GHRC
Global Hydrology Resource Center

Data User Guide

GOES-R PLT Surface Radiance Ivanpah

Introduction

The GOES-R PLT Field Campaign Ivanpah dataset consists of surface reflectance and total optical depth data measured at Ivanpah Playa, Nevada during the GOES-R Post Launch Test (PLT) field campaign. The atmospheric measurements were made using an Automated Solar Radiometer (ASR), which tracks the sun throughout the day. Surface reflectance measurements were made using an ASD portable spectroradiometer and Spectralon reference panel. The GOES-R PLT field campaign took place from March to May of 2017 in support of post-launch L1b and L2+ product validation of the Advanced Baseline Image (ABI) and the Geostationary Lightning Mapper (GLM). The main goal of this dataset is to provide an independent validation of the AVIRIS-NG airborne instrument calibration. Data files in Excel format and browse imagery files in JPEG and PNG formats are only available for March 23 and March 28, 2017.

Citation

Czapla-Myers, Jeffrey and Mark C. Helmlinger. 2019. GOES-R PLT Surface Radiance Ivanpah [indicate subset used]. Dataset available online from the NASA Global Hydrology Resource Center DAAC, Huntsville, Alabama, U.S.A. DOI: http://dx.doi.org/10.5067/GOESRPLT/RAD/DATA201

Keywords:

NASA, GHRC, NOAA, GOES-R, GOES-16, ABI, GLM, SURFRAD, surface reflectance, total optical depth, Ivanpah Playa, Nevada

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 by the NASA ER-2 high-altitude aircraft coordinated with ground-based and low earth-orbit referenced data from several operational and research satellite missions. 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 and the GOES-R PLT Field Campaign Micro Article. More information about SURFRAD's role in GOES-R ABI product validation is described in this GOES-R ABI Validation Planning document.
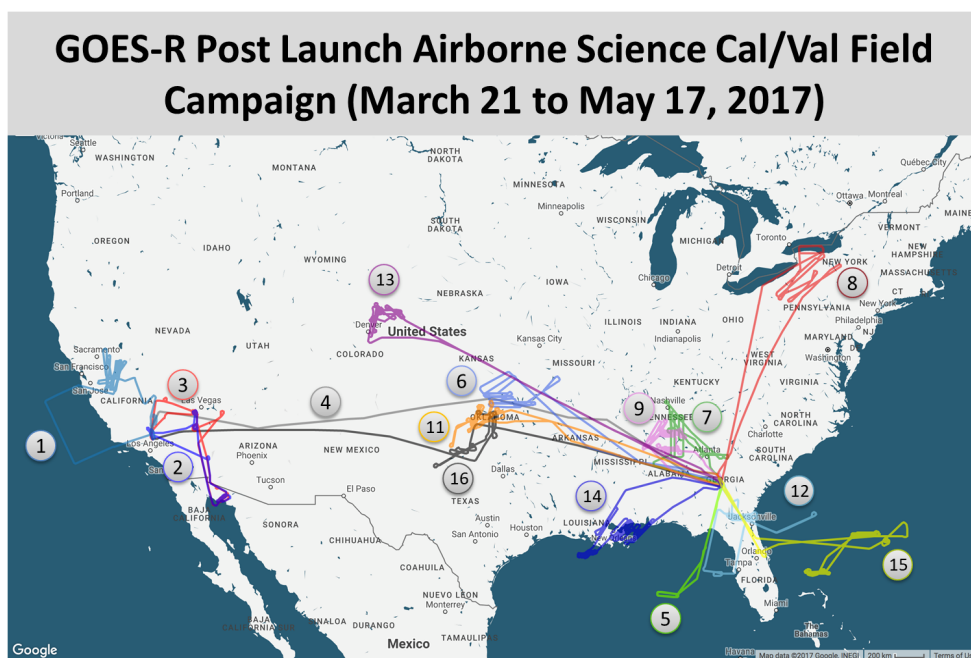
*Flight #10 - April 27, 2017 - Huntsville, AL not shown due to aircraft navigation not reporting

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

Instrument Description

The GOES-R PLT Field Campaign Ivanpah dataset consists of surface reflectance and total optical depth data measured at Ivanpah Playa, Nevada during the GOES-R Post Launch Test (PLT) field campaign. Ivanpah Playa is a well-studied vicarious calibration site with good atmospheric conditions. It has a bright uniform surface for validating the observation model and calibration. The atmospheric measurements were made using an Automated Solar Radiometer (ASR) developed at the University of Arizona. This ASR contains 10 sensors at wavelengths from 380 nm to 1,030 nm with bandwidths of 7 to 17 nm. It tracks the sun throughout the day. Tracking accuracy is ± 0.05° and the system maintains solar tracking in the presence of occasional small clouds. Data collection is possible for up to an entire day at intervals adjustable from 10 seconds to several minutes. Data gathered by ASR is used to determine atmospheric aerosol optical depth, estimate ozone optical depth, and the column abundance of atmospheric precipitable water.

The Analytical Spectral Devices (ASD) field spectrometer is a portable, lightweight, battery-powered instrument that uses a fiber-optic cable to sample the light field being measured. The fiber-optic bundle within the cable is divided into three bundles. Each bundle delivers the collected light to the entrance slit of one of three spectrometers covering the spectral range 350-2,500 nm. The fiber optic cable has a full view angle of 25°, with special attachments allowing restriction to 8°. The total spectral acquisition time is on the order of a few seconds per spectrum depending on integration time chosen, making the instrument very useful for rapid acquisition of large numbers of ground spectra which can be used to form average reflectances of large natural target areas (https://misr.jpl.nasa.gov/Mission/validation/instruments/).

Investigators

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Data Characteristics

The GOES-R PLT Surface Radiance Ivanpah dataset consists of surface reflectance and total optical depth data measured at Ivanpah Playa, Nevada on March 23 and March 28, 2017. Data files are in Microsoft Excel format at a Level 1B processing level. More information

about the NASA data processing levels is available on the [EOSDIS Data Processing Levels webpage](#). The characteristics of this dataset are listed in Table 1.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground stations
Instruments	Automated Solar Radiometer (ASR), Analytical Spectral Devices (ASD) field spectrometer
Spatial Coverage	N: 35.670, S: 35.650, E: -114.055, W: -114.075 (Ivanpah Playa, Nevada)
Spatial Resolution	Point
Temporal Coverage	March 23, 2017 and March 28, 2017
Temporal Resolution	Daily
Sampling Frequency	1 second -< 1 minute
Parameter	Surface reflectance, optical depth
Version	1
Processing Level	1B

File Naming Convention

The GOES-R PLT Surface Radiance Ivanpah dataset files are named using the following convention:

Data files: goesrplt_surfref_ivanpah_YYYYMMDD_ASD_[aviris-ng_results|Refls].xlsx
goesrplt_surfref_ivanpah_YYYYMMDD_ASR_Analysis.xlsx
goesrplt_surfref_ivanpah_YYYYMMDD_ASR.[aux|cal]

Browse files: goesrplt_surfref_ivanpah_YYYYMMDD_ASR_[InstTau|TauPlot].jpg
goesrplt_surfref_ivanpah_YYYYMMDD_ASR_LangPlot<#>.jpg
goesrplt_surfref_ivanpah_YYYYMMDD_AVIRISNG.png

Table 3: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
ASD_[aviris-ng_results|Refls]	aviris-ng_results: Top of Atmosphere (TOA) spectral reflectances measured by AVIRIS-NG onboard an ER-2 aircraft and ASD at Ivanpah ground station Refls: ASD measured surface reflectances
ASR_Analysis	Instantaneous Total Optical Depth (TOD) measured by ASR at Ivanpah
ASR.[aux.cal]	Text files for ASR data:

	.aux: auxiliary data .cal: spectral optical depth data
InstTau|TauPlot	InstTau: instantaneous total optical depth TauPlot: in-situ spectral optical depth
LangPlot	Langley plot and fractional deviation of instantaneous TOD from mean TOD (i.e., (Inst.TOD - Mean TOD)/Mean TOD), where TOD stands for total optical depth and Inst. is abbreviation for instantaneous.
#	0 to 9, corresponding to ASR's 10 channels (380, 400, 440, 520, 610, 670, 780, 870, 940, 1,030 nm)
AVIRISNG	NASA's Next Generation Airborne Visible Infrared Imaging Spectrometer (AVIRIS-NG)
.xlsx	Microsoft Excel format
.jpg	JPEG image format
.png	PNG image format

Data Format and Parameters

The GOES-R PLT Surface Radiance Ivanpah dataset consists of data files in Excel format and browse images in JPEG and PNG formats.

Data files:
goesrplt_surfref_ivanpah_YYYYMMDD_ASD_aviris-ng_results.xlsx -- This Excel file contains Top of Atmosphere (TOA) spectral reflectances measured by AVIRIS-NG onboard an ER-2 aircraft and ASD at Ivanpah Playa ground station. The ratios between these two measurements are calculated and plotted.

goesrplt_surfref_ivanpah_YYYYMMDD_ASD_Refls.xlsx -- This Excel file contains surface spectral reflectances measured by ASD at Ivanpah.

goesrplt_surfref_ivanpah_YYYYMMDD_ASR_Analysis.xlsx -- This Excel file contains Instantaneous Total Optical Depth (TOD) measured by ASR at Ivanpah.

Browse files:
goesrplt_surfref_ivanpah_YYYYMMDD_ASR_InstTau.jpg -- Time series plots of ASR-measured instantaneous total optical depth for 10 spectral channels, respectively.

goesrplt_surfref_ivanpah_YYYYMMDD_ASR_TauPlot.jpg -- In-situ spectral optical depth measured by ASR.

goesrplt_surfref_ivanpah_YYYYMMDD_ASR_LangPlot<#>.jpg -- Lanley plot and fractional deviation of instantaneous TOD from mean TOD (i.e., (Inst.TOD - Mean TOD)/Mean TOD), where TOD stands for total optical depth and Inst. is abbreviation for

instantaneous. <#> can be 0-9, corresponding to ASR's 10 channels (380, 400, 440, 520, 610, 670, 780, 870, 940, 1,030 nm).

goesrplt_surfref_ivanpah_YYYYMMDD_AVIRISNG.png -- Ivanpah Playa scene containing reference surface.

Algorithm

NASA's AVIRIS-NG overflew Ivanpah Playa, Nevada in March 2017 in an ER-2 aircraft at approximately 20 km altitude. Meanwhile, a ground team measured the surface using ASD field spectrometers. Surface reflectances were calculated by ratioing the ASD measurements against those of factory calibrated near-white Lambertian Spectralon reference panels. Panels were placed using a bullseye circular bubble level. A standard parabolic correction was applied to help mitigate time-variable changes in the different detectors within the instrument. Regular reference panel measurements also protected against instability on minute timescales (Thompson et al., 2018).

Software

No special software is needed to view these Microsoft Excel and text data files. The Microsoft Excel file can be opened in spreadsheet software.

Known Issues or Missing Data

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

References

Thompson, D., V. Natraj, R. O. Green, M. Helmlinger, B. Gao, and M. Eastwood (2018). Optimal estimation for imaging spectrometer atmospheric correction, *Remote Sensing of Environment*, 216, 355-373. doi: https://doi.org/10.1016/j.rse.2018.07.003

Related Data

All data collected by other instruments during GOES-R PLT are considered related datasets. They can be located using the GHRC HyDRO2.0 search tool and entering the term 'GOES-R PLT' in the search box.

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

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