8/30/19	Springs	Ponderosa pine, Jeffry pine forest

Derived Data Products:

The FIREX-AQ team generated several data products which they derived from observational data, modeling, and satellite observations. These derived products enable users to exploit the observational data products and to readily access information that is not directly available from the FIREX-AQ in-situ observations, but that are still necessary for an integrated data analysis. One of the derived data products is the DC-8 smoke flags product, which is intended to signify the sampling time of fire plumes. These flags were determined by examining the fire tracer observations, e.g., CH_3CN or CO. Plume and fire identifiers, estimated distance to fire, and fire mass combustion efficiency are also included in this derived product. The tabular summary data product lists all plume transects to link the fire origins with values such as estimated plume age, mass combustion efficiency, fuel, and other critical elements to the analysis of plume evolution and fire emissions. Given their importance, plume ages were evaluated as independent data products using model and different meteorological data.

The incorporation of satellite observations plays a major role in the analysis and location of fires and their emissions. The FIREX-AQ Fuel2Fire science team spatiotemporally subset fire locations, burned area, ecosystems, fuels, fire emissions, and SITuation and other ground-based reports (e.g., GeoMAC). A combination of satellite- and ground-based data (FCCS, MODIS, VIIRS, Planet, Sentinel, GOES-16, and GOES-17) were used to derive daily, per fire datasets for every FIREX-AQ aircraft and ground sampling domain for all platforms. For the western fires, emissions are calculated based on the Fuel Characteristic Classification System (FCCS) fuels, fire weather, and satellite data [active fire, Fire Radiative Power (FRP)]. The subset data products are given in a combination of images, maps, tables, pdfs, docs, ArcGIS spatially explicit data, and 1-second data in ICARTT format.

Individual derived products are summarized in Table 20.

Satellite Data Products:

The FIREX-AQ science team members and partners have spatiotemporally subset the VIIRS, GOES-16, and GOES-17 satellite data into the temporal FIREX-AQ aircraft sampling domain. The subset data products are given in a combination of images and numerical data. Table 30 provides a brief product description, file format, instrument, principal investigator, and affiliation for satellite data products.

Merged Data Products:

The users who worked with data from airborne field campaigns have probably used merged data products, which aggregate data files from different in-situ instruments to one file. This allows users to readily examine parameters measured by different instruments. The need for the merge files reflects that 1) different instruments often have different sampling time stamps and/or integration time periods and 2) the data from these instruments are often reported in separate data files. The merge process is to put multiple in-situ measurements from a same platform as well as aircraft navigational and attitude parameters to a common time base (i.e., merge time base). This is implemented using weighted time average of individual instrument data onto the common time base. The weighting factor estimate is based on the overlap between an instrument sampling time interval and merge time interval. The merged data products are detailed in Table 19.

General File Format Guidelines:

The two file formats most often used for remote sensing measurements and satellite data are Hierarchical Data Format (HDF) and Network Common Data Form (netCDF). HDF is a standard format for large datasets and comes in two file types: HDF4 and HDF5. The data from FIREX-AQ in HDF format are HDF5 files. HDFView can be used to browse and edit HDF files and can also be used to browse netCDF files. NetCDF supports the creation, access, and sharing of array-oriented scientific data. Both HDF and NetCDF files can be explored using the software application Panoply.

The FIREX-AQ in-situ measurement data products are most often in The International Consortium for Atmospheric Research on Transport and Transformation (ICARTT) format. The ICARTT data format is a text-based, self-describing, and simple-to-use file structure consisting of a metadata file header and a comma-separated value (CSV) data section. The file header includes variable definition, uncertainty estimate, and data reporting information, a brief measurement/instrument description and caveat, as well as a brief revision history. The ICARTT format version used for FIREX-AQ is 1.1 with additional features from ICARTT 2.0, i.e., standardized time stamp variable names and variable standard names as tags for data product variables. These variable standard names enhance the data usability and simplify the data ingest process to the permanent archive, the ASDC. ICARTT files can be opened with a preferred text or CSV file viewing software.

FIREX-AQ data products vary between using the abovementioned file formats and other formats, such as .pdf, .png, or .jpg. Tables 11 through 36 include the file format used for each dataID.

File Naming Convention:

Data File Organization:

ICARTT file naming conventions, regardless of the file format type, dictate the naming of FIREX-AQ data products. As discussed in the "File Naming Convention" sub-section below, this organizational scheme depends on a data product identifier (dataID) and a measurement platform (locationID). One data file contains the data collected during one flight or during a sampling day for ground-based operation from one or more instrument(s) operated by one instrument team, which can be identified by the instrument PI. When a data file contains data from more than one instrument, the sampling time stamps for all instruments are synchronized so that all data can be reported using a common sampling time stamp.

The data files generated from the same instrument(s) from different flights or different sampling days have consistent structure (i.e., have the same number and sequence of the variables as well as consistent variable names for these files).

File Naming Convention:

The FIREX-AQ data files adopt ICARTT naming convention:

DataID_LocationID_YYYYMMDD_R#_Description.extension

Where:

DataID: A data product identifier, e.g., a short description of measured parameter/species, instrument, or model. The dataID for FIREX-AQ data products are prefixed by "FIREXAQ", e.g., FIREXAQ-SAGA, FIREXAQ-LIF-NO

LocationID: An identifier of measurement/sampling platform, e.g., "DC8," "ER2," "Mobile," "Ground," "Analysis," or "Satellite"

YYYYMMDD: UTC sampling date when the flight takes off

R#: Revision number. The revision number will be R0, R1, R2, for the publication quality data. Note: archived files cannot be overwritten, only replaced by files with subsequent revisions

Description: Optional additional description of the file if necessary. For example:

"L1" or "L2" are the equivalent of "Launch 1" or "Launch 2"
"V1" or "V2" are the equivalent of "Volume 1" or "Volume 2"

Extension: "ict" for ICARTT files, "nc" for netCDF, and "h5" for HDF 5 files, etc.

Examples: The filename for "Water Vapor Volumetric Mixing Ratio" measurement made on August 21, 2019 DC-8 flight may be:

FIREXAQ-DLH_DC8_20190821_R0.ict

Collection Details:

FIREX-AQ measurements have been grouped into collections, also referred to as "data products". Collections for observational data products are generally organized by platform, type of variables measured, and observation type (in-situ or remote sensing). Some collections have been separated in this organizational schema by instrument where appropriate. Derived data products, satellite data products and merged data products are organized into separate collections. The organization of FIREX-AQ data by collection enables users to readily access all data necessary for a comprehensive characterization of fire plumes. The data products within these collections have been summarized in the following tables, which provide dataID (the unique identifier for each product), a description of the measured variables within the data product, the instrument(s) used, the principal investigator, their affiliation, and measurement reporting frequency (in appropriate instances). The hyperlinks associated with each collection within the following tables can be used to explore additional documentation and related information as well as to access data on Earthdata Search and the ASDC's Sub-Orbital Order Tool (SOOT)

Table 11
Collection: FIREXAQ_Aerosol_AircraftInSitu_DC8_Data_1
Platform: DC-8
Dates: 15 July – 05 September 2019

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
FIREXAQ-NOAA-LiNeph-P11-405	Scattering phase function	ICARTT	LINEPH	Variable	Adam Ahern	NOAA ESRL CSD
FIREXAQ-NOAA-LiNeph-P11-660	Scattering phase function	ICARTT	LINEPH	Variable	Adam Ahern	NOAA ESRL CSD
FIREXAQ-NOAA-LiNeph-P12-405	Scattering polarized phase function	ICARTT	LINEPH	Variable	Adam Ahern	NOAA ESRL CSD
FIREXAQ-NOAA-LiNeph-P12-660	Scattering polarized phase function	ICARTT	LINEPH	Variable	Adam Ahern	NOAA ESRL CSD
firexaq-SAGA-AERO	Aerosol water soluble composition	ICARTT	Filter/IC	~1 Hz	Jack Dibb	UNH
FIREXAQ-AMS	Aerosol Composition	ICARTT	AMS	1 Hz	Jose Jimenez	UC Boulder

FIREXAQ-AMSSD	Size resolved aerosol composition	ICARTT	AMS	Variable	Jose Jimenez	UC Boulder
firexaq-EESI	OA	ICARTT	EESI ToFMS	1 Hz	Jose Jimenez	UC Boulder
FIREXAQ-LARGE-LAScold	Size distribution	ICARTT	LAS	1 Hz	Richard Moore	NASA LaRC
FIREXAQ-LARGE-LAShot	Size distribution (heated)	ICARTT	LAS	1 Hz	Richard Moore	NASA LaRC
FIREXAQ-LARGE-OPTICAL	Scattering, absorption, fRH	ICARTT	fRH	1 Hz	Richard Moore	NASA LaRC
FIREXAQ-LARGE-SMPS	Size distribution	ICARTT	SMPS	0.02 Hz	Richard Moore	NASA LaRC
FIREXAQ-LARGE-AerosolCloudConc	Aerosol concentration, CCN	ICARTT	CPCs, LAS, SMPS, CCN	1 Hz	Richard Moore	NASA LaRC
FIREXAQ-SP2-BC-1HZ	Black carbon	ICARTT	SP2	1 Hz	Joshua Schwarz	NOAA ESRL CSD
firexaq-AOP-optical	Extinction, absorption	ICARTT	AOP	1 Hz	Nick Wagner	NOAA ESRL CSD
firexaq-AOP-UHSAS-TD	Size distribution (heated)	ICARTT	UHSAS/TD	1 Hz	Nick Wagner	NOAA ESRL CSD

FIREXAQ-SAGA-AERO-BrC	Absorption (brown carbon)	ICARTT	Filter/LWCC	Variable	Rodney Weber	Georgia Tech
FIREXAQ-SAGA-MC-BrC	Absorption (brown carbon)	ICARTT	MC/LWCC	0.01 Hz	Rodney Weber	Georgia Tech

Table 12
Collection: FIREXAQ_Cloud_AircraftInSitu_DC8_Data_1
Platform: DC-8
Dates: 22 July – 05 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
FIREXAQ-LARGE-CDP	Cloud Droplet Size distribution	ICARTT	CDP	1 Hz	Richard Moore	NASA LaRC
FIREXAQ-LARGE-CPSPD	Cloud Droplet Size distribution	ICARTT	CPSPD	1 Hz	Richard Moore	NASA LaRC
firexaq-CARE-cloudindicator	Cloud Flag	ICARTT	CAPS	1 Hz	Bernadett Weinzierl	U of Vienna
firexaq-CARE-NCoarseAerosol	Number concentration	ICARTT	CAPS	1 Hz	Bernadett Weinzierl	U of Vienna

Table 13
Collection: FIREXAQ_TraceGas_AircraftRemoteSensing_DC8_Data_1
Platform: DC-8
Dates: 15 July – 05 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
FIREXAQ-UCLA-MiniDOAS-5AVG	NO2, CH2O, HONO, SO2, O4	NetCDF	Mini-DOAS	Variable	Jochen Stutz	UCLA
FIREXAQ-UCLA-MiniDOAS	NO2, CH2O, HONO, SO2, O4	NetCDF	Mini-DOAS	Variable	Jochen Stutz	UCLA

Table 14
Collection: FIREXAQ_MetNav_AircraftInSitu_DC8_Data_1
Platform: DC-8
Dates: 15 July – 05 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
FIREXAQ-MetNav5Hz	Aircraft navigation and attitude parameters, pressure, temperature	ICARTT	LN251, TTS, Pressure Transducer	5 Hz	Melissa Yang	NSRC
FIREXAQ-MetNav	Aircraft navigation and attitude parameters, pressure, temperature	ICARTT	LN251, TTS, Pressure Transducer	1 Hz	Melissa Yang	NSRC
FIREXAQ-MMS-1HZ	Pressure, temperature, horizontal and vertical wind	ICARTT	MMS	1 Hz	Paul Bui	NASA ARC
FIREXAQ-MMS-20HZ	Pressure, temperature, horizontal and vertical wind	.zip	MMS	20 Hz	Paul Bui	NASA ARC
FIREXAQ-DLH-20Hz	$H_2O(v)$	ICARTT	DLH	20 Hz	Glenn Diskin	NASA LaRC

Table 15
Collection: FIREXAQ_JValues_AircraftInSitu_DC8_Data_1
Platform: DC-8
Dates: 15 July – 05 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
FIREXAQ-CAFS-JV	Photolytic coefficients	ICARTT	CAFS	1 Hz	Samuel Hall	NCAR ACOM

Table 16
Collection: FIREXAQ_HSRL_AircraftRemoteSensing_DC8_Data_1
Platform: DC-8
Dates: 17 July – 05 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
FIREXAQ-DIAL-IMAGES	O3, aerosol property profiles	.zip	DIAL-HSRL	N/A	Jonathan Hair	NASA LaRC
FIREXAQ-DIAL	O3, aerosol property profiles	.zip, ICARTT, HDF	DIAL-HSRL	Variable	Jonathan Hair	NASA LaRC

Table 17
Collection: FIREXAQ_TraceGas_AircraftInSitu_DC8_Data_1
Platform: DC-8
Dates: 15 July – 05 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
FIREXAQ-TOGA-VOCs	VOCs	ICARTT	TOGA	105 Hz	Eric Apel	NCAR ACOM
firexaq-UCI-WAS	VOCs	ICARTT	WAS/gc	Variable	Donald Blake	UC Irvine
FIREXAQ-CO2-7000	CO2	ICARTT	LICOR 7000	1 Hz	Glenn Diskin	NASA LaRC
FIREXAQ-CO2-7000-5Hz	CO2	ICARTT	LICOR 7000	5 Hz	Glenn Diskin	NASA LaRC
FIREXAQ-DACOM-5Hz	CO, CH4	ICARTT	DACOM	5 Hz	Glenn Diskin	NASA LaRC
FIREXAQ-DACOM	CO, CH4	ICARTT	DACOM	1 Hz	Glenn Diskin	NASA LaRC
FIREXAQ-C2H6	C2H6	ICARTT	CAMS	1 Hz	Alan Fried	UC Boulder
FIREXAQ-CH2O	CH2O	ICARTT	CAMS	1 Hz	Alan Fried	UC Boulder
FIREXAQ-NOAA-iWAS-VOCs	VOCs	ICARTT	iWAS/GC-MS	Variable	Jessica Gilman	NOAA ESRL CSD
firexaq-ISAF-CH2O-10Hz	CH2O	ICARTT	ISAF	10 Hz	Thomas Hanisco	NASA GSFC
firexaq-ISAF-CH2O-1Hz	CH2O	ICARTT	ISAF	1 Hz	Thomas Hanisco	NASA GSFC
FIREXAQ-GTCIMS-PANS	PAN, PPN, APAN, PBN	ICARTT	CIMS	1 Hz	Greg Huey	Georgia Tech

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FIREXAQ-GTCIMS-PAN-10Hz	PAN	ICARTT	CIMS	10 Hz	Greg Huey	Georgia Tech
FIREXAQ-GTCIMS-APAN-10Hz	APAN	ICARTT	CIMS	10 Hz	Greg Huey	Georgia Tech
FIREXAQ-LIF-NO-5Hz	NO	ICARTT	LIF	5 Hz	Andrew Rollins	NOAA ESRL CSD
FIREXAQ-LIF-NO	NO	ICARTT	LIF	1 Hz	Andrew Rollins	NOAA ESRL CSD
FIREXAQ-LIF-SO2-5Hz	SO2	ICARTT	LIF	5 Hz	Andrew Rollins	NOAA ESRL CSD
FIREXAQ-LIF-SO2	SO2	ICARTT	LIF	1 Hz	Andrew Rollins	NOAA ESRL CSD
firexaq-NOyO3-NO2	NO2	ICARTT	CL	1 Hz	Thomas Ryerson	NOAA ESRL CSD
firexaq-NOyO3-NO	NO	ICARTT	NOyO3	1 Hz	Thomas Ryerson	NOAA ESRL CSD
firexaq-NOyO3-NOy	NOy	ICARTT	NOyO3	1 Hz	Thomas Ryerson	NOAA ESRL CSD
firexaq-NOyO3-O3	O3	ICARTT	NOyO3	1 Hz	Thomas Ryerson	NOAA ESRL CSD
FIREXAQ-NOAACIMS-BrCl	BrCl	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-BrCN	BrCN	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-BrO	BrO	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-CH3COOCl	CH3COOCl	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD

FIREXAQ-NOAACIMS-Cl2	Cl2	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-ClNO2	ClNO2	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-HCN	HCN	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-HCOOH	HCOOH	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-HNCO	HNCO	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-HNO2	HNO2	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-HPMTF	HPMTF	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
FIREXAQ-NOAACIMS-N2O5	N2O5	ICARTT	CIMS	1 Hz	Patrick Veres	NOAA ESRL CSD
firexaq-NOAAPTR-Urban-VOCs-1Hz	VOCs	ICARTT	PTR-ToF-MS	1 Hz	Carsten Warneke	NOAA ESRL CSD
firexaq-NOAAPTR-Urban-VOCs-5Hz	VOCs	ICARTT	PTR-ToF-MS	5 Hz	Carsten Warneke	NOAA ESRL CSD
firexaq-NOAAPTR-VOCs-1Hz	VOCs	ICARTT	PTR-ToF-MS	1 Hz	Carsten Warneke	NOAA ESRL CSD

firexaq-NOAAPTR-VOCs-2Hz	VOCs	ICARTT	PTR-ToF-MS	2 Hz	Carsten Warneke	NOAA ESRL CSD
firexaq-NOAAPTR-VOCs-5Hz	VOCs	ICARTT	PTR-ToF-MS	5 Hz	Carsten Warneke	NOAA ESRL CSD
firexaq-CIT-BUTENE-HN-10Hz	Butene Hydroxynitrates	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-BUTENE-HN-1Hz	Butene Hydroxynitrates	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-BUTENE-HP-10Hz	C4 Hydroxyperoxide	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-BUTENE-HP-1Hz	C4 Hydroxyperoxide	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-ETHENE-HN-10Hz	Ethene Hydroxynitrate	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-ETHENE-HN-1Hz	Ethene Hydroxynitrate	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-ETHENE-HP-10Hz	Ethene Hydroxyperoxide	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-ETHENE-HP-1Hz	Ethene Hydroxyperoxide	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-ISOPN-10Hz	Isoprene Hydroxynitrates	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-ISOPN-1Hz	Isoprene Hydroxynitrates	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-PHENOL-10Hz	Phenol	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech

firexaq-CIT-PHENOL-1Hz	Phenol	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-PROPENE-HN-10Hz	Propene Hydroxynitrate	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-PROPENE-HN-1Hz	Propene Hydroxynitrate	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-PROPENE-HP-10Hz	Propene Hydroxyperoxide	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-PROPENE-HP-1Hz	Propene Hydroxyperoxide	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-H2O2-10Hz	H2O2	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-H2O2-1Hz	H2O2	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-HCN-10Hz	HCN	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-HCN-1Hz	HCN	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-HNO3-10Hz	HNO3	ICARTT	ToF-CIMS	10 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-HNO3-1Hz	HNO3	ICARTT	ToF-CIMS	1 Hz	Paul Wennberg	Cal Tech
firexaq-CIT-CH3OOH	CH3OOH	ICARTT	ToF-CIMS		Paul Wennberg	Cal Tech
firexaq-CIT-GLYC	Glycoaldehyde	ICARTT	ToF-CIMS		Paul Wennberg	Cal Tech
firexaq-CIT-IEPOX	IEPOX	ICARTT	ToF-CIMS		Paul Wennberg	Cal Tech

firexaq-CIT-ISOPOOH	ISOPOOH	ICARTT	ToF-CIMS		Paul Wennberg	Cal Tech
firexaq-CIT-PAA	PAA	ICARTT	ToF-CIMS		Paul Wennberg	Cal Tech
firexaq-PTRMS-HCHO-1Hz	CH2O	ICARTT	PTR-ToF-MS	1 Hz	Armin Wisthaler	U of Oslo

Table 18
Collection: FIREXAQ_Radiation_AircraftInSitu_DC8_Data_1
Platform: DC-8
Dates: 22 July – 05 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
firexaq-cafs-ActinicFluxDownwelling	Downwelling component	ICARTT	CAFS	~1 Hz	Samuel Hall	NCAR ACOM
firexaq-cafs-ActinicFluxUpwelling	Upwelling component	ICARTT	CAFS	~1 Hz	Samuel Hall	NCAR ACOM

Table 19
Collection: FIREXAQ_Merge_Data_2
Platform: DC-8
Dates: 22 July – 06 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
firexaq-mrg01-dc8_merge	1-sec merged variables	ICARTT	Multiple	Gao Chen	NASA LaRC
firexaq-mrg10-dc8_merge	10-sec merged variables	ICARTT	Multiple	Gao Chen	NASA LaRC
firexaq-mrg60-dc8_merge	60-sec merged variables	ICARTT	Multiple	Gao Chen	NASA LaRC
firexaq-mrgiWAS-dc8_merge	Merged variables to FIREXAQ-NOAA-iWAS-VOCs dataID	ICARTT	Multiple	Gao Chen	NASA LaRC
firexaq-mrgSAGAAero-dc8_merge	Merged variables to firexaq-SAGA-AERO dataID	ICARTT	Multiple	Gao Chen	NASA LaRC
firexaq-mrgSAGAMC-dc8_merge	Merged variables to firexaq-SAGA-MC dataID	ICARTT	Multiple	Gao Chen	NASA LaRC
firexaq-mrgTOGA-dc8_merge	Merged variables to FIREXAQ-TOGA-VOCs dataID	ICARTT	Multiple	Gao Chen	NASA LaRC
firexaq-mrgWAS-dc8_merge	Merged variables to firexaq-UCI-WAS dataID	ICARTT	Multiple	Gao Chen	NASA LaRC
firexaq-mrgAMS60-dc8_merge	Merged variables based on FIREXAQ-AMS60 time base	ICARTT	Multiple	Gao Chen	NASA LaRC

Table 20
Collection: FIREXAQ_Analysis_Data_1
Platform: Multiple
Dates: 24 July – 03 September 2019

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
FIREXAQ-Plume-Ratios-5hz	Plume ratios	ICARTT	DACOM, LICOR	5 Hz	Hannah Halliday	NASA LaRC
FIREXAQ-Plume-Ratios-1hz	Plume ratios	ICARTT	DACOM, LICOR	1 Hz	Hannah Halliday	NASA LaRC
FIREXAQ-FIREFLAG-TABULARDATA	Transect start stop times and associated transect-level information	.xlsx	N/A	1 Hz	Joshua Schwarz	NOAA ESRL CSD
firexaq-Fuel2Fire-TotalCarbonEmissions	Total, new, residual carbon, flaming, smoldering emissions	ICARTT	FCCS-fuel, VIIRS, GOES, MODIS, ground data	1 Hz	Amber Soja	NIA
FIREXAQ-Fuel2Fire-EcosystemsBurned	Total area burned, percent area burned	.xlsx	N/A	N/A	Amber Soja	NIA
FIREXAQ-Fuel2Fire-EasternCentralFires	Flight tracks, fire names, and images	.zip, .kmz, .xlsx	N/A	N/A	Amber Soja	NIA
FIREXAQ-Fuel2Fire-Ancillary	Ancillary data	.zip	N/A	N/A	Amber Soja	NIA

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Table 21
Collection: FIREXAQ_Ground_InSitu_Data_1
Platform: Ground-based observations
Dates: 4 June – 10 August 2019

Data ID	Key Variables	File Format	Instrument	Sampling Frequency	Principal Investigator	Institution
firexaq-GCTOF-VOC-npa	VOCs	ICARTT	GC-EI-ToF	1 Hz	Megan Claflin	Aerodyne
firexaq-GCTOF-VOC	VOCs	ICARTT	GC-EI-ToF	1 Hz	Megan Claflin	Aerodyne
firexaq-acsm	Aerosol Composition	ICARTT	ACSM	0.2 Hz	Philip Croteau	Aerodyne
firexaq-OCEC-McCall	OC, EC	ICARTT	OC/EC Analyzer	Variable	Allen Goldstein	UC Berkeley
firexaq-cTAG-McCall	OAs	ICARTT	cTAG	Variable	Allen Goldstein	UC Berkeley
firexaq-LCSC-SO2	SO2	.xlsx	PUVF	1 Hz	Nancy Johnston	LCSC ACRG
firexaq-LCSC-VOC	C15H24, C7H7Cl, C10H16, etc	.xlsx	TD-GC-MS	Variable	Nancy Johnston	LCSC ACRG
firexaq-McCallAuxandMet	Meteorology	ICARTT	Derived from McCall Airport measurements	0.2 Hz	Tara Yacovitch	Aerodyne

Table 22
Collection: FIREXAQ_MetNav_AircraftInSitu_ER2_Data_1
Platform: ER-2
Dates: 1 August – 21 August 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-MetNav	Aircraft navigation and attitude parameters	ICARTT	NASDAT	Olga Kalshnikova	JPL

Table 23
Collection: FIREXAQ_TraceGas_AircraftRemoteSensing_ER2_GCAS_Data_1
Platform: ER-2
Dates: 2 August – 21 August 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
firexaq-GCAS-CH2O	CH2O, NO2	HDF	GCAS	Scott Janz	NASA GSFC
firexaq-GCAS-HNO2	HNO2	HDF	GCAS	Scott Janz	NASA GSFC
firexaq-GCAS-NO2-C2H2O2	NO2, C2H2O2	HDF, KMZ	GCAS	Scott Janz	NASA GSFC

Table 24
Collection: FIREXAQ_AerosolCloud_AircraftRemoteSensing_ER2_CPL_Data_1
Platform: ER-2
Dates: 1 August – 21 August 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
Firexaq-CPL-L1B	Size Distribution	HDF	CPL	Matt McGill	NASA GSFC
firexaq-CPL-L2-Lay	Aerosol properties, cloud properties, mixed layer height	HDF	CPL	Matt McGill	NASA GSFC
firexaq-CPL-L2-Pro	Aerosol properties, cloud properties	HDF	CPL	Matt McGill	NASA GSFC

Table 25
Collection: FIREXAQ_TraceGas_AircraftRemoteSensing_ER2_SHIS_Data_1

Platform: ER-2
Dates: 2 August – 21 August 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
firexaq-shis-rad	Temperature, H_2O	NetCDF	SHIS	Joe Taylor	U of WI - SSEC
firexaq-shis-rtv	Temperature, H_2O	HDF, NetCDF	SHIS	Joe Taylor	U of WI - SSEC

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https://asdc.larc.nasa.gov/

Table 26
Collection: FIREXAQ_TraceGas_AircraftRemoteSensing_ER2_NASTI_Data_1
Platform: ER-2
Dates: 2 August – 21 August 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-NASTI-GP	CO, temperature, RH	NetCDF	NAST-I	Allen Larar	NASA LaRC

Table 27
Collection: FIREXAQ_SurfaceMobile_CARB_InSitu_Data_1
Platform: CARB
Dates: 15 August – 4 November 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-CARB-MC	Navigation, meteorology, trace gases, BC, aerosol absorption	ICARTT	Multiple	Shang Liu	CARB Research Division

Table 28
Collection: FIREXAQ_SurfaceMobile_Aerodyne_InSitu_Data_1
Platform: Aerodyne
Dates: 6 August – 28 August 2019

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
firexaq-AMS-AerosolChemicalLoadings	Chl, NH4, NO3, SO4, OA	ICARTT	HR ToF AMS	Edward Fortner	Aerodyne
firexaq-SPAMS-AerosolChemicalLoadings	BC, Chl, NH4, NO3, SO4, OA	ICARTT	HR ToF AMS, SP2	Edward Fortner	Aerodyne
firexaq-filter-AML	OAs	ICARTT	GC-HRToFMS, OC/EC	Allen Goldstein	UC Berkeley
firexaq-VocusPTRMS-VOC	VOCs	ICARTT	PTR ToF-MS	Francesca Maljuf	Aerodyne
firexaq-SP2BNL	BC Size distribution	ICARTT	SP2	Tim Onasch	Aerodyne
firexaq-AMLGAS	Navigation, meteorology, and trace gases	ICARTT	AMLGAS	Tara Yacovitch	Aerodyne

Table 29
Collection: FIREXAQ_SurfaceMobile_MACH2_InSitu_Data_1
Platform: MACH2
Dates: 21 July – 26 August 2019

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-MACH2-LARGE	Navigation, trace gases, aerosol properties	ICARTT	Multiple	Bruce Anderson	NASA LaRC

FIREXAQ-MACH2-LARGE-APS	Aerosol size distribution	ICARTT	APS	Bruce Anderson	NASA LaRC
FIREXAQ-MACH2-LARGE-OPS	Aerosol size distribution	ICARTT	OPS	Bruce Anderson	NASA LaRC
FIREXAQ-MACH2-SAGAAERO	Aerosol Composition	ICARTT	Filter/IC	Jack Dibb	UNH
FIREXAQ-MACH2-SAGAMC	HNO3, HONO	ICARTT	MC/IC	Jack Dibb	UNH
FIREXAQ-MACH2-RN-Isotopes	Isotopic compositions for HONO, NOx, NO2, HNO3, NO3	ICARTT	Colorimetry and IRMS	Meredith Hastings	Brown
FIREXAQ-MACH2-SpEx-ExtCoeffSpectra	Aerosol Extinction Spectrum	ICARTT	SpEx	Carolyn Jordan	NIA/NASA LaRC

Table 30
Collection: FIREXAQ_Satellite_Data_2
Platform: Satellite
Dates: 01 July – 30 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-VIIRS-SNPP-AF	Fire detection	.tar	VIIRS	Ivan Csiszar	NASA/UMD
firexaq-GOES17-images-DC8	True color still images and movies of fires	.zip	GOES	Christopher Holmes	FSU
firexaq-GOES17-data-WesternUS	True color still images and movies of fires	.zip	GOES	Christopher Holmes	FSU
firexaq-GOES16-images-DC8	True color still images and movies of fires	.zip	GOES	Christopher Holmes	FSU

firexaq-GOES16-data-WesternUS	True color still images and movies of fires	.zip	GOES	Christopher Holmes	FSU
firexaq-GOES16-data-EasternUS	True color still images and movies of fires	.zip	GOES	Christopher Holmes	FSU
FIREXAQ-GOES17-FDCC	Fire detection	.tar	GOES	Chris Schmidt	
FIREXAQ-GOES16-FDCC	Fire detection	.tar	GOES	Chris Schmidt	

Table 31
Collection: FIREXAQ_TraceGas_AircraftInSitu_N48_Data_1
Platform: NOAA-CHEM Twin Otter
Dates: 29 July – 06 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-GCGCTOFMS	VOCs	ICARTT	Tenax cartridge autosampler	Kelley Barsanti	UC-Riverside
FIREXAQ-COCO2CH4	CO, CO2, CH4, H2O	ICARTT	Picarro CRDS	Michael Robinson	NOAA ESRL
FIREXAQ-UWCIMS	Acids, Acid gases, Oxygenated organics, Organic nitrates, Halogens	ICARTT	I-ToF CIMS	Joel Thornton	UW
FIREXAQ-NONO2O3	NO, NO2, O3	ICARTT	Chemiluminescence	Andy Weinheimer	NCAR/UCAR

Table 32
Collection: FIREXAQ_Aerosol_AircraftInSitu_N48_Data_1
Platform: NOAA-CHEM Twin Otter
Dates: 15 July – 05 September 2019

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-UHSAS	Aerosol Size Distributions	ICARTT	UHSAS	Alessandro Franchin	NCAR/UCAR
FIREXAQ-CLAP	Absorption Coefficient	ICARTT	CLAP	Alessandro Franchin	NCAR/UCAR
FIREXAQ-AMS	Non-refractory PM1 aerosol composition	ICARTT	AMS	Ann Middlebrook	NOAA ESRL CSD
FIREXAQ-BrCPILS	Aerosol WSOC Concentration	ICARTT	Brown Carbon PiLS	Rebecca Washenfelder	NOAA ESRL CSD
FIREXAQ-PILSOffline	Particle Composition	ICARTT	Brown Carbon PiLS	Cora Young	York University

Table 33
Collection: FIREXAQ_MetNav_AircraftInSitu_N48_Data_1
Platform: NOAA-CHEM Twin Otter
Dates: 29 July – 06 September 2019

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-FlightData	Altitude, latitude, longitude	ICARTT	ARIM200 Digital Air Probe	Michael Robinson	NOAA ESRL

Table 34
Collection: FIREXAQ_Analysis_N48_Data_1
Platform: NOAA-CHEM Twin Otter
Dates: 29 July – 06 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-FSU-smokeage	Smoke age estimates	ICARTT	N/A	Christopher Holmes	FSU

Table 35
Collection: FIREXAQ_jValue_AircraftInSitu_N48_Data_1
Platform: NOAA-CHEM Twin Otter
Dates: 29 July – 07 September 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-jNO2	NO2 photolysis rates	ICARTT	Filter radiometers	Michael Robinson	NOAA ESRL

Table 36
Collection: FIREXAQ_N46_Data_1
Platform: NOAA-CHEM Twin Otter
Dates: 23 July – 14 August 2019

EARTHDATA

Data ID	Key Variables	File Format	Instrument	Principal Investigator	Institution
FIREXAQ-MicroDop02-Vert	Vertical Wind Profiles	NetCDF-3	Micropulse Dopper lidar	Alan Brewer	NOAA ESRL

FIREXAQ-MicroDop02-wProf	Wind Profiles	NetCDF-3	Micropulse Dopper lidar	Alan Brewer	NOAA ESRL
FIREXAQ-FireTemp	Fire Temperature	ICARTT	NightFOX UAS	Ru-Shan Gao	NOAA ESRL

Acknowledgements:

The ASDC gratefully acknowledges members of the FIREX-AQ science team for their feedback provided on this user guide and for their contributions during the revision process.

Resources:

References:

FIREX-AQ Overview Paper
ASDC FIREX-AQ Landing Page
Earthdata Search FIREX-AQ Collections
ESPO Project Homepage
FIREX-AQ NOAA Landing Page
Atmospheric Composition Variable Standard Name Recommendations
ICARTT File Format V2.0
ADMG Airborne and Field Data Inventory Definitions

Relevant Publications:

The ranges of the DC-8 and Twin Otter aircraft are explained in the FIREX-AQ whitepaper. Additional information about the background of the mission and initial intentions for the mission are available in the whitepaper as well.

Warneke, C., Schwarz, J. P., Ryerson, T., Crawford, J., Dibb, J., & Lefer, B. (2018). Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ): A NOAA/NASA Interagency Intensive Study of North American Fires. Retrieved from https://csl.noaa.gov/projects/firex-aq/whitepaper.pdf

Related data:

FASMEE
FIREX Fire Lab 2016
Joint Fire Science Program's Fire Western Wildfire Campaign
NOAA FIREX-AQ Data
Sectoral Applications Research Program (SARP) (NOAA website)
Satellite instruments that support FIREX-AQ (NOAA website)
WE-CAN 2018

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Project Points of Contact:
Users are encouraged to contact instrument and science team PIs, who are outlined in Tables 11 through 28, for additional information.
Earthdata Forum: https://forum.earthdata.nasa.gov/viewforum.php?f=7

Acronym List:

Key:
Instrument/Instrument Group Acronyms
General Acronyms

ACES	Active Sensing of CO2 Emissions over Nights, Days, and Seasons (ASCENDS) CarbonHawk Experiment Simulator
ACSM	Aerosol Chemical Speciation Monitor
AERONET	AErosol RObotic NETwork
AirMSPI	Airborne Multi-angle SpectroPolarimeter Imager
AMLGAS	Aerodyne Mobile Laboratory Position, Wind, and Gas-Phase Tracers
AMS	Aerosol Mass Spectrometer
AOP	In-Situ Measurements of Aerosol Optical Properties
APS	Aerosol Particle Sizer
ASDC	Atmospheric Science Data Center at NASA LaRC
AVIRIS	Airborne Visible/Infrared Imaging Spectrometer
CAMS	Compact Atmospheric Multispecies Spectrometer
CANOE	Compact Airborne NO2 Experiment
CAFS	NCAR CCD Actinic Flux Spectroradiometers
CAPS	Cloud, Aerosol and Precipitation Spectrometer
CARB-MC	California Air Resources Board Ground Mobile Measurement Platform
CARE	Cloud, Aerosol, and Refractive Index Experiment
CIMS	Chemical Ionization Mass Spectrometer
CLAP	Continuous Light Absorption Photometer
CPL	Cloud Physics Lidar
CRDS	Cavity Ring-Down Spectroscopy
CSL	Chemical Sciences Laboratory
CTAG	Comprehensive Thermal Desorption Aerosol Gas Chromatograph
DACOM	Differential Absorption Carbon monOxide Measurement
DC-8 (platform)	Douglas Commercial 8

DIAL	Differential Absorption Lidar
DLH	Diode Laser Hygrometer
DOAS	Differential Optical Absorption Spectrometer
DOE BNL	Department of Energy Brookhaven National Laboratory
DOI	Digital Object Identifier
EESI-ToF-MS	CU Aircraft Extractive Electrospray Time-of-Flight Mass Spectrometer
eMAS	Enhanced MODIS Airborne Simulator
ER-2 (platform)	Earth Resources 2
ESRL	Earth System Research Laboratories
FCCS	Fuel Characteristic Classification System
FIREX-AQ	Fire Influence on Regional to Global Environments and Air Quality
GCAS	Geostationary Coastal and Air Pollution Events (GEO-CAPE) Airborne Simulator
GC-EI-ToF	Gas Chromatograph Electron Impact Mass Spectrometer
GC-HRToFMS	Two-Dimensional Gas Chromatograph High-Resolution Time-of-Flight Mass Spectrometer
HR ToF AMS	High-Resolution Time-of-Flight Aerosol Mass Spectrometer
HSRL	High Spectral Resolution Lidar
I-ToF CIMS	Iodide Ion Time-of-Flight Chemical Ionization Mass Spectrometer
ICARTT	International Consortium for Atmospheric Research on Transport and Transportation
ISAF	In Situ Airborne Formaldehyde
IWAS	NOAA Improved Whole Air Sampler
LARGE	Langley Aerosol Research Group Experiment
LCSC	Lewis-Clark State College
LGR	Los Gatos Research Gas Analyzers
LIF	Laser Induced Fluorescence
LINEPH	NOAA Laser Imaging Nephelometer
LWCC	Liquid Waveguide Capillary Cell
MMS	Meteorological Measurement System
NASA	National Aeronautics and Space Administration
NASA AFRC	NASA Armstrong Flight Research Center
NASA ARC	NASA Ames Research Center
NASA GSFC	NASA Goddard Space Flight Center
NASA JPL	NASA Jet Propulsion Laboratory
NASA LaRC	NASA Langley Research Center
NASDAT	NASA Airborne Science Data and Telemetry System
NAST-I	National Airborne Sounder Testbed - Interferometer
NCAR	National Center for Atmospheric Research
NCAR ACOM	NCAR Atmospheric Chemistry Observations & Modeling Laboratory
NIA	National Institute of Aerospace
NOAA	National Oceanic and Atmospheric Administration
NOAA CSL	NOAA Chemical Sciences Laboratory
NOAA ESRL	NOAA Earth System Research Laboratories

NOyO3	NOAA Nitrogen Oxides and Ozone
NSRC	National Sub-Orbital Research Center
OC/EC	Organic Carbon/Elemental Carbon Analyzer
ORNL	Oak Ridge National Laboratory
OPS	Optical Particle Sizer
PAM	Potential Aerosol Mass
PI	Principal Investigator
PiLS	Particle Into Liquid Sampler
PTR-ToF-MS	Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer
RN	Reduced Nitrogen
ROZE	NASA Rapid Ozone Experiment
SAGA	Soluble Acidic Gases and Aerosols
SHIS	Scanning High-Resolution Interferometer Sounder
SMPS	Scanning Mobility Particle Sizer
SOOT	Sub-Orbital Order Tool
SP2	Single Particle Soot Photometer
SPAMS	Single-Particle Aerosol Mass Spectrometer
SpEx	Spectral Aerosol Extinction Monitor
SSEC	University of Wisconsin Space Science and Engineering Center
TD-GC-MS	Thermal Desorption Gas Chromatograph Mass Spectrometer
TOGA	Trace Organic Gas Analyzer
UAS	Uncrewed Aerial System
UCAR	University Corporation for Atmospheric Research
UCI WAS	University of California Irvine Whole Air Sampler
UHSAS	Ultra-High Sensitivity Aerosol Spectrometer
UNH	University of New Hampshire