# ATom: Aircraft Flight Track and Navigational Data

## Get Data

Documentation Revision Date: 2018-09-04

Data Set Version: 1

## Summary

This dataset provides flight track and aircraft navigation data from the NASA Atmospheric Tomography Mission (ATom). Flight track information is available for the four ATom campaigns: ATom-1, ATom-2, ATom-3, and ATom-4. Each ATom campaign consists of multiple individual flights and flight navigational information is recorded in 10-second intervals. Data available for each flight includes research flight number, date, and start and stop time of each 10-second interval. In addition, latitude, longitude, altitude, pressure and temperature is included at each 10-second interval. NASA's ATom campaign deploys an extensive gas and aerosol payload on the NASA DC-8 aircraft for systematic, global-scale sampling of the atmosphere, profiling continuously from 0.2 to 12 km altitude. Flights occurred in each of 4 seasons from 2016 to 2018. During each campaign, flights originate from the Armstrong Flight Research Center in Palmdale, California, fly north to the western Arctic, south to the South Pacific, east to the Atlantic, north to Greenland, and return to California across central North America. ATom establishes a single, contiguous, global-scale dataset. One intended use of this flight track data is to facilitate to mapping model results from global models onto the precise ATom flight tracks for comparison.

This dataset contains 8 data files; 4 comma delimited (*.csv), and 4 keyhole markup language (*.kml) files. The csv and KML files contain the same data with the exception of the csv files providing metadata information in the header of the file.

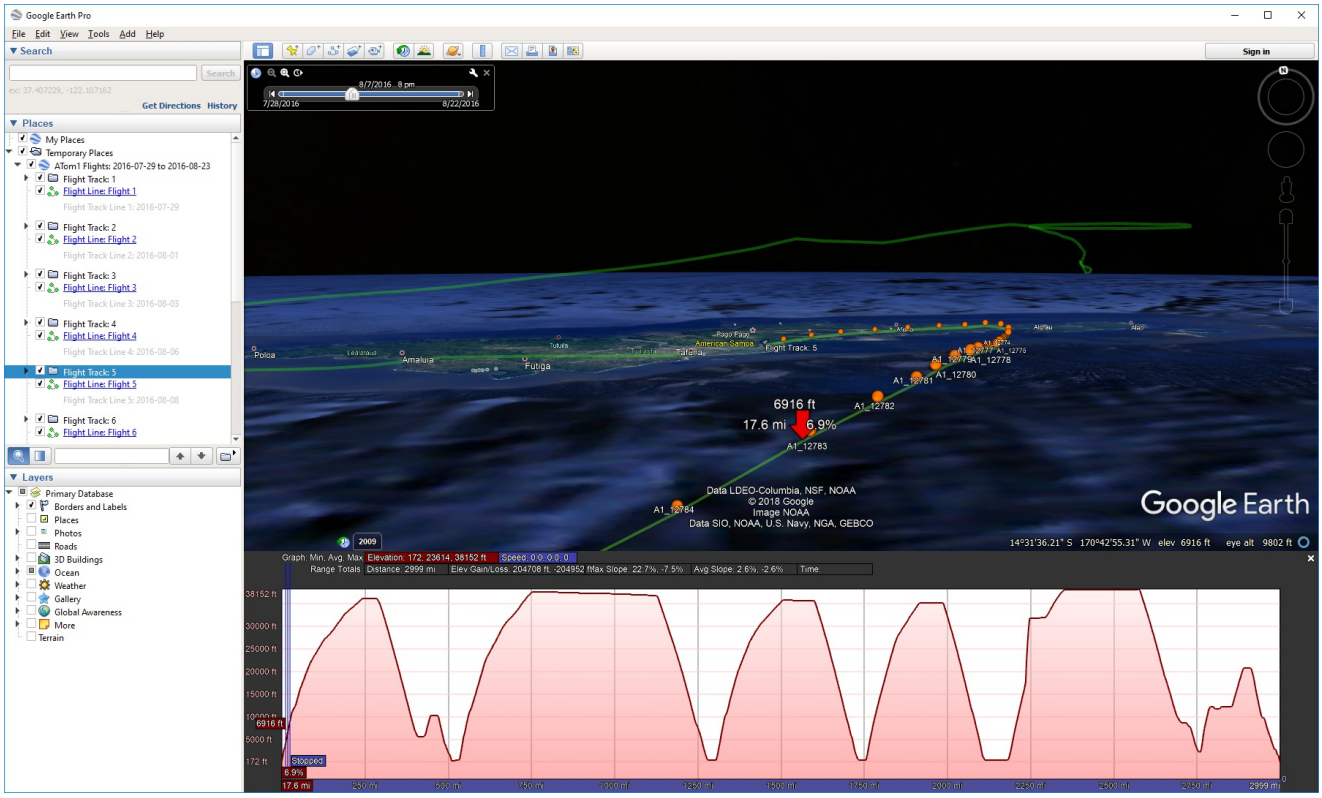


Figure 1: Flight tracks KML file displayed in Google Earth showing part of the flight path and 10 second interval points for Flight 5 flown on August 8, 2016 of the ATom-1 campaign. The elevation profile of the entire flight is shown on the bottom pane.

## Citation

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## Table of Contents



## 1. Data Set Overview

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**Project:** Atmospheric Tomography Mission (ATom)

The Atmospheric Tomography Mission (ATom) is a NASA Earth Venture Suborbital-2 mission. It will study the impact of human-produced air pollution on greenhouse gases and on chemically reactive gases in the atmosphere. ATom deploys an extensive gas and aerosol payload on the NASA DC-8 aircraft for systematic, global-scale sampling of the atmosphere, profiling continuously from 0.2 to 12 km altitude. Flights will occur in each of 4 seasons over a 4-year period.

## 2. Data Characteristics

**Spatial Coverage:** Flights begin in California, fly north to the western Arctic, south to the South Pacific, east to the southern Atlantic, north to Greenland, and return to California across central North America.

**Spatial Resolution:** Point measurements

**Temporal Coverage:** Periodic flights occurred during each deployment.

ATom flight deployment schedule:

| Deployment | Date Range |
|---|---|
| ATom-1 | July 29 - August 23, 2016 |
| ATom-2 | January 26 - February 21, 2017 |
| ATom-3 | September 28 - October 26, 2017 |
| ATom-4 | April 24 - May 21, 2018 |

**Temporal Resolution:** Each navigation point is presented every 10-seconds.

**Data File Information:**

This dataset contains 8 data files; 4 comma delimited (*.csv), and 4 keyhole markup language (*.kml) files. The csv and KML files contain the same data with the exception of the csv files providing several rows of metadata information in the header of the file. There is one csv and one kml file per campaign (ATom-1, 2, 3 & 4), and within a campaign file, the individual flights are indicated by the Research Flight Number.

**File Naming Conventions:**

Naming conventions are the same for both file formats. Files are indicated by each ATom# campaign, where # is 1, 2, 3, or 4.

**Data Variables:**

| Variable | Description | Units |
|---|---|---|
| Index | Index A# [sequence number], where #= 1, 2, 3, 4 | |
| RF | Research Flight number | |
| YYYYMMDD | Starting date of a flight in UTC time | Date as YYYYMMDD |
| UTC_Start | Start time of interval UTC seconds from midnight on YYYYMMDD (may exceed 86400, does not roll after midinght) | |
| UTC_Stop | End time of interval (10s nominal) UTC seconds from midnight on YYYYMMDD | |
| Latitude | Latitude | degree (GPS data from MMS) |
| Longitude | Longitude | degree (GPS data from MMS) |
| Altitude | Altitude | m above mean sea level (MASL; GPS data from |

| | | |
|---|---|---|
| | | MMS) |
| P | Pressure | hPa (Static pressure from MMS) |
| T | Temperature | K (Static temperature from MMS) |
| CumDist | Cumulative ground track distance | km, for each ATom deployment |

## 3. Application and Derivation

ATom builds the scientific foundation for mitigation of short-lived climate forcers, in particular methane (CH4), tropospheric ozone (O3), and Black Carbon aerosols (BC).

**ATom Science Questions:**

**Tier 1**

- What are chemical processes that control the short-lived climate forcing agents CH4, O3, and BC in the atmosphere? How is the chemical reactivity of the atmosphere on a global scale affected by anthropogenic emissions? How can we improve chemistry-climate modeling of these processes?

**Tier 2**

- Over large, remote regions, what are the distributions of BC and other aerosols important as short-lived climate forcers? What are the sources of new particles? How rapidly do aerosols grow to CCN-active sizes? How well are these processes represented in models?
- What type of variability and spatial gradients occur over remote ocean regions for greenhouse gases (GHGs) and ozone depleting substances (ODSs)? How do the variations among air parcels help identify anthropogenic influences on photochemical reactivity, validate satellite data for these gases, and refine knowledge of sources and sinks?

**Significance**

ATom delivers unique data and analysis to address the Science Mission Directorate objectives of acquiring “datasets that identify and characterize important phenomena in the changing Earth system” and “measurements that address weaknesses in current Earth system models leading to improvement in modeling capabilities.” ATom will provide unprecedented challenges to the CCMs used as policy tools for climate change assessments, with comprehensive data on atmospheric chemical reactivity at global scales, and will work closely with modeling teams to translate ATom data to better, more reliable CCMs. ATom provides extraordinary validation data for remote sensing.

## 4. Quality Assessment

None provided for the navigational data.

## 5. Data Acquisition, Materials, and Methods

**Project Overview:**

ATom makes global-scale measurements of the chemistry of the atmosphere using the NASA DC-8 aircraft. Flights span the Pacific and Atlantic Oceans, nearly pole-to-pole, in continuous profiling mode, covering remote regions that might have been regarded as pristine 20 years ago but today receive long-range inputs of pollution from expanding industrial economies. The payload has proven instruments for in situ measurements of reactive and long-lived gases, diagnostic chemical tracers, and aerosol size, number, and composition, plus spectrally resolved solar radiation and meteorological parameters.

## 6. Data Access

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

ATom: Aircraft Flight Track and Navigational Data

Contact for Data Center Access Information:

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

## 7. References