

The Alpha Jet Atmospheric eXperiment Data Product User Guide



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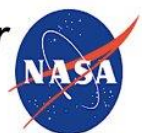


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Introduction:

The Alpha Jet Atmospheric eXperiment (AJAX) was a partnership between NASA's Ames Research Center and H211, L.L.C. Beginning in 2011, AJAX facilitated routine in-situ measurements over multiple seasons collecting data over California, Nevada, and the coastal Pacific. All data files available in the AJAX collections are in the ICARTT (.ict) file format, which can be easily opened in basic text editors such as Notepad, Microsoft Excel, or can be opened similarly to a Comma-Separated Values (.CSV) file in many programming languages. This user guide aims to allow users, both new and experienced, to better understand the AJAX campaign and its data, promote data access, and make the data more accessible to a wider audience.

Disclaimer: Please follow any stipulations on use provided by instrument Principal Investigators in the data files prior to data use.

Citation:

[Cite ASDC Data](#)

[DOI Citation Formatter](#)

Campaign Level DOI:

<https://doi.org/10.5067/ASDC/SUBORBITAL/AJAX/DATA001>

Campaign Overview:

AJAX facilitated routine in-situ measurements over California, Nevada, and the coastal Pacific in support of satellite validation. The standard payload complement included rigorously calibrated ozone (O₃), formaldehyde (HCHO), carbon dioxide (CO₂), and methane (CH₄) mixing ratios, as well as meteorological data including 3D winds. Multiple vertical profiles (to ~8.5 km) could be accomplished in each 2-hour flight. AJAX collected trace gas data on a regular basis in all seasons for nearly a decade, helping to assess satellite sensors' health and calibration over significant portions of their lifetimes, and complementing surface and tower-based observations collected elsewhere in the region.

AJAX supported NASA's Orbiting Carbon Observatory (OCO-2/3) and Japan's GOSAT and GOSAT-2, and collaborated with many other research organizations including NOAA, CARB, USFS, and the EPA. AJAX celebrated its 200th science flight in 2016, and studies have investigated topics as varied as stratospheric-to-tropospheric transport, forest fire plumes, atmospheric river events, long-range transport of pollution from Asia to the western US, urban outflow, and emissions from gas leaks, oil fields, and dairies.



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AJAX had several flight objectives listed in the following table:

CABOTS	In support of CARB's California Baseline Ozone Transport Study (Summer 2016)
CentralValley	Boundary layer measurements in California's Central Valley
DAQ	Focused on the boundary layer over Central California during DISCOVER-AQ field campaign (Jan-Feb 2013)
Fire	Sampling influenced by one or more fires, usually wildfires
O&G	Sampling over known oil and/or gas infrastructure
Offshore	Sampling off the California coast, does not include vertical profile
On/Off	At least one vertical profile over land and at least one offshore (>5 km)
Profile	Spiral vertical profile from ~8 km to surface
RRV	Vertical profile over Railroad Valley, NV (elev. ~1.4 km), usually coordinated with GOSAT overpass
SanBernardinoWestMojave	Boundary layer measurements in the San Bernardino Mountains and/or west Mojave Desert regions
SFBayArea	Boundary layer measurements in the San Francisco Bay Area
TCCON	Vertical profile over TCCON instrument at NASA's Armstrong Flight Research Center (formerly Dryden)
THD	Vertical profile near Trinidad Head observatory, usually coordinated with NOAA ozonesonde
UrbanOutflow	Boundary layer measurements around Sacramento, CA
VPOcean	Vertical profile over ocean, with top altitude \geq ~5 km

The relevant flight objectives are indicated in each file and are a searchable field in the Flight Catalog described below.



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Data Products:

Once the user downloads a data file, a “README” file may be available that gives details on how to open, read, and use the data. Further resources are available on the landing page of each collection in the “Resources and Documentation” section. Note: accessing/downloading data requires a free Earthdata Login account.

ICARTT file naming conventions dictate the naming of AJAX data files. 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, in this case ALPHA). One data file contains the data collected during one flight.

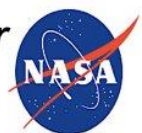
Per the NASA Airborne Data Management Group (ADMG) a data product is “a logically meaningful group of data with the same basic characteristics (instrument source or class of source, processing level, resolution, etc.) but may have multiple variables.” Data products are commonly referred to as collections and represent items that are listed on Earthdata Search and are typically assigned data product DOIs when they are publicly released. There are four data products within the AJAX collection, one for each instrument in the payload, as shown in the table below. Within a data product is what is referred to in this user guide as a granule, or an individual data file that can be accessed and downloaded. Granules, or data files, contain the data collected during a particular flight.

When using Earthdata Search to look up granules, it is important to note a few “wildcards” on the website. When looking up granules in specific collections, these wildcards are meant to let Earthdata Search know what exactly the user is looking for. The two wildcards are the asterisk (*) and the question mark (?). An asterisk would be used to search exact characters. For example, typing “*20230623*” into the search bar would return granules that have “20230623” in their name. The question mark is used to match exactly one character in a search. For example, to search for a granule in all days of a month or every revision of a granule, replace a character with a “?”. For example, to search for a granule in the year 2018, use the string “*2018????*”. This would have Earthdata Search pull up granules within the year 2018 with all available months and days.

In addition to the release of the entire data set, a Compendium focusing on emissions sampled by AJAX in and around 12 wildfires and 1 prescribed fire event in California between 2013 and 2017 has been assembled and is available at DOI: [10.5067/ASDC/AJAX/wildfire](https://doi.org/10.5067/ASDC/AJAX/wildfire). This Compendium has been described in a publication in the journal *Earth and Space Science* as part of the American Geophysical Union’s Fire in the Earth System Special Collection and is linked in the Resources section below. Additionally, a peer-reviewed manuscript described the entire AJAX dataset was published in 2023 and is also linked in the Resources section below.



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File Naming Convention:

The AJAX data files adopt ICARTT naming conventions:

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 AJAX data products are prefixed by "AJAX", e.g., AJAX-CH₂O, AJAX-O₃

LocationID: An identifier of measurement/sampling platform, e.g., "ALPHA"

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. Letter revisions, such RA, RB, etc. indicate data that is preliminary and not suitable for use in publications or scientific analyses.

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

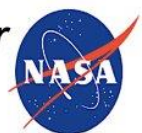
"L1" or "L2" are the equivalent of "Launch 1" or "Launch 2"

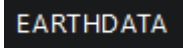
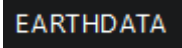
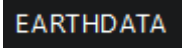
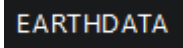
"V1" or "V2" are the equivalent of "Volume 1" or "Volume 2"

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



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	AJAX_CH2O_1	AJAX_CO2CH4_1	AJAX_MMS_1	AJAX_O3_1
Data ID	AJAX-CH2O	AJAX-CO2CH4	AJAX-MMS	AJAX-O3
DOI	10.5067/ASDC/AJAX_CH2O	10.5067/ASDC/AJAX_CO2_CH4	10.5067/ASDC/AJAX_MMS	10.5067/ASDC/AJAX_O3
Date	12 December 2015 – Present	11 June 2011 – Present	20 June 2013 – Present	1 Feb 2011 - Present
Key Variables	Formaldehyde (CH ₂ O)	Carbon dioxide (CO ₂), Methane (CH ₄), Water Vapor (H ₂ O)	U, V, and W Wind Speeds, Potential Temperature, GPS Position	Ozone (O ₃)
File Format	ICARTT	ICARTT	ICARTT	ICARTT
Instrument	COFFEE (COmpact Formaldehyde Fluorescence Experiment)	Picarro CRDS (model 2301-m, SN:634-CFDDS2120), GPS from Qstar tracker	Meteorological Measurement System (MMS)	2B Technologies, model 205, S/N: 734, GPS from Qstar tracker
Sampling Frequency	1Hz	Variable	1Hz	Variable
Principal Investigator	Thomas Hanisco	Laura Iraci	Paul Bui	Emma Yates
Institution	NASA Goddard Space Flight Center	NASA Ames Research Center	NASA Ames Research Center	NASA Ames Research Center
Data on Earthdata Search				



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Data on the Sub-Orbital Order Tool (SOOT):

Here is where to find the AJAX data on SOOT, an ASDC tool designed to promote suborbital data discovery, research, and analysis:



Searchable Flight Catalog

The ASDC and AJAX science team collaborated on a Searchable Flight Catalog, which includes flight dates, flight numbers, indications as to which measurements were taken on each flight date, and the flight objectives. There is an “All Files” section with access to flight analysis documents and ICARTT text files. You will need an Earthdata Login account to access the ICARTT files. There is more information and in-depth demonstrations of the flight catalog in the AJAX Flight Catalog StoryMap, linked in the Resources section below.

Acknowledgments:

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

Resources:

[AJAX Landing Page at the ASDC](#)

[AJAX Project Website](#)

[AJAX on Earthdata Search](#)

[AJAX on Direct Data Download \(DDD\)](#)

[AJAX on the Sub-Orbital Order Tool \(SOOT\)](#)

[Earthdata Forum](#)

[AJAX Data in Action StoryMap](#)

[Dr. Laura Iraci Researcher Profile](#)

[AJAX Flight Catalog at the ASDC](#)

[AJAX Flight Catalog StoryMap](#)

[ICARTT Documentation](#)



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Iraci L T, Yates E L, Marrero J E, Parworth C L, Ryoo J-M, and Tanaka T. 2021. *Compendium of Airborne Trace Gas Measurements Collected in an around California Fire Plumes by the AJAX Project*, Atmospheric Science Data Center, initial release, DOI: [10.5067/ASDC/AJAX/wildfire](https://doi.org/10.5067/ASDC/AJAX/wildfire)

Iraci L T, Parworth C L, Yates E L, Marrero J E, and Ryoo J-M. 2022. *A Collection of Airborne Measurements and Analyses of Trace Gases Emitted from Multiple Fires in California*, Earth and Space Science, Vol 9, e2021EA002116, <https://doi.org/10.1029/2021EA002116>

Yates, E. L., Iraci, L. T., Kulawik, S. S., Ryoo, J.-M., Marrero, J. E., Parworth, C. L., St. Clair, J. M., Hanisco, T. F., Bui, T. P. V., Chang, C. S., and Dean-Day, J. M.: *An extensive database of airborne trace gas and meteorological observations from the Alpha Jet Atmospheric eXperiment (AJAX)*, Earth Syst. Sci. Data, vol 15, 2375–2389, <https://doi.org/10.5194/essd-15-2375-2023>, 2023.

Acronym List:

Short Name:	Long Name:
AJAX	Alpha Jet Atmospheric Experiment
ARC	Ames Research Center
ASDC	Atmospheric Science Data Center
CARB	California Air Resources Board
COFFEE	COmpact Formaldehyde FluorescencE Experiment
CRDS	Cavity Ring-Down Spectroscopy
EPA	United States Environmental Protection Agency
GOSAT/GOSAT-2	Greenhouse gases Observing SATellite (2)
GPS	Global Positioning System
ICARTT	International Consortium for Atmospheric Research on Transport and Transportation
MMS	Meteorological Measurement System
NOAA	National Oceanic and Atmospheric Administration
OCO-2/3	Orbiting Carbon Observatory
PI	Principal Investigator
USFS	United States Department of Agriculture Forest Services



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