Global Hydrology Resource Center

Data User Guide

GOES-R PLT Geostationary Coastal and Air Pollution Event (GEO-CAPE) Airborne Simulator (GCAS)

Introduction

The GOES-R PLT Geostationary Coastal and Air Pollution Event (GEO-CAPE) Airborne Simulator (GCAS) dataset consist of solar backscattered radiation measured by the Geostationary Coastal and Air Pollution Event (GEO-CAPE) Airborne Simulator (GCAS) flown aboard a NASA ER-2 high-altitude aircraft during the GOES-R Post Launch Test (PLT) field campaign. The GOES-R PLT field campaign took place from March to May of 2017 in support of post-launch L1B product validation of the Advanced Baseline Image (ABI) and the Geostationary Lightning Mapper (GLM). Data files in HDF-5 format are available for March 21, 2017 through May 14, 2017.

Citation

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Keywords:

NASA, GHRC, GOES-R PLT, United States, GEO-CAPE, GCAS, Air Quality, radiance

Campaign

The Geostationary Operational Environmental Satellites - R series (GOES-R) is a geostationary satellite program comprised of a four-satellite fleet including GOES-R, GOES-S, GOES-T, and GOES-U. The GOES-R Series Program is a collaborative development and acquisition effort between the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) to develop, launch and

operate the satellites. The first satellite in the GOES-R series, GOES-R, launched on November 19, 2016, and became GOES-16 when it reached geostationary orbit. GOES-16 replaced GOES-13 as NOAA's operational GOES-East satellite at 75.2 degrees west longitude on December 18, 2017. GOES-16 observes North and South America, as well as the Atlantic Ocean all the way to the west coast of Africa. GOES-16 provides high spatial and temporal resolution imagery of the Earth using its Advanced Baseline Imager (ABI). GOES-16's Geostationary Lightning Mapper (GLM) is the first operational lightning mapper flown in geostationary orbit. GOES-16 also includes four other scientific instruments for monitoring space weather and the Sun. More information about the GOES-R mission can be found at the GOES-R website.

The GOES-R Post Launch Test (PLT) field campaign took place between March 21 and May 17, 2017, in support of the post-launch validation of NOAA's new generation of geostationary Earth-observing instruments: ABI and GLM. The campaign was comprised of two phases: the first centered on the U.S. west coast, providing tests primarily for the ABI instrument, and the second focused on the central and eastern U.S. with tests primarily for the GLM instrument (Figure 1). The validation effort included targeted data collections from the NASA ER-2 high-altitude aircraft integrated with nine payloads (both passive and active instruments) coordinated with ground-based and low earth-orbit referenced data from several operational and research satellite missions. Sixteen ER-2 aircraft validation missions, totaling 105.1 mission flight hours, were conducted over ideal Earth validation targets, such as deserts and oceans, thunderstorms, active wildfires, and an expansive set of cloud and moisture phenomenology. Dedicated ABI 30-second mesoscale (MESO) imagery collections were conducted concurrently with the ER-2 high-altitude aircraft based sensors during each GLM mission. The GOES-R PLT field campaign provided critical reference data and new insights into the performance NOAA's new generation of geostationary Earth-observing instrument products. More information about the GOES-R PLT field campaign is available on the GOES-16 Field Campaign webpage.

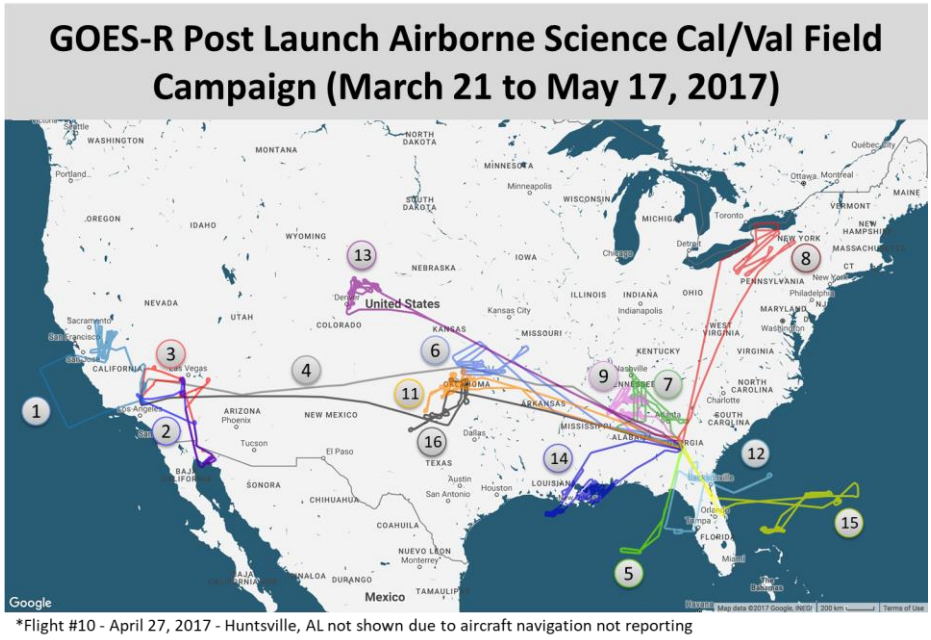

Figure 1: The GOES-R PLT Field Campaign study area
(Image source: Frank Padula)

Instrument Description

The Geostationary Coastal and Air Pollution Event (GEO-CAPE) Airborne Simulator (GCAS) instrument flew aboard the NASA Armstrong ER-2 (NA809) aircraft and was located in the aft section of the left-wing superpod. GCAS is a hyperspectral pushbroom sensor designed to measure solar backscattered radiation. The Air Quality (AQ) spectrometer observes wavelengths from 290nm to 490nm and the Ocean Color (OC) spectrometer observes wavelengths from 480nm to 900nm. Please note that during the GOES-R PLT field campaign, only the AQ spectrometer was flown, thus only AQ data files are present.

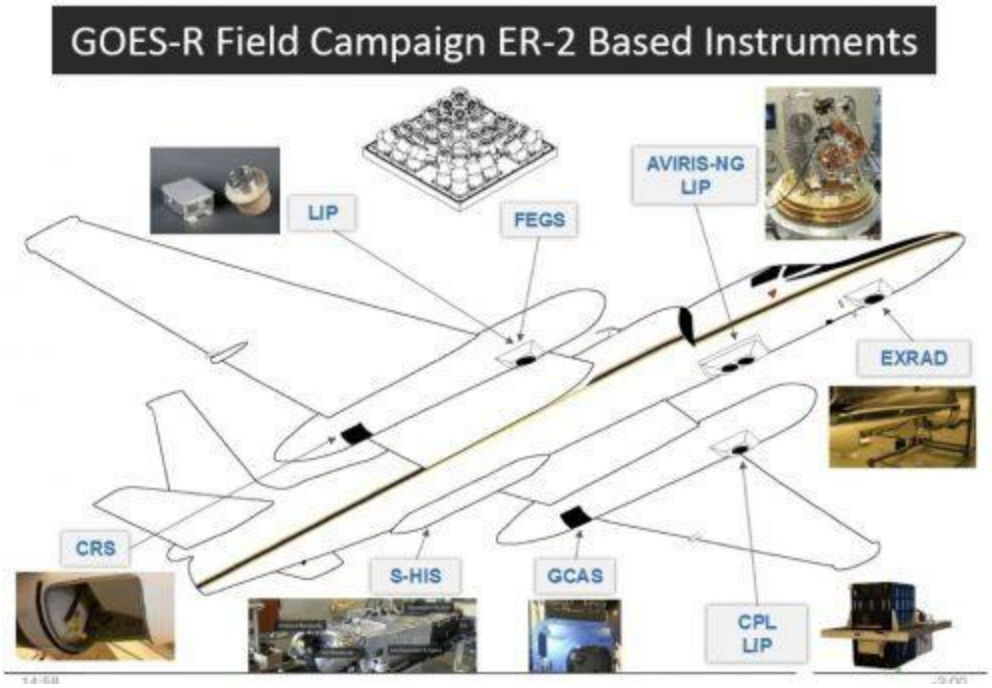

Figure 1: Instrument aboard the NASA ER-2 Aircraft (Image source: Steve Goodman and Francis Padula)

Investigators

Scott J. Janz
NASA Goddard Space Flight Center
Greenbelt, Maryland

Dale Allen
NASA Goddard Space Flight Center
Greenbelt, Maryland

Ken Pickering
NASA Goddard Space Flight Center
Greenbelt, Maryland

Matt Kowalewski
NASA Goddard Space Flight Center
Greenbelt, Maryland

Data Characteristics

GOES-R PLT Geostationary Coastal and Air Pollution Event (GEO-CAPE) Airborne Simulator (GCAS) data are available in HDF-5 format at Level 1B processing level. More information about the NASA data processing levels is available on the EOSDIS Data Processing Levels webpage. Table 1 outlines key dataset characteristics.

Table 1: Data Characteristics

Characteristic	Description
Platform	NASA ER-2 Aircraft
Instrument	Geostationary Coastal and Air Pollution Event (GEO-CAPE) Airborne Simulator (GCAS)
Spatial Coverage	N: 43.649, S: 27.478, E: -72.140, W: -124.838 (United States)
Spatial Resolution	250 m x 250 m
Temporal Coverage	March 21, 2017 - May 14, 2017
Temporal Resolution	File created for each day time flight
Sampling Frequency	10 seconds
Parameter	Solar backscattered radiation
Version	1
Processing Level	1B

File Naming Convention

The GOES-R PLT GCAS dataset contains HDF-5 data files with the following naming convention:

Data files: goesrplt_GCAS_YYYYMMDD_hhmmss.h5

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
mm	Two-digit minute in UTC
ss	Two-digit second in UTC
.h5	HDF-5 format

Data Format and Parameters

The GOES-R PLT GCAS dataset contains radiance measurements collected during flight by the GCAS instrument while mounted on the NASA ER-2 high altitude science aircraft. Each data file also contains flight information such as aircraft altitude, yaw, pitch, roll, heading, and locations. Please refer to Table 3 for additional data field information.

Table 3: Data Fields

Field Name	Description	Data Type	Unit
ALT	Aircraft altitude	double	m
CORNER_LAT	Corner latitude	double	Degrees North

CORNER_LON	Corner longitude	double	Degrees East
DATE	Date of collection	double	-
HDG	Aircraft heading	double	degrees
LAT	latitude	double	Degrees North
LON	longitude	double	Degrees East
PITCH	Aircraft pitch angle	double	degrees
ROLL	Aircraft roll angle	double	degrees
SAZ	solar azimuth angle: solar azimuth relative to north (positive clockwise, 0 – 360 deg.)	double	degrees
SCAN_ANGLE	Aircraft scan angle	double	degrees
SCAN_FLAG	Aircraft scan flag	double	-
SPEED	Aircraft speed	double	m/s
SZA	solar zenith angle: solar angle relative to zenith (0 – 180 deg.)	double	degrees
TIME_STAMP	Time of collection	double	UTC
VAZ	view azimuth angle: pixel view vector azimuth relative to north (positive clockwise, 0 – 360 deg.)	double	degrees
VZA	view zenith angle: pixel view vector relative to local zenith (0 – 180 deg, nadir = 180 deg.)	double	degrees
YAW	Aircraft yaw angle	double	degrees
RADIANCE	Radiance measurements	double	$mW/nm/m^2/sr$
WVLMAP	Pixel wavelength assignment	float	nm

Algorithm

Cloud layer heights measured by the Cloud Physics LiDAR (CPL), also aboard the NASA ER-2 aircraft, were used as a time-dependent pseudo-elevation map in order to properly reference the location of the GCAS observations. All flight days used the CPL cloud layer information when available.

Quality Assessment

Raw GCAS flight data are converted to corrected count rates (counts/sec) using pre-GOES-R PLT laboratory calibration corrections. The final conversion to radiances ($mW/nm/m^2/sr$) is accomplished with the accompanying sensitivity correction file. Only one sensitivity file is required for the entire mission at this time. Given the potential that future updates of the instrument's sensitivity correction could be generated based on additional laboratory and flight data analyses, it would be more efficient to separate out this final correction step for the science product user to apply. No stray light correction has been applied to either the corrected count rates or sensitivity correction file.

In addition to instrument level corrections, the Level 1B radiances are geolocated using pixel pointing unit vectors, the aircraft altitude provided by the Applanix Inertial Measurement Unit (IMU), and the co-manifested CPL cloud layer heights. The pixel pointing

unit vectors were specific to each flight due to the mounting procedure and location on the aircraft. For example, the aft section of the aircraft's superpod in which GCAS was mounted was removed to facilitate post-flight/pre-flight operations. The repeatability of the pos section's orientation was not precise enough to allow the use of only one set of pixel pointing vectors. In-flight data was used to identify ground reference points in order to derive the flight-specific vectors.

Software

This dataset is in HDF-5 format and does not require any specific software to read. However, Panoply is an easy-to-use free tool for reading and visualizing the data within the HDF-5 files.

Known Issues or Missing Data

There are no known issues or missing data for this dataset.

References

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Related Data

All datasets from the GOES-R PLT field campaign can be considered related to this dataset. Other GOES-R PLT campaign data can be located using the GHRC HyDRO 2.0 search tool, by entering the term 'GOES-R PLT'.

Contact Information

To order these data or for further information, please contact:

NASA Global Hydrology Resource Center DAAC
User Services
320 Sparkman Drive
Huntsville, AL 35805
Phone: 256-961-7932
E-mail: support-ghrc@earthdata.nasa.gov
Web: https://ghrc.nsstc.nasa.gov/

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