

University of North Dakota Cessna Citation GCPEX Data Set

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1. The University of North Dakota (UND) Cessna Citation aircraft was the in situ platform for the GCPEX campaign. The Citation carried a suite of instruments for measurements of cloud microphysics, state of the atmosphere parameters, bulk aerosol, three-dimensional winds, and turbulence. The Citation flew 12 data missions, which totaled 38.4 flight hours. The data are stored as a separate file for each flight, with a primary (*.gcpex) file containing both direct and derived parameters. In a different data set, separate files were archived that contain particle size spectra for the imaging probes (processed by NCAR). Raw data files for each cloud instrument are also being archived to allow investigators who wish to use their own processing software.

2. Brief Description of Instrument and Function

State Parameters

Total Temperature probe – flight level temperature

Pressure Transducer – flight level pressure

Cooled Mirror Hygrometer – dew/frost point

Laser Hygrometer – dew/frost point temperature

Winds, Turbulence

Gust Probe – airspeed, angles of attack and sideslip

Pitot Tube – airspeed, turbulence

Cloud Imaging, Sizing

CDP – cloud droplet concentration and size

PMS 2DC – cloud particle imaging probe

Cloud Imaging Probe (CIP) – cloud particle imaging probe

CPI – small cloud particle imaging probe

HVPS-3 – precipitation particle imaging probe

Water

King Probe – liquid water content

Nevzorov Probe – liquid water, total water content

Rosemount Icing Detector – supercooled liquid water presence and content

Aerosol

CPC – condensation particle counter

Aircraft

Applanix – inertial platform with integrated GPS

3. There are no restrictions on access or use of these data.

4. Documentation related to the data files is stored in the '/flight_summaries/doc' directory. Data files are stored in three main sub-directories, 'Raw', '/data/browse' and '/data/QC_Processed'. The 'Raw' directory contains the raw data files recorded by data systems onboard the Citation aircraft. The 'browse' directory contains cloud particle images. The 'QC_Processed' directory contains processed files which contain parameters derived from the raw data files. Under each of these main directories are flight sub-directories.

Flight sub-directories are named based on the UTC data and time using the 'YYYYMMDD_hhmiss' format, where 'YYYY' represented the four digit year, 'MM' the two digit month, 'DD' the two digit day, 'hh' the two digit hour, 'mi' the two digit minute, and 'ss' the two digit second of when the M300 data system on the Citation started taking data for that flight (these definition are use throughout this document). Each flight has one unique flight sub-directory name, common to all three main directories. Note that there can be more than one flight per day and hence two flight sub-directories on one day. The data set contains only research flights and not ferry flights, etc. Below are the 12 flight IDs for the project.

20120119_144804 20120127_015533 20120128_154901 20120130_224015 20120212_030055
20120212_234037 20120214_163121 20120216_142427 20120218_094352 20120218_153846
20120224_113408 20120224_164010

Raw

Under the 'Raw' directory, within the flight sub-directories, are all the unprocessed data files related to that flight. The file suffixes for files within these sub-directories are listed below, grouped by the data systems used to record measurements.

- **M300 Data System** – Recorded data from all of the Citation's research probes except the HVPS and 2DC.
 - *.sea – One file per flight, unless the data system was restarted during the flight. File name prefix defines the UTC start date and time for data within the file using the YY_MM_DD_hh_mi_ss convention. For file format information, see the Science Engineering and Associates (SEA) model M300 data system manual.
- **CPI Data System** – Recorded data from the SPEC Inc. Cloud Particle Imager (CPI).
 - *.roi – Multiple files per flight. File suffix defines the UTC start date and time for data within the file using the MMDDhhmi naming convection. For file format information, see the SPEC Inc. CPI manual.
- **HVPS Data System** – Recorded data from the SPEC Inc. High Volume Spectrometer Probe (HVPS) – Version 3 instrument.
 - *.HVPS, spec2d.ini, Spec2ds.log – Several *.HVPS files per flight. For file naming convention and format information, see the SPEC Inc. HVPS3 manual.

Browse

Under the 'Browse' directory, and within the flight sub-directories, are image files (png format) from the Cloud Particle Imager (CP*.png).

QC_Processed

Under the 'QC_Processed' directory, and within the flight sub-directories, are the processed data in text files. These files all use the UND-NASA-AMES format which is fully illustrated in Appendix A of Delene, 2011. The UND-NASA-AMES format contains a meta-data header that describes the parameters in each file, the units of the parameters, the missing value codes used, etc. Following the meta-data header, is a space delimited list of parameters. The first parameter in the list is the UTC time of the measurement in the format of seconds-from-midnight on the day the aircraft flight started. Data frequency is 1 Hz; however, files may contain gaps due to instrument problems. File name prefix defines the UTC start date and time for data within the file using the YY_MM_DD_hh_mi_ss convention. The different file name suffixes, along with general file description, are listed below

- *.mc3e – Summary data files containing measurements from several probes.
- *.conc.cdp.1Hz – Cloud droplet spectra from the DMT Cloud Droplet Probe (CDP).

5. File Contents

a. List of Parameters:

Already provided in the PI survey and included in meta-data headers of all files under the 'Processed' directory

b. Data Format

Raw data file formats are provided in each data system's manuals. Probe images are in png format. Processed data files are in the UND-NASA-AMES format.

c. Processing Level of Data

Data within the 'Raw' directory have no quality assurance. Data within the 'QC_Processed' data have been quality assured.

d. Data Resolution in File.

Data within the 'QC_Processed' directory are at a time resolution of 1 Hz. Spatial resolution depends on the speed of the aircraft.

6. Temporal organization is one file per flight. All data files within the 'QC_Processed' directory are time sequential from old to new.

7. As part of the quality assurance process, data anomalies were handled by inserting missing value codes (documented in the meta-data file header) into the data files contained within the 'Processed' directory. Times when a data parameter is not available or values were questionable are denoted by missing value codes.

- Winds – Current values are best used as approximations or as relative values. Work is ongoing to resolve absolute accuracy and reprocessed data will be provided when available.
- Imaging probes – Due to various environmental and electronic issues, there are some gaps in these data sets.

8. References:

Delene, D. J., Airborne Data Processing and Analysis Software Package, *Earth Science Informatics*, 4(1), 29-44, 2011, URL: <http://dx.doi.org/10.1007/s12145-010-0061-4>, DOI: 10.1007/s12145-010-0061-4.

9. Additional Points of Contact:

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