ADMG CASEI Inventory Terms Definitions

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Status of this Memo

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Abstract

This memo provides the terms used for developing NASA's Catalog of Archived Suborbital Earth Science Investigations (CASEI) inventory of airborne and field campaign metadata. These terms are defined to capture the relationships among various Earth Science field campaign components and how they are structured in the CASEI data model. These terms were vital to the development of the CASEI information model upon which the inventory database was built. Consistent terminology is required for organization and clear communication of the variety of airborne and field investigation metadata. Definitions herein have been reviewed (twice) by relevant stakeholders to ensure clear understanding of the terms and how ADMG has used them for CASEI.

Table of Contents

1 Introduction

The NASA ESDIS Standards Coordination Office (ESCO) is conducting a second round review of the Airborne Data Management Group (ADMG) list of airborne and field terms and definitions. These terms have been used to build NASA's Airborne and Field Investigation inventory, called the Catalog of Archived Suborbital Earth Science Investigations (CASEI). Reviewer comments from the initial review have been addressed and incorporated into the current document status. This follow-up edited version is provided to ensure that initial comments have been adequately addressed and is open to both past and new reviewers.

Airborne and field terms and definitions were vital to the development of the CASEI information model upon which the inventory database was built. Consistent terminology is required for organization and clear communication of the variety of airborne and field investigation metadata. The consistent use of these common terms could also benefit all airborne and field investigation researchers and inventory users. Wherever possible, definitions have been structured to agree with those in standard use within the various NASA science research communities served and some are similar to those in the EOSDIS Glossary. ADMG definitions may or may not match similar terms used by other entities within or external to NASA - this is indeed part of what motivated the need to develop this list so the CASEI inventory could be created.

ADMG exists to support NASA's airborne science community, NASA Distributed Active Archive Centers (DAACs), and airborne and field data users by improving access to relevant resources and data, and by supplying information about ongoing and past airborne and field investigations. ADMG is located within the Interagency Implementation and Advanced Concepts Team (IMPACT) and operates under the direction of NASA's Earth Science Data Systems (ESDS) Program. One of ADMG's primary goals is to take complete inventory of all NASA airborne and field activities and ensure the information of these activities are made available to all users, whether the data products resulting from those activities are currently archived at DAACs or not. This led to the creation of CASEI, a user-friendly public interface which provides carefully vetted contextual details about NASA airborne and field investigations and directly links users to data product access, if available.

Reviewers completed these proposed terms and definitions in the context of their experience with Earth Observing System Data and Information System (EOSDIS), airborne research and data, related inventories, tools, and services.

2 Summary of Terms

Good metadata (data about data) improves the ability of users to accurately and quickly identify and locate data and information. The terms below refer to metadata contents of the Catalog of Archived Suborbital Earth science Investigations (CASEI) inventory. Many terms are related and represent a hierarchical organizational investigation information structure around which the CASEI database was constructed. Definitions of terms used in the hierarchy below are provided in the rest of this document.

A NASA *Mission, Project or Program* funds a *Field Investigation* (also commonly called campaign) that supports the mission/project/program goals.

- Each *field investigation* has one or more *deployments* that occur during the funded investigation time period.
- Each *deployment* has at least one *Intensive Operation Period (IOP).*
- Within *deployments*, one or more *Significant Events* most likely occur, but not necessarily during an *IOP*.

The above information is included on the ADMG definitions web page where an image exists that illustrates the relationships between the terms presented here for review.

3 Terms

3.1 Mission

Definition:

A NASA-funded effort, project or program involving one or more satellite-based instruments and/or field investigations. Missions target a relatively broad set of science requirements, while supporting activities (e.g., field investigations, modeling studies, individual experiments, instrument/sensor technology development, algorithm evaluation) tend to investigate a narrower set of objectives and/or specific research questions.

Example Values:

- Aqua
- Global Precipitation Measurement (GPM)
- Earth Venture-Suborbital (EVS) Program

3.2 Field Investigation

Definition:

An observational study during which individuals, programs, agencies, and/or institutions utilize pre-selected, specific sensors or sets of sensors to acquire targeted observations or samples in a natural, non-laboratory setting in support of common, clearly defined, science or research objectives. Field investigations usually occur over a designated geographical space and/or period of time. The in-field, active period may stop and start again after a non-field period, meaning a field investigation may contain multiple sessions spread over weeks, months, seasons, or years. Sensors can include in-situ and/or remote sensing instruments operating on airborne, ground-based, and/or other non-satellite platform(s). Satellite-based observations may be included in, but are not collected specifically as part of, a field investigation. ADMG uses the terms “field Investigation” and “campaign” interchangeably to represent this level of the effort. While various individuals, science teams, or research groups may also refer to ADMG’s field investigations as airborne investigations, airborne campaigns, field campaigns, campaigns, projects, field missions, deployments, or Intensive Operation Periods (IOPs), within ADMG and CASEI, terms such as deployment and IOP have other specific uses – defined herein.

Example Values:

- Olympic Mountains Experiment (OLYMPEX)
- Dynamics and Chemistry of the Summer Stratosphere (DCOTSS)
- Long Island Sound Tropospheric Ozone Study (LISTOS)
- Atmospheric Carbon and Transport - America (ACT-America)
- Operation IceBridge (OIB)

3.3 Deployment

Definition:

A scheduled and planned continuous time period during which a field investigation's platforms and/or sensors are dedicated for use in support of the field investigation's science objective(s). Platforms may or may not be at the same location. The deployment time frame typically consists of the calendar date range (which may even cross calendar years) during which there are mission and/or instrument scientists and/or NASA Earth Science Project Office (ESPO) personnel stationed on-site for the field investigation. There may be time periods within a deployment during which individual platforms and/or instruments do not operate due to unfavorable environmental conditions, mechanical issues/maintenance, and/or prescribed personnel rest time. There may be one or more deployments within a single field investigation.

Example Values:

- The 2012 deployment of HS3, from 28 August to 5 November, 2012
- The 2017 deployment of ABoVE, from 27 April 2017 to 4 November 2017
- The fall 2017 deployment of ACT-America from 3 October 2017 to 13 November 2017

3.4 IOP – Intensive Operation Period

Definition:

An individual time frame, within a deployment, during which all or a majority of the field investigation's instrument(s) and/or platform(s) are operating with the goal of observing phenomena in support of the field investigation's science or research objective(s). IOPs are the primary measurement periods within a single deployment and typically signify a highly focused effort by investigation scientists and staff. A single IOP may contain observations of one or more events or cases. There may be one or more IOPs within a single deployment.

Example Values:

- From 27 April through 23 June, multiple aircraft collected observations during the first IOP within the 2017 deployment of ABoVE. There were 3 additional IOPs during this same deployment, for a total of 4 IOPs:
    - First IOP: 27 April - 23 June 2017
    - Second IOP: 2 August - 30 August 2017
    - Third IOP: 7 September - 28 September 2017
    - Fourth IOP: 18 October - 4 November 2017
- Due to field access and environmental conditions, many of the OLYMPEX field stations were placed in the fall of 2015 and retrieved in the spring of 2016. This full period is the *deployment*. The scientists, aircraft and ground radars were in the field and used during a subset of this time (late November 2015 to early January 2016). This subset of time is the *IOP*.

3.5 Significant Event

Definition:

An event observed during a deployment that is notable for the occurrence of a particularly illustrative example of one or more specific phenomena that relates to or addresses the field investigation science or research objective(s). Significant events may occur within or outside of an IOP.

Example Values:

- On 15 June 2017, an outstanding example of glacial melt and drainage was observed at the Kaskawulsh Glacier draining into Kluane Lake during the 2017 deployment of ABoVE, as part of the first IOP.
- On December 8th and 9th, 2015, a notable atmospheric river event occurred during the IOP of the OLYMPEX campaign that led to the need to move the flooded DOW radar site.
    - In addition, another atmospheric river occurred at the beginning of March 2016, but only the parsivel disdrometers and rain gauges were still operating to capture measurements. This event occurred outside the IOP, but still within the deployment date range. Field instruments remained in operation until spring when the snow conditions permitted instrument retrieval.
- On 29 August 2021, Hurricane Ida made landfall at the delta region of coastal Louisiana as a category 4 hurricane. Ida provided a unique opportunity for Delta-X to observe the study region before and after the hurricane. Ida caused an early end to deployment, but the aircraft were brought back after landfall to collect a significant event dataset of great value.

3.6 Partner Organization

Definition:

An institution (a university, other government agency or department, a private company, or an organization from another country) that participates in a field investigation with separate (non-NASA) funding resources allocated specifically for the field investigation. This term includes any organization that provides specific platforms or instruments to the campaign without NASA funding, including another co-participating or cooperating field investigation. Also, if the investigation data are archived by a non-NASA entity such as NOAA, the archiving organization is a partner organization, regardless of the funding pathway. For example, University X coordinates with NASA during a field investigation to collect data that University X is willing to share with NASA as part of the field investigation, despite University X not receiving any funding from NASA for this effort. In contrast, University Y also participates in the field investigation but is receiving NASA funding to do so. Therefore, University Y is not considered a partner organization, but rather is an investigation participant. The funding for University Y's participation is coming from NASA, the funding for University X's participation is not.

Example Values:

- NOAA
- University of Alabama in Huntsville
- California Air Quality Resource Board

3.7 Platform

Definition:

A structure, item, or surface on which an instrument package can be placed for operation. Platforms can be moving or stationary; permanent or temporary; and airborne, land-/ground-, or water-based. ADMG has identified platform types, guided largely by the category level of the Global Change Master Directory (GCMD's) Platform keywords. Examples of platform types include: aircraft, balloons, field sites, vehicles, ships, and buoys. In order to provide a consistent method of organizing field investigation metadata, the following are also considered platform types: satellites, models, and visuals (maps, photographs, etc.). These are included so that data from any of these sources, if specifically pertinent for the field investigation and archived in concert with other field investigation data, are properly accounted for in the CASEI Inventory.

Example Values:

- C-130 > Lockheed C-130 Hercules
- B-200 > Beechcraft King Air B-200
- Balloons (used to carry radiosondes aloft)
- Permanent Land-based Sites (such as a tower or long-operating radar installed at a specific permanent location)
- Vehicles such as a truck mounted with a radar or a car with an ozone measuring instrument
- Marine Research Vessel > Roger Revelle

3.8 Instrument Package

Definition:

All instruments operating on a platform. This may consist of a single instrument or multiple individual instruments and any associated technology such as power systems or telecommunications hardware. The instrument package used on a given platform can change over time, by flight, deployment, or field investigation, in order to support specific science/research objectives or due to an individual instrument failure. Note that ADMG uses the terms "instrument" and "sensor" interchangeably. Also note that individuals, science teams, or research groups may also refer to this as the instrument payload, particularly for airborne platforms.

Example Values:

- The B-200 aircraft flew in the 2017 deployment of the ABoVE campaign with the following instrument package: AVIRIS-NG, AirSWOT, and LVIS.
- The LearJet flew in the CAMP2Ex campaign deployment in 2019 with the following instrument package: High Volume Precipitation Spectrometer (HVPS) and various cloud probes (Hawkeye Combination Cloud Particle Probe, Fast Cloud Droplet Probe, 2D-S Stereo Probe, Passive-Cavity Aerosol Spectrometer Probe, Forward Scattering Spectrometer Probe, and Condensation Particle Counter).
- During the DISOCOVER-AQ campaign, the University of Maryland (UMD) Cessna 402B flew with the following instrument package: Cavity ring down spectrometer with a light emitted diode light source (LED-CRD) and the Thermo Environmental Instruments model 49C Ozone Analyzer (TE49C).

3.9 Continuous Data Collection Period (CDCP)

Definition:

A continuous period of data collection by a platform during which the instrument package is operated. Continuous Data Collection Periods (CDCPs) are based on the activity or operation of a platform, not on the individual instruments comprising the instrument package on the platform, as individual instrument operations can vary widely. For airborne platforms, CDCPs are also often colloquially referred to as flights. For water-based platforms, such as ships or vessels, CDCPs are also commonly referred to colloquially as cruises or voyages. CDCPs generally fall within a deployment and likely within the IOP. If a platform, such as an aircraft, is transported to the study location with the science instruments turned on, then the transport CDCP may be included in the data collection even though the data acquisition occurred outside the deployment and IOP range. There may be instances of individual instrument non-operation that result in missing data within a CDCP; this does NOT negate the fact that a single CDCP has occurred. For example: A sensor of an aircraft’s instrument package may not operate for one flight during a deployment. The aircraft flight is still considered an individual, complete CDCP.

Example Values:

- The ER-2 flight on Dec 15th from 16:09:07Z to 20:07:36Z during the Nov - Jan IOP of the only deployment of OLYMPEX
- Voyage or cruise of the research vessel Oceanus during the fall 2021 deployment of the Sub-Mesoscale Ocean Dynamics Experiment (S-MODE)

3.10 Facility Instrument

Definition:

NASA uses the term facility instrument for an airborne instrument/sensor or specific instrument/platform combination that is designated and supported directly by NASA Headquarters and is applicable to multiple science disciplines, field investigations, and NASA science objectives. Facility instruments are typically available to NASA's science research community via the Science Operations Flight Request System (SOFRS) within the NASA Airborne Science Program. Investigators must include the cost for facility instrument operation in their funded field investigation budgets. Each facility instrument is assigned to one DAAC that is responsible for the archival and stewardship of all the instrument data products. This varies from other investigation instruments that would have data located at different DAACs if used in different campaigns.

Example Values:

- Airborne Visible/Infrared Imaging Spectrometer (AVIRIS-C and AVIRIS-NG)
- Land, Vegetation and Ice Sensor (LVIS)
- MODIS/ASTER Airborne Simulator (MASTER)

3.11 Major Airborne Instrument (MAI)

Definition:

An instrument/sensor or instrument/platform combination that is used frequently in various kinds of field investigations, but is not identified as a facility instrument due to an alternative funding source and procedure for use within an investigation. For the benefit of users, the data from these instruments are best archived as a collection by a single DAAC, with different operation (flight) ranges identified by investigation or operation (flight) purpose. To have a major airborne instrument participate in a field investigation, the instrument principal investigator (PI) must be one of the investigation-funded collaborators. MAIs are often generally considered to be a facility instrument by scientists in the NASA Earth Sciences community who may not be entirely aware or sure of the facility instrument definition. There is no official list of major airborne instruments at this time, though ADMG is working with NASA HQ to develop one.

Example Values:

- Airborne Multi-angle Spectro Polarimetric Imager (AirMSPI)
- Goddard's LiDAR, Hyperspectral and Thermal (G-LiHT)
- Airborne SWOT (AirSWOT)
- Doppler Aerosol WiNd Lidar (DAWN)
- Portable Remote Imaging Spectrometer (PRISM)

3.12 Data Product

Definition:

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. A data product, as the term is used in the ADMG CASEI inventory, represents each item that would be listed in Earthdata Search for a given field investigation. Data products can consist of raw data, higher level/processed data, or may be composed of output from a merging of observations from several similar instruments or from a model. Data products may also be assigned individual data product Digital Object Identifiers (DOIs) when publicly released. Within the context of NASA Earth Science data preservation, a data product includes the data and the associated information (metadata). Data products may also be referred to as data sets, derived products, or data collections (as used in Earthdata Search).

Example Values:

- ACT-America: L3 Merged In Situ Atmospheric Trace Gases and Flask Data, Eastern USA, https://doi.org/10.3334/ORNLDAAC/1593
- SBU Pluvio Precipitation Gauge IMPACTS V1, https://doi.org/10.5067/IMPACTS/PLUVIO/DATA101
- CAMEX-4 Andros Island Rawinsonde and Radiosondes V1, https://doi.org/10.5067/camex-4/radiosonde/data101

3.13 Field Investigation Data Collection

Definition:

The group of all the data products generated by observations from airborne and other (non-satellite) instruments/sensors during a field investigation. Thus, the field investigation data collection consists of multiple data products. Note that a Digital Object Identifier (DOI) can be obtained to identify the landing page for an entire field investigation data collection. A field investigation data collection may also be referred to as a campaign data collection, dataset series, data set series, or data product group.

Example Values:

- North Atlantic Aerosols and Marine Ecosystems Study, https://doi.org/10.5067/SUBORBITAL/NAAMES/DATA001
- Integrated Precipitation and Hydrology Experiment, https://doi.org/10.5067/GPMGV/IPHEX/DATA101

3.14 Variable

Definition:

A quantity or value observed or diagnosed from measurements made using an instrument. For example, a radar measures the amount of power and phase received due to returned electromagnetic waves, and through signal processing and retrieval techniques provides several variables, including reflectivity, radial velocity, and spectrum width. As another example, tipping bucket-type rain gauges measure the number of bucket tips that occur with time in order to provide the variables of rain amount and rain rate. By utilizing the GCMD Science Keywords for the Earth Science Category, the ADMG inventory tracks variables collected by individual instruments or instrument packages. A variable may also be commonly referred to as a parameter, observation, or measurement.

Example Values:

- Radar reflectivity
- Brightness temperature
- Specific humidity
- Precipitation rate
- Convective Available Potential Energy (CAPE)
- Sulfur dioxide profiles
- Atmospheric carbon dioxide

3.15 Geophysical Concept

Definition:

High-level science concepts identified by ADMG as a means to bridge the necessary generality of NASA's Earth Science Focus Areas and the inherent specificity of the GCMD Science Keywords. These intermediary concepts are intended to facilitate improved communication and contextual use of both the NASA Earth Science Focus Areas and the GCMD Earth Science Keywords, bearing in mind the many-to-many relationships among them and the fundamental interconnectedness of the various processes that comprise the Earth system. There are currently 26 ADMG-identified geophysical concepts which can be assigned as metadata in CASEI to categorize a field investigation with respect to its purpose, goals, effort, or findings.

ADMG's 26 Geophysical Concepts:

- Aerosols
- Air Quality
- Atmospheric Chemicals & Trace Gases
- Upper Atmospheric Chemistry
- Radiation & Energy Budget
- Cloud Properties, Processes, & Dynamics
- Boundary Layer Processes
- Atmospheric Electricity & Lightning
- Tropical Cyclones
- Mid-latitude Cyclones
- Mesoscale Convection & Severe Weather
- Precipitation
- Terrestrial Hydrology
- Ice and Glacial Properties & Processes
- Ocean Properties & Processes
- Ecosystems & Biogeochemical Interactions
- Biodiversity
- Carbon Storage & Processes
- Soil Properties
- Land Characteristics
- Tectonic Processes
- Volcanic Processes
- Earth's Magnetic Field
- Earth's Interior
- Earth-Climate Interactions
- Geodesy

3.16 Assigned DAAC

Definition:

The DAAC designated by NASA's Earth Science Data Systems (ESDS) Program to have the responsibility of ensuring proper stewardship of the data and information for an investigation or facility instrument/major airborne instrument. Until recently, formal DAAC assignments were not often completed. Therefore, for older field investigations with data products already within the EOSDIS system, the DAAC that distributes the majority of the data is considered, by default, the assigned DAAC. If data products from a field investigation are archived and distributed by separate DAACs, it is the responsibility of the assigned DAAC to organize all information, clearly identify all data products, provide additional metadata and information links, and obtain a data product group DOI to represent all the data products resulting from an investigation, as needed. The assigned DAAC must maintain all links and preserve all materials needed to fully understand the data products and the campaign context in the future. For historical data not yet available in EOSDIS and the Common Metadata Repository (CMR), a DAAC-assignment procedure is followed to assign the historical field investigation to a DAAC for data publication.

Example Values:

- NSIDC DAAC
- ASDC
- ORNL DAAC

4 References

[1] Airborne Data Management Group website
https://earthdata.nasa.gov/esds/impact/admg

[2] ADMG Airborne and Field Data Inventory Definitions
https://earthdata.nasa.gov/esds/impact/admg/admg-definitions

[3] ADMG's Geophysical Concepts Description
https://docs.google.com/document/d/1bthNre9AIgImeluxXlZlpBEJaBZH_oB5y-8N0g153TQ/view

[4] Catalog of Suborbital Earth science Investigations
https://impact.earthdata.nasa.gov/casei/

[5] EOSDIS Glossary
https://www.earthdata.nasa.gov/learn/glossary

5 Authors' Addresses

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Appendix A Glossary of Acronyms

ABoVE	Artic-boreal Vulnerability Experiment
ACT-America	Atmospheric Carbon and Transport - America
ADMG	Airborne Data Management Group
AirMSPI	Airborne Multi-angle Spectro Polarimetric Imager
AirSWOT	Airborne Surface Water and Ocean Topography
ASDC	Atmospheric Science Data Center
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
AVIRIS-C	Airborne Visible/Infrared Imaging Spectrometer Classic
AVIRIS-NG	Airborne Visible/Infrared Imaging Spectrometer Next Generation
CAMEX	Convection and Moisture EXperiment
CAMP2EX	Cloud, Aerosol and Monsoon Processes Philippines Experiment
CAPE	Convective Available Potential Energy
CASEI	Catalog of Archived Suborbital Earth Science Investigations
CDCP	Continuous Data Collection Period
CMR	Common Metadata Repository
DAAC	Distributed Active Archive Center
DAWN	Doppler Aerosol WiND Lidar
DCOTSS	Dynamics and Chemistry Of The Summer Stratosphere
DISCOVER-AQ	Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality
DOI	Digital Object Identifier
DOW	Doppler On Wheels
EOSDIS	Earth Observing System Data and Information System
ESCO	ESIDS Standards Coordination Office
ESDS	Earth Science Data Systems
ESPO	Earth Science Project Office

EVS	Earth Venture-Suborbital
G-LiHT	Goddard's LiDAR, Hyperspectral and Thermal
GCMD	Global Change Master Directory
GPM	Global Precipitation Measurement
HQ	Headquarters
HS3	Hurricane and Severe Storm Sentinel
HVPS	High Volume Precipitation Spectrometer
IMPACT	Interagency Implementation and Advanced Concepts Team
IMPACTS	Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms
IOP	Intensive Operation Period
LED-CRD	Light Emitting Diode – Cavity Ring Down
LiDAR	Light Detection and Ranging
LISTOS	Long Island Sound Tropospheric Ozone Study
LVIS	Land, Vegetation, and Ice Sensor
MASTER	MOIDS/ASTER Airborne Simulator
MODIS	Moderate Resolution Imaging Spectrometer
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NSIDC	National Snow and Ice Data Center
OIB	Operation Ice Bridge
OLYMPEX	Olympic Mountain Experiment
ORNL	Oak Ridge National Laboratory
PRISM	Portable Remote Imaging Spectrometer
S-MODE	Sub-Mesoscale Ocean Dynamics Experiment
SBU	Stony Brook University
SOFRS	Science Operations Flight Request System
TE49C	Thermo Environmental Instruments Model 49C
UMD	University of Maryland