National Aeronautics and Space Administration Goddard Earth Science Data Information and Services Center (GES DISC)

README Document for Cloud Absorption Radiometer (CAR) BRDF Data Products

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Revision History

Revision Date	***Changes***	***Author***
06/04/2019	Added new products	Charles Gatebe

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1.0 Introduction

This document provides basic information for using Cloud Absorptive Radiometer (CAR) BRDF products. These products include data acquired by CAR over a 30-year period (1984-2017) during many NASA sponsored international field campaigns:

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2. CAR Arctic Radiation Measurement in Column: Atmosphere-surface System BRDF Measurements (CAR_ARMCAS_ BRDF)
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1.1 Data set/Mission Instrument Description

The CAR project consists of many missions spanning the globe. The versatility of the CAR measurements has allowed for multiple missions investigating snow melt and albedo, air quality, ocean reflectance anisotropy and implications in ocean color remote-sensing problems, radiative characteristics of clouds embedded in smoke, and changes in vegetation. Although the applications of the instrument and data have expanded over time, primary applications were for cloud diffusion domain studies and measurements of bidirectional reflectance.

The CAR instrument is an airborne multi-wavelength scanning radiometer. It is mounted on an aircraft and deployed in the field to make measurements including: bidirectional reflectance, angular distributions of scattered radiation, determining single scattering albedo, and collecting imagery. These data sets consist of measurements of spectral radiance for numerous environments. The CAR instrument was developed at NASA Goddard Space Flight Center by Dr. Michael King. The current principal investigator is Dr. Charles Gatebe.

For further information about the instrument see:

The BRDF database encompasses various natural surfaces that are representative of many land cover or ecosystem types found throughout the world (Gatebe and King 2016). This database is therefore of great value in validating many satellite sensors and assessing corrections of reflectances for angular effects. Considering that surface bidirectional reflectance-distribution function (BRDF) is a ratio of two infinitesimally small quantities, it can never be measured directly because truly infinitesimal elements of solid angle do not include measurable amounts of radiant flux. To get measurable optical properties, we assume that the effective BRDF at a horizontal reference plane is an average over an appropriate area, angle and solid angle, for a particular source-target-sensor geometry [Gatebe and King, 2016]. The CAR unique viewing geometry -- scan mirror rotates 360° in a plane perpendicular to the direction of flight, and data are collected through a 190° aperture--- makes it most suitable for measuring the BRDF. During the BRDF acquisition over a selected target, the CAR acquires surface–atmosphere scenes by banking at a roll angle of about 20° (or any other angle as needed) and fly circles of different diameters above the surface (one circle takes approximately 2-3 min, assuming an altitude of 600 m above the ground and a circle diameter of about 3 km). Multiple circular orbits are acquired over selected surfaces, at different altitudes. Data are acquired at a high angular (1°) and spatial (better than 10 m at nadir, assuming 600 m altitude) resolution, coupled with a high signal-to-noise ratio.

CAR Level-1D/BRDF data products are organized by missions, where the intent of each mission was different as described below:

SnowEx17 Snow Mass and Energy Measurements

SnowEx is a multi-year airborne project to help advance snow remote sensing capabilities, and plan for a near-future space mission to monitor global seasonal snow water equivalent — currently an inconsistently collected and difficult-to-obtain data point that scientists say is critical to understanding the world's water resources.

During the SnowEx mission in 2017, the CAR instrument was flown aboard the Naval Research Lab (NRL) P-3 Orion research aircraft and obtained measurements of bidirectional reflectance distribution function (BRDF) of snow covered forests for a variety of conditions including snow grain size or age, snow liquid water content, solar zenith angle, cloud cover, and snowpack thickness at Grand Mesa, Colorado – one of the largest flat-topped mountain in the world.

Discover AQ Air Quality

DISCOVER-AQ, a NASA Earth Venture program funded mission, stands for Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality.

In recent years, progress in reaching air quality goals has begun to plateau for many locations. Furthermore, near-surface pollution is one of the most challenging problems for Earth observations from space. However, with an improved ability to monitor pollution from satellites DISCOVER-AQ seeks to improve the interpretation of satellite observations to diagnose near-surface conditions relating to air quality.

During the DISCOVER-AQ mission in 2014, the CAR instrument was flown aboard NASA P-3 aircraft and obtained measurements of bidirectional reflectance distribution function (BRDF) at different scales over agricultural and urban areas in Colorado, USA.

Eco-3D Vegetation Response to Changing Forcing Factors

This study provide critical measurements on 3-dimensional structure of vegetation, which is important for quantifying the amount of carbon stored in biomass.

During the ECO-3D mission in 2011, the CAR instrument was flown aboard the NASA P-3 and obtained measurements of bidirectional reflectance distribution function (BRDF) over forests ranging from Boreal to tropical wetlands covering sites from Quebec to Southern Florida.

ARCTAS Arctic Atmospheric Composition and Climate

ARCTAS was a major science field campaign in 2008 that was designed to study the atmosphere in the Arctic and high northern latitudes as part of the International Polar Year. The first phase of ARCTAS was based in Fairbanks and Barrow, Alaska with some flights to Thule, Greenland in April and focused on thick aerosol layers known as “arctic haze.” The second phase followed in July based from Cold Lake, Alberta and the Northwest Territories focusing on the emissions from large boreal forest fires in northwest Canada.

During the ARCTAS mission, the CAR instrument was flown aboard the NASA P-3 and obtained measurements of bidirectional reflectance distribution function (BRDF) over snow, ice, clouds, smoke and ocean. In addition, the CAR instrument obtained solar radiation measurements inside very thick forest fire smoke.

CLASIC Cloud and Land Surface Measurements

CLASIC (Cloud and Land Surface Interaction Campaign) focuses on advancing the understanding of how land surface processes influence cumulus convection. CLASIC was conducted in the Southern Great Plains (SGP – a region comprising Kansas, Oklahoma, and Texas) of the United States during June 2007. The SGP site consists of in situ and remote-sensing instrument clusters arrayed across approximately 55,000 square miles (143,000 square kilometers) in north-central Oklahoma, making it the largest and most extensive climate research field site in the world. The CAR flew aboard Sky Research Jetstream-31 and measured spectral and angular distribution of scattered light by clouds and aerosols, and provided bidirectional reflectance of various surfaces, and imagery of cloud and Earth surface features over covering many locations within the SGP. By making such diverse measurements, our goal is to widen the audience of potential end-users and to foster collaborations among campaign participants and with outside users.

INTEX-B Long-range Pollution Transportation

INTEX-B (Intercontinental Chemical Transport Experiment-Phase B) focuses on the long-range transport of pollution, global atmospheric photochemistry, and the effects of aerosols and clouds on radiation and climate. It has two phases: phase 1 of the study was performed in Mexico from March 1-20, 2006, and phase 2 was performed in April and May and focused on Asian City pollution outflow over the western Pacific. The CAR flew aboard Sky Research Jetstream-31 (March 2006) and measured spectral and angular distribution of scattered light by clouds and aerosols, and provided bidirectional reflectance of various surfaces including Gulf of Mexico, Mexico City, and imagery of cloud and Earth surface features.

Skukuza South African Ecosystems

Southern Africa interact with a persistent high pressure (anticyclonic circulation) system that remains in place about 80% of the time, especially during the winter months (April to October). The large- scale subsidence resulting from the presence of the continental high pressure in turn creates multiple persistent layers of stability that occur throughout the atmosphere at nearly the same pressure levels (~850, 700, 500, and 300 hPa) and with a high degree of frequency throughout the year. These persistent continental high pressure system enhances concentrations of aerosols and trace gases by inhibiting vertical mixing.

CAR mission Skukuza measured bidirectional reflection functions at different altitudes over the savanna ecosystem in southern Africa to study the vertical distribution of optical characteristics of atmospheric aerosol in southern Africa. The measurements were conducted to characterize surface anisotropy in support of the NASA's Earth Observing System satellites validation program and provided an opportunity to develop and test new algorithms for retrieving profiles of aerosol properties.

Clams Chesapeake Lighthouse Aircraft Ocean Measurements

CLAMS is the Chesapeake Lighthouse and Aircraft Measurements for Satellites field campaign sponsored by CERES, MISR, MODIS-Atmospheres and the NASA/GEWEX Global Aerosol Climatology Project (GACP). The centerpiece of CLAMS is the Chesapeake Lighthouse sea platform 20 km east of Virginia Beach, at which NASA and NOAA make continuous, long-term measurements of radiation, meteorology, and ocean waves. Members of the CERES, MISR and MODIS instrument teams are collaborating to accomplish a common set of objectives tied to the validation of EOS data products. The CLAMS campaign took place in July-August 2001 to validate Terra data products from a shortwave closure experiment targeting clear (cloud-free) sky conditions and focused on obtaining:

1. more accurate spectral and broadband radiative fluxes at the surface and within the atmosphere,
2. characterization of ocean optics in the vicinity of the lighthouse.
3. description of the atmospheric aerosol amounts, micro-physical and optical properties, and their variability.

The CAR was flown aboard the University of Washington Convair 580 (CV-580) research aircraft during the CLAMS field campaign and obtained measurements of bidirectional reflectance distribution function (BRDF) of the ocean under different illumination conditions with solar zenith angles ranging from 15° to 46° and under different environmental conditions, where the ocean wind speed ranges from 1-11 m/s.

Safari South African Biogeophysics and Biogeochemistry

The Southern African Regional Science Initiative (SAFARI) 2000 is an international science field campaign aimed at developing a better understanding of the southern Africa earth-atmosphere-human system. The goal of SAFARI 2000 is to identify and understand the relationship between the physical, chemical, biological, and anthropogenic processes that underlie the biogeophysical and biogeochemical systems of southern Africa. Particular emphasis will be placed upon biogenic, pyrogenic, and anthropogenic emissions - their characterization and quantification, their transport and transformations in the atmosphere, their influence on regional climate and meteorology, their eventual deposition, and the effects of this deposition on ecosystems.

Between 12 August and 16 September 2000, the CAR onboard the University of Washington Convair CV- 580 research aircraft obtained measurements of surface bidirectional reflectance of savanna, salt pans, and strato- cumulus clouds throughout southern Africa as part of SAFARI 2000.

FIREACE Arctic Ice and Cloud Radiation

The scientific objectives of FIRE/ACE are to study impact of Arctic clouds on radiation exchange between surface, atmosphere, and space, and the influence of surface characteristics of sea ice, leads, and ice melt ponds on these clouds. It was conducted over the Beaufort Sea, Alaska, from May 20 - June 24, 1998. FIRE/ACE will attempt to document, understand, and predict the Arctic cloud-radiation feedbacks, including changes in cloud fraction and vertical distribution, water vapor cloud content, cloud particle concentration and size, and cloud phase as atmospheric temperature and chemical composition change. FIRE/ACE uses the data to focus on improving current climate model simulations of the Arctic climate, especially with respect to clouds and their effects on the surface energy budget. In addition, FIRE/ACE addresses a number of scientific questions dealing with radiation, cloud microphysics, and atmospheric chemistry.

SCAR-B Smoke, Clouds, and Radiation-Brazil

The campaign was conducted in August-September 1995 in selected areas of central Brazil. The objectives for the SCAR-B mission are to collect measurements of the properties of smoke from biomass burning and the microphysical properties of clouds embedded in the smoke (emission rates of trace gases, properties of smoke particles, light scattering efficiency, interaction processes of smoke particles, effect of biomass burning on surface vegetation, etc.). Comparison and validation with data from other SCAR campaign was another important goal and advance our knowledge of how the physical, chemical and radiative processes in our atmosphere are affected by sulfate aerosol and smoke from biomass burning; to improve our expertise at

remotely sensing smoke, water vapor, clouds, vegetation and fires; and to assess the effects of deforestation and biomass burning on tropical landscapes. The SCAR-B campaign occurred in Brazil.

SCAR-A Sulfates, Clouds, and Radiation-America

The campaign was completed in July 1993. The objectives for the SCAR mission was to collect information on the properties and effects of radiation on clouds and sulfite particles --- compared with those for aerosol particles and biomass burning. The SCAR-A campaign occurred in western Atlantic Ocean.

During a two-week period In July 1993, the University of Washington C-131A aircraft took off from its base at Wallops Flight Facility on Wallops Island, Virginia, and flew over several regions, including Hog Island, the Great Dismal Swamp in southern Virginia, the Pine Barrens in New Jersey, Atlantic City, and over parts of the Atlantic Ocean.

ARMCAS Arctic Cloud Radiation Measurements

The Arctic Radiation Measurement in Column Atmosphere-surface System (ARMCAS) was a collaborative research effort funded by NASA, NSF and ONR and conducted from June 1-15, 1995 in the North Slope of Alaska and the Beaufort Sea area. The objectives were collect cloud mask data for MODIS algorithm development, perform scale analysis for varying spatial resolutions, retrieve cloud properties over highly reflecting surfaces, obtain in-situ measurements for cloud retrieval validation, measure droplet spectral absorption with microphysics, measure aerosol light scattering and CCN (Cloud Condensation Nuclei) properties, study statistical properties of cloud microphysics, measure bidirectional reflectance of various surface types, serve as pilot study for FIRE-III and SHEBA campaigns.

The CAR onboard the University of Washington Convair C-131A research aircraft obtained measurements of surface bidirectional reflectance of the melt-season sea ice and tundra. Coordinated flights with ER-2 aircraft took place over the tundra of the North Slope and over the partially ice-covered Beaufort Sea. Several of these flights were closely coordinated in order to provide simultaneous in situ and remote sensing measurements of arctic clouds.

LEADEX Artic Sea Ice and Tundra Radiation Measurements

CAR LEADEX mission measured bidirectional reflectance functions for four common arctic surfaces: snow covered sea ice, melt season sea ice, snow covered tundra, and tundra shortly

after snowmelt. The measurements show how the reflectance differs amongst the mentioned arctic surfaces and provides insights into the variability of albedo in the arctic.

Kuwait Oil Fire Kuwait Oil Fire Spectral Reflectance

This experiment was a part of an international research effort in response to an environmental crisis, when over 600 oil wells in Kuwait were ignited by Iraqi forces in 1991. The resulting fires produced large plumes of smoke that had significant effects on the Persian Gulf region but limited global effects. Between May 16 and June 12, 1991, the Kuwait Oil Fire Smoke Experiment (KOFSE) was conducted in the Persian Gulf Region. The purpose of KOFSE was to determine the chemical and physical nature of the smoke and to investigate its potential effects on air quality, weather, and climate.

During the experiment, CAR aboard the University of Washington C-131A aircraft flew over Kuwait, Saudi Arabia, and the Persian Gulf, and obtained bidirectional reflectance function of smoke from Kuwait oil fires. Measurements were also taken over the Saudi Arabian desert with overlying desert dust, and Persian Gulf waters with some overlying aerosols.

TARFOX Tropospheric Aerosol Radiative Forcing Observational Experiment

TARFOX was conducted to reduce uncertainties in the effects of tropospheric aerosols on climate by determining the direct radiative impacts on regional radiation budgets in cloud-free skies, as well as the chemical, physical, and optical properties of the aerosols carried over the western Atlantic Ocean from the United States. In July 1996, CAR data were collected aboard the University of Washington C-131A aircraft over the forested Great Dismal Swamp wetlands south of Norfolk, Virginia and the Atlantic Ocean approximately 340 km offshore of Richmond, Virginia.

1.2 Algorithm Background

CAR data post processing involves first separating the various data types: header (navigation), the science, housekeeping, and dark current (read data cycle section on our CAR website: https://car.gsfc.nasa.gov/instrument/schematics). Secondly, the science data is corrected for aircraft roll so that the reference pixel in each scan corresponds to a known geophysical feature (e.g. first pixel corresponds to 5° before zenith and the last one 5° after nadir for starboard imaging). Also, in each scan an average of dark current signal is subtracted from each value of the science data signal of the subsequent scan. Thirdly, the resulting product is converted to radiance units using the calibration constants computed during the pre-and post-flight

calibrations. Finally, data are geographically and time referenced before they are archived for use by the scientific community.

1.3 Data Disclaimer

The CAR data is provided as a public service by the National Aeronautics and Space Administration (NASA). We make every effort to provide complete and accurate information. However, we do not guarantee accuracy, completeness, timeliness or correct sequencing of the information. We will do our best to correct errors brought to our attention.

Reference herein to any specific commercial products, processes, or services by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement or recommendation by NASA or the United States Government.

1.3.1 Acknowledgment

NASA promotes the full and open sharing of all data with the research and applications communities, private industry, academia, and the general public (Read the NASA Science Data and Information Policy N). The Cloud Absorption Radiometer (CAR) data is a public domain data. We request that end users who make use of CAR data or imagery for subsequent distribution, deriving value added products, or using or referencing CAR products in written or oral presentations to add the following acknowledgment:

We acknowledge the use of CAR data products or imagery archived by the NASA/GSFC/Earth Science Data and Information System (ESDIS) with funding provided by NASA.

If the CAR data is a principal component of a scientific paper, please work with principal investigator and offer co-authorship.

1.3.2 Contact Information

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1.4 What is New in Version 2 BRDF Data

Version 2 represents the best available CAR BRDF data product. Key changes include:

1. Masked incidences of false high BRDF values caused by unknown reasons. This mainly impacted missions that were conducted before 2000.

2. Removed cases of questionable geometric correction. This mainly impacted missions that were conducted before 2000.

2.0 Data Organization

The CAR BRDF data is level 1 aircraft data as defined by NASA ESDIS. However due to the uniqueness of this data set, the data provider identifies this data as level 1D. Each file corresponds to an aircraft flight for that mission. Each file contains observations of bidirectional reflectance factor and spectral response function as measured by the CAR instrument. The data also includes derived surface-atmosphere albedo. The timespan and spatial coverage for the files can differ from one another. The 'AircraftLatitude', 'AircraftLongitude', 'AircraftAltitude', and 'Time' variables describe the changes in space and time for the aircraft.

The CAR data consist of views of Earth-atmosphere scenes through 190° defined by observations of both local zenith and nadir around the starboard horizon, or 190° views of the Earth scene from horizon to horizon, or 190° views of the sky above the aircraft from horizon to horizon. Data are always sampled simultaneously and continuously for eight spectral bands from 0.34 µm to 1.27 µm (or seven bands for missions prior to 2000), plus one of the six bands on the filter wheel (1.55–2.30 µm). Data from the filter wheel either include all six spectral bands at a prescribed interval (usually changing filter every fifth scan line), or one of the six spectral bands, usually 1.66, 2.10, or 2.21 µm, sampled continuously.

2.1 File Naming Convention

ZZZZ-car_AAA_yyyyMMddhhmmss_CARXXXX_productionDate.nc

Where:
ZZZZ = CAR mission name
AAA = Aircraft
yyymmddhhmmss = mission start date

yyyy = 4 digit year number
MM = 2 digit month [01-12]
dd = 2 digit day [01-31]
hh = 2 digit hour [01-24]
mm = 2 digit minute [01-60]
ss = 2 digit second [01-60]
XXXX = flight number
productionDate = 4 digit year (yyyy), 2 digit month (mm), 2 digit day (dd), (yyymmdd)

Filename example: SnowEx2017-car_p3b_20170216344_2063_20180802.nc

2.2 File Format and Structure

CAR BRDF data set files are in NetCDF4 (network Common Data Form) format. NetCDF is a self-describing, hierarchical, and machine independent data format for array oriented scientific data. For more information visit:

3.0 Data Contents

These data sets contain radiance and spectral response functions at given wavelengths for multiple environments (see mission descriptions Section 1.1).

3.1 Dimensions

CAR data set dimensions are listed below.

- AzimuthAngles
- ZenithAngles
- Spectral_band
- SpectralRange_XXXXnm

The ‘SpectralRange_XXXXnm’ dimensions differ across data sets and are dependent on the mission and instrument.

The ‘XXXX’ in the ‘SpectralRange_XXXXnm’ dimensions refer to the spectral bands for the CAR instrument.

- SpectralRange_XXXXnm

a. The ‘SpectralRange_XXXXnm’ dimension provides the spectral range for the spectral bands which are denoted with XXXX.

3.2 Products/Parameters

Variables with empty “Unit” cells are unitless. ‘XXXX’ in variable short names denote the spectral band and wavelength of the instrument. These wavelength values can vary across missions.

Table 1. CAR BRDF variables

Short Name	Long Name	Unit
AircraftAltitude	GPS height in Meters above the mean sea level	m
AircraftLatitude	Aircraft Latitude Degrees	degrees_north
AircraftLongitude	Aircraft Longitude Degrees	degrees_east
AircraftPitch	Aircraft Pitch Degrees	degrees
AzimuthAngles	Azimuth angles	degree
brdf_reflectance_XXXXnm	bidirectional reflectance factor at instrument channel wavelength	
SolarAzimuthAngle	Solar Azimuth Angle relative to the local geodetic north	degree
SolarZenithAngle	Solar Zenith Angle relative to the local sky-earth normal	degree
Spectral_band	Spectral band	nm
SpectralRange_XXXXnm	SpectralRange for CAR chlY XXXXnm	nm
SRF_XXXXnm	Spectral Response Function at XXXXnm	1/nm
SurfaceAtmosphereAlbedo	Surface Atmosphere albedo	
Time	seconds since midnight UTC 20170216 (yyyymmdd)	seconds
Zenithangles	Zenith angles	degree

Table 1. A list of the variables’ “Short Name”, “Long Name” and “Unit” attributes across all CAR BRDF data sets described in section 1.1.

4.0 Options for Reading the Data

The CAR data are stored in NetCDF-4 format. There are many software packages that can be used for manipulating or displaying NetCDF data. This Unidata site provides references about these packages.

4.1 Command Line Utilities

ncdump
The ncdump tool can be used as a simple browser for NetCDF and HDF data files, to display the dimension names and sizes; variable names, types, and shapes; attribute names and values; and optionally, the values of data for all variables or selected variables in a NetCDF file. The most common use of ncdump is with the –h option, in which only the header information is displayed.

ncdump [-c|-h] [-v …] [[-b|-f] [c|f]] [-l len] [-n name] [-d n[,n]] filename
Options/Arguments:
[-c] Coordinate variable data and header information
[-h] Header information only, no data
[-v var1[,…]] Data for variable(s) <var1>,… only data
[-f [c|f]] Full annotations for C or Fortran indices in data
[-l len] Line length maximum in data section (default 80)
[-n name] Name for NetCDF (default derived from file name)
[-d n[,n]] Approximate floating-point values with less precision filename File name of input NetCDF file

4.2 Tools/Programming

Panoply

Panoply is a visualization tool developed at the Goddard Institute for Space Studies (GISS). It is compliant with NetCDF Climate and Forecast (CF) Metadata Conventions. A strength of the tool is that data can be previewed “remotely” over the network – i.e. user can preview file content of HDF or NetCDF files stored on a remote site, without downloading them. Panoply is available from GISS:

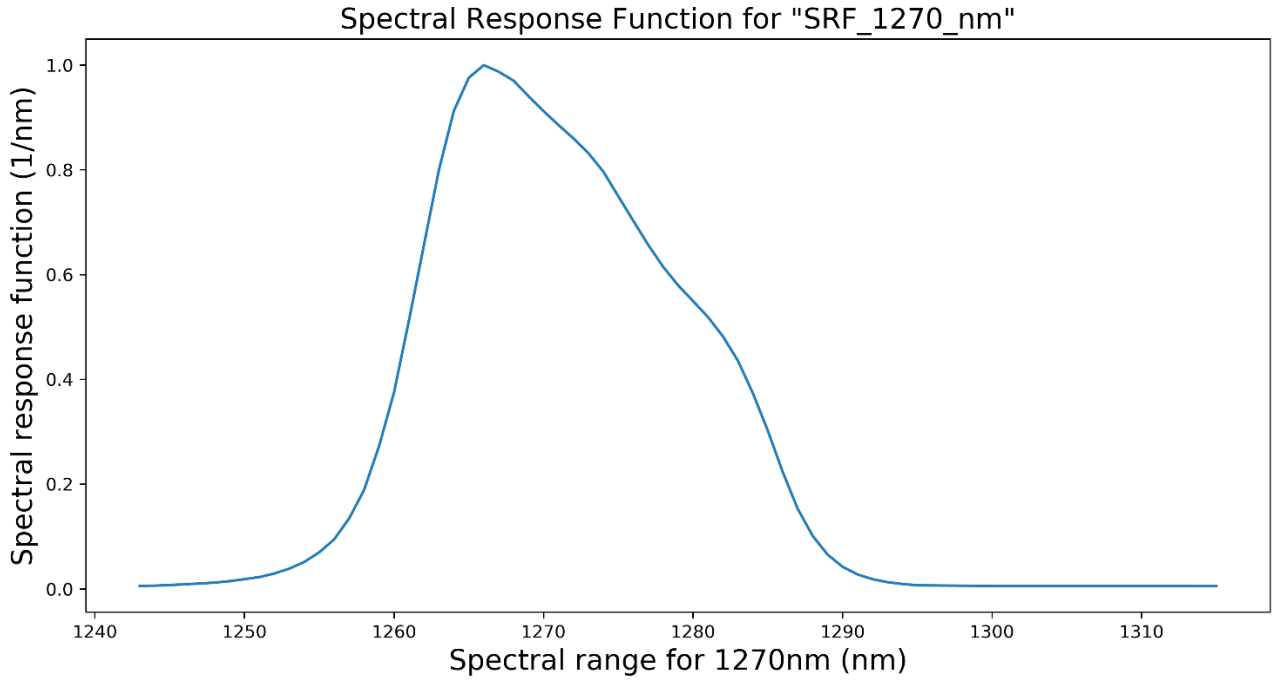
Python
Python is a versatile open source programming language that can be used to subset, process, analyze, and visualize data. To download and learn more about Python visit:

Below is a Python 2.7 script that will read-in and plot CAR data

```
#========== Begin Python CAR script ======================================
from netCDF4 import Dataset
import matplotlib.pyplot as plt

# Read in NetCDF4 file. Assign directory path if necessary.
```

```
data = Dataset('C:\Users\esherman\Desktop\CAR 1D data prep\SnowEX\SnowEx2017-
car_p3b_20170216224708_R1_CAR2063_Level1D-20180802.nc', mode='r')

# prints header information
print data

# read variables
srf1270=data.variables['SRF_1270nm']
sr1270=data.variables['SpectralRange_1270nm']


# plot spectral response function
plt.figure(figsize=(12,6))
plt.plot(sr1270,srf1270)
plt.title('Spectral Response Function for "SRF_1270_nm"', fontsize=16)
plt.xlabel('Spectral range for 1270nm (nm)', fontsize=16)
plt.ylabel('Spectral response function (1/nm)', fontsize=16)

plt.savefig('%s_SRF_1222nm.png'%str(data.experiment_name), format='png',
dpi=360)

data.close()
#============ End Python CAR script ========================================
```

Example image produced by Python CAR script:



5.0 Data Services

5.1 NASA Earthdata Login System

Starting August 1st, 2016, access to GES DISC data requires all users to be registered with the Earthdata Login system. Data continue to be free of charge and accessible via HTTPS. Access to data via FTP will no longer be available on or after October 3rd, 2016. Detailed instructions on how to register and receive authorization to access GES DISC data are provided at https://disc.sci.gsfc.nasa.gov/data-access.

GES DISC users who deploy scripting methods to list and download data in bulk via anonymous FTP are advised to review the How to Download Data Files from HTTP Service with wget recipe that provides examples of GNU wget commands for listing and downloading data via HTTPS.

If you need assistance or wish to report a problem:

GES DISC Help Page:

(https://disc.gsfc.nasa.gov/information/documents?title=Contact%20Us)

Email: emailgsfc-help-disc@lists.nasa.gov
Voice: 301-614-5224
Fax: 301-614-5268
Address: Goddard Earth Sciences Data and Information Services Center NASA Goddard Space Flight Center Code 610.2 Greenbelt, MD 20771 USA

5.2 Landing Pages

Below is a list of landing pages for each CAR mission. These landing pages provide product summary, data citation, documentation, data access and services for each mission.

https://disc.gsfc.nasa.gov/datasets/CAR_ARCTAS_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_ARMCAS_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_CLAMS_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_CLASIC_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_DISCOVERAQ_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_ECO3D_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_FIREACE_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_INTEXB_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_KUWAITOILFIRE_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_LEADEX_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_SAFARI_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_SCARA_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_SCARB_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_SKUKUZA_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_SNOWEX17_BRDF_V2/summary?keywords=CAR

https://disc.gsfc.nasa.gov/datasets/CAR_TARFOX_BRDF_V2/summary?keywords=CAR

6.0 More Information

Additional information can be found at the Cloud Absorption Radiometer (CAR) website:

https://car.gsfc.nasa.gov/

7.0 Acknowledgments

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