



**SIMULATED TOP-OF-ATMOSPHERE RADIANCE
DATA SET DESCRIPTION**

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Figure 1. Fulldisk TOA brightness temperatures for ABI band 11 (8.5 μm).

LIST OF ACRONYMS

ABI	Advanced Baseline Imager
AWG	Algorithm Working Group
CIMSS	Cooperative Institute for Meteorological Satellite Studies
GOES-R	Geostationary Operational Environmental Satellite R series
MATLAB	MATrix LABoratory
netCDF	network Common Data Format
NW	North West
SE	South East
TOA	Top of Atmosphere
WRF	Weather Research Forecasting

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to acquaint users with the simulated ABI and hyperspectral TOA radiance datasets developed at CIMSS for GOES-R AWG Proxy Data Set activities.

1.2 Who Should Use This Document?

This document is intended for members of the GOES-R AWG who will use simulated ABI radiance datasets for testing algorithms and products.

1.3 Section Summaries

The next section provides a brief description of the delivered datasets. Section 3 contains a short MATLAB example for viewing the data.

2 DATA DESCRIPTION

2.1 Spatial and Temporal Coverage

The delivered datasets include three time steps at 40-minute intervals. The times are 0000, 0040, and 0120 for 25 June 2003. The spatial coverage of the complete set of data ranges from 54° South to 54° North and 130° West to 20° West. A sample data set is shown in Figure 1.

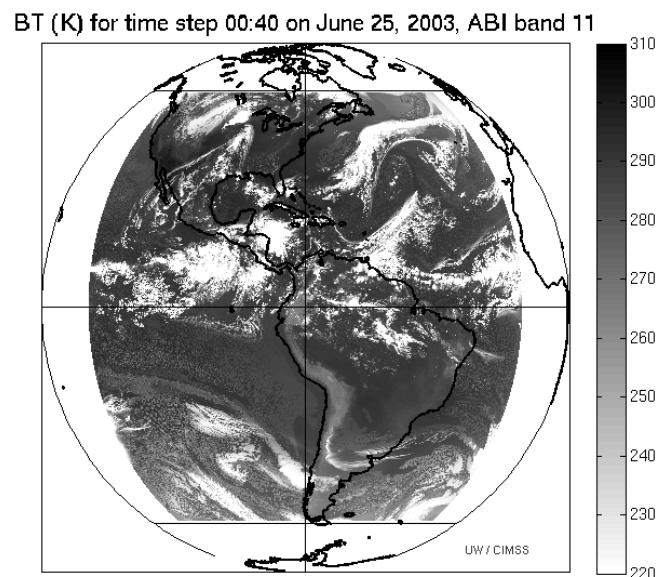


Figure 1. Fulldisk TOA brightness temperatures for ABI band 11 (8.5 μm).

2.2 File Description

Included in the deliverables are three types of data files:

1. WRF model data files (8km_0625_2003.HHMMutc_x_y.nc)
2. Hyperspectral TOA radiance data files (TOA_2003_0625_HHMM_XX_YY.cdf)
3. ABI TOA radiance data files (sim_abi_2003_0625_HHMMutc.nc)

where HHMM is either 0000, 0040, or 0120. All files are in netCDF. The WRF model and hyperspectral radiance data sets each consist of 168 equal-sized files (128 x 128 horizontal grid points) per time step to keep the file sizes manageable. These data sets are numbered starting at the upper left (NW) corner and end at the lower right (SE) corner. Each data set is identified by its row (YY) and column (XX) in the filename. The ABI radiance datasets, however, consist of one file over the entire domain per time step. More information on the variables contained in these files is included in the attached appendix.

2.3 Contacts

Individuals who can answer questions related to these datasets:

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3 VISUALIZATION EXAMPLE

The following is MATLAB code to display a 2D contour plot of channel 546 radiance data from the hyperspectral TOA radiance dataset. Note that the netCDF toolbox for MATLAB is required to execute this code.

```
% reading data from netcdf file
nc = netcdf('TOA_2003_0624_1320_02_01.cdf')
% number of channels, given in the form of wave number
chan = nc{'wvn'}(:);
% Latitude for observation window
lat = nc{'lat'}(:, :);
```

```

% Longitude for observation window
lon = nc{'lon'}(:, :);
% Spectral radiance, Watts per meter squared per steradian per
inverse cm
radiance = nc{'radiance'}(:, :, :);
% To view spatial (horizontal, in lat-lon plane) radiance
distribution at single wavelength
% plot TOA radiance distribution for specified channel, here for
wavenumber 900 figure
contourf(lon, lat, radiance(:, :, 546));
shading flat;
title('TOA Radiance for 2003\_0624\_1320, wavenumber
900', 'FontSize', 14);
xlabel('Longitude', 'FontSize', 12)
ylabel('Latitude', 'FontSize', 12)
colorbar
print -dpng TOA_Radiance.png

```

APPENDIX: SAMPLE DATA FILE HEADERS

This appendix lists sample netCDF file headers to show file contents for each type of data set.

WRF model data:

```
netcdf 8km_0625_2003.0000utc_3_1 {
dimensions:
    time = UNLIMITED ; // (1 currently)
    top_bot = 101 ;
    south_north = 128 ;
    west_east = 128 ;
    number_land_categories = 24 ;
    string_length = 50 ;
variables:
    float T(time, south_north, west_east, top_bot) ;
        T:long_name = "Temperature" ;
        T:units = "K" ;
        T:coordinates = "P lon lat" ;
        T:standard_name = "air_temperature" ;
    float Q(time, south_north, west_east, top_bot) ;
        Q:long_name = "Water vapor mixing ratio" ;
        Q:units = "g/kg" ;
        Q:coordinates = "P lon lat" ;
        Q:standard_name = "humidity_mixing_ratio" ;
    float Ozone(time, south_north, west_east, top_bot) ;
        Ozone:long_name = "Ozone" ;
        Ozone:units = "ppmv" ;
        Ozone:coordinates = "P lon lat" ;
    float Cloud_diam(time, south_north, west_east, top_bot) ;
        Cloud_diam:long_name = "Cloud liquid effective diameter" ;
        Cloud_diam:units = "microns" ;
        Cloud_diam:coordinates = "P lon lat" ;
    float Ice_diam(time, south_north, west_east, top_bot) ;
        Ice_diam:long_name = "Ice effective diameter" ;
        Ice_diam:units = "microns" ;
        Ice_diam:coordinates = "P lon lat" ;
    float Rain_diam(time, south_north, west_east, top_bot) ;
        Rain_diam:long_name = "Rain liquid effective diameter" ;
        Rain_diam:units = "microns" ;
        Rain_diam:coordinates = "P lon lat" ;
    float Snow_diam(time, south_north, west_east, top_bot) ;
        Snow_diam:long_name = "Snow effective diameter" ;
        Snow_diam:units = "microns" ;
        Snow_diam:coordinates = "P lon lat" ;
    float Graupel_diam(time, south_north, west_east, top_bot) ;
```

```

    Graupel_diam:long_name = "Graupel effective diameter" ;
    Graupel_diam:units = "microns" ;
    Graupel_diam:coordinates = "P lon lat" ;
float Cloud(time, south_north, west_east, top_bot) ;
    Cloud:long_name = "Cloud microphysics mixing ratio" ;
    Cloud:units = "g/kg" ;
    Cloud:coordinates = "P lon lat" ;
float Ice(time, south_north, west_east, top_bot) ;
    Ice:long_name = "Ice microphysics mixing ratio" ;
    Ice:units = "g/kg" ;
    Ice:coordinates = "P lon lat" ;
float Rain(time, south_north, west_east, top_bot) ;
    Rain:long_name = "Rain microphysics mixing ratio" ;
    Rain:units = "g/kg" ;
    Rain:coordinates = "P lon lat" ;
float Snow(time, south_north, west_east, top_bot) ;
    Snow:long_name = "Snow microphysics mixing ratio" ;
    Snow:units = "g/kg" ;
    Snow:coordinates = "P lon lat" ;
float Graupel(time, south_north, west_east, top_bot) ;
    Graupel:long_name = "Graupel microphysics mixing ratio" ;
    Graupel:units = "g/kg" ;
    Graupel:coordinates = "P lon lat" ;
float LWP(time, south_north, west_east) ;
    LWP:long_name = "Liquid water path" ;
    LWP:units = "g_m-2" ;
    LWP:coordinates = "lon lat" ;
    LWP:standard_name = "atmosphere_cloud_liquid_water_content" ;
float IWP(time, south_north, west_east) ;
    IWP:long_name = "Ice water path" ;
    IWP:units = "g_m-2" ;
    IWP:coordinates = "lon lat" ;
    IWP:standard_name = "atmosphere_cloud_ice_content" ;
float TGRND(time, south_north, west_east) ;
    TGRND:long_name = "Ground temperature" ;
    TGRND:units = "K" ;
    TGRND:coordinates = "lon lat" ;
    TGRND:standard_name = "surface_temperature" ;
float Altitude(south_north, west_east) ;
    Altitude:long_name = "Terrain" ;
    Altitude:units = "m" ;
    Altitude:coordinates = "lon lat" ;
    Altitude:standard_name = "surface_altitude" ;
float LANDCLAS(south_north, west_east) ;
    LANDCLAS:long_name = "Land class index" ;
    LANDCLAS:units = "category" ;

```



```

    LANDCLAS:coordinates = "lon lat" ;
float lat(south_north, west_east) ;
    lat:long_name = "Latitude" ;
    lat:units = "degrees_north" ;
    lat:standard_name = "latitude" ;
float lon(south_north, west_east) ;
    lon:long_name = "Longitude" ;
    lon:units = "degrees_east" ;
    lon:standard_name = "longitude" ;
float LTOP(time, south_north, west_east) ;
    LTOP:long_name = "Cloud top with respect to liquid" ;
    LTOP:units = "hPa" ;
    LTOP:coordinates = "lon lat" ;
    LTOP:_FillValue = 9999.f ;
float ITOP(time, south_north, west_east) ;
    ITOP:long_name = "Cloud top with respect to ice" ;
    ITOP:units = "hPa" ;
    ITOP:coordinates = "lon lat" ;
    ITOP:_FillValue = 9999.f ;
float PSFC(time, south_north, west_east) ;
    PSFC:long_name = "Surface pressure" ;
    PSFC:units = "hPa" ;
    PSFC:coordinates = "lon lat" ;
    PSFC:standard_name = "surface_air_pressure" ;
float emiss(time, south_north, west_east) ;
    emiss:long_name = "surface broadband thermal emissivity" ;
    emiss:units = "dimensionless" ;
    emiss:coordinates = "lon lat" ;
float albedo(time, south_north, west_east) ;
    albedo:long_name = "surface broadband visible albedo" ;
    albedo:units = "dimensionless" ;
    albedo:coordinates = "lon lat" ;
    albedo:standard_name = "surface_albedo" ;
float P(top_bot) ;
    P:long_name = "pressure" ;
    P:units = "hPa" ;
    P:standard_name = "air_pressure" ;
char CH_LAND(number_land_categories, string_length) ;
    CH_LAND:long_name = "Land-surface classification" ;
    CH_LAND:units = "" ;
    CH_LAND:standard_name = "surface_cover" ;
double time(time) ;
    time:long_name = "time" ;
    time:units = "Minutes since 2003-6-24 0:0:0" ;

```

```
// global attributes:
:TITLE = "FULLDISK 8-KM DATA" ;
:MODEL = " OUTPUT FROM WRF V2.1 MODEL" ;
:INSTITUTION = "UNIVERSITY OF WISCONSIN-MADISON SSEC/CIMSS" ;
:AUTHOR = "JASON OTKIN" ;
:OUTPUT_TIME = "2003-06-25_00:00:00" ;
:CONVENTIONS = "CF-1.0" ;
:WEST-EAST_GRID_DIMENSION = 128 ;
:SOUTH-NORTH_GRID_DIMENSION = 128 ;
:DX = 8000.f ;
:DY = 8000.f ;
:GRIDTYPE = "C" ;
:WRF_MICROPHYSICS_SCHEME = 6 ;
:CEN_LAT = -51.28159f ;
:CEN_LON = -107.3026f ;
:LAND_SURFACE_CLASSIFICATION_SCHEME = "USGS" ;
}
```

Hyperspectral TOA radiance data:

```
netcdf TOA_2003_0624_1320_02_01
{
dimensions:
    time = UNLIMITED ; // (0 currently)
    south_north = 128 ;
    west_east = 128 ;
    red_blue = 3074 ;
variables:
    double wvn(red_blue) ;
        wvn:long_name = "wavenumber" ;
        wvn:units = "1/cm" ;
    float Altitude(south_north, west_east) ;
        Altitude:long_name = "Terrain" ;
        Altitude:units = "m" ;
    float lat(south_north, west_east) ;
        lat:long_name = "Latitude" ;
        lat:units = "degrees_north" ;
    float lon(south_north, west_east) ;
        lon:long_name = "Longitude" ;
        lon:units = "degrees_east" ;
    int CLD_INDT(south_north, west_east) ;
        CLD_INDT:long_name = "Cloud indicator" ;
        CLD_INDT:units = "category" ;
        CLD_INDT:coordinates = "lon lat" ;
    float CP4(south_north, west_east) ;
        CP4:long_name = "Upper cloud top pressure" ;
```

```

        CP4:units = "hPa" ;
        CP4:coordinates = "lon lat" ;
float CTau4(south_north, west_east) ;
        CTau4:long_name = "Upper cloud visible optical depth" ;
        CTau4:units = "dimensionless" ;
        CTau4:coordinates = "lon lat" ;
float CDe4(south_north, west_east) ;
        CDe4:long_name = "Upper cloud particle effective diameter" ;
        CDe4:units = "microns" ;
        CDe4:coordinates = "lon lat" ;
float CP2(south_north, west_east) ;
        CP2:long_name = "Lower cloud top pressure" ;
        CP2:units = "hPa" ;
        CP2:coordinates = "lon lat" ;
float CTau2(south_north, west_east) ;
        CTau2:long_name = "Lower cloud visible optical depth" ;
        CTau2:units = "dimensionless" ;
        CTau2:coordinates = "lon lat" ;
float CDe2(south_north, west_east) ;
        CDe2:long_name = "Lower cloud particle effective diameter" ;
        CDe2:units = "microns" ;
        CDe2:coordinates = "lon lat" ;
float theta(south_north, west_east) ;
        theta:long_name = "Observation zenith angle" ;
        theta:units = "degrees" ;
        theta:coordinates = "lon lat" ;
float radiance(south_north, west_east, red_blue) ;
        radiance:long_name = "Spectral radiance" ;
        radiance:units = "milliWatts per meter squared per steradian per inverse cm" ;
        radiance:coordinates = "wvn lon lat" ;

// global attributes:
        :TITLE = "SIMULATED GIFTS TOA RADIANCES FOR FULLDISK 8-KM
DATA" ;
        :INSTITUTE = "UNIVERSITY OF WISCONSIN-MADISON SSEC/CIMSS" ;
        :AUTHOR = "TOM GREENWALD" ;
        :OUTPUT_TIME = "2003-06-24_13:20:00" ;
        :FILE_PROCESSED = "8km_0624_2003.1320utc_2_1.nc" ;
        :NWP_MODEL = "OUTPUT FROM WRF V2.1 MODEL" ;
        :NWP_MODEL_AUTHOR = "JASON OTKIN" ;
        :WRF_MICROPHYSICS_SCHEME = 6 ;
        :DX = 8000.f ;
        :DY = 8000.f ;
        :CEN_LAT = -51.28159f ;
        :CEN_LON = -116.5114f ;
}

```

ABI TOA radiance data:

```
netcdf sim_abi_2003_0625_0000utc {
dimensions:
    west_east = 1536 ;
    south_north = 1792 ;
variables:
    float lat(south_north, west_east) ;
        lat:long_name = "Latitude" ;
        lat:units = "degrees_north" ;
    float lon(south_north, west_east) ;
        lon:long_name = "Longitude" ;
        lon:units = "degrees_east" ;
    float altitude(south_north, west_east) ;
        altitude:long_name = "Terrain_height" ;
        altitude:units = "m" ;
    float landmask(south_north, west_east) ;
        landmask:long_name = "landmask" ;
        landmask:units = "-" ;
    int CLD_INDT(south_north, west_east) ;
        CLD_INDT:long_name = "Cloud indicator" ;
        CLD_INDT:units = "category" ;
        CLD_INDT:missing_value = -999 ;
    float ABI_rad_band_08(south_north, west_east) ;
        ABI_rad_band_08:long_name = "ABI radiance band 08" ;
        ABI_rad_band_08:central_wavenumber = 1617.155f ;
        ABI_rad_band_08:units = "mW/m2/ster/cm-1" ;
        ABI_rad_band_08:missing_value = -999.f ;
    float ABI_rad_band_09(south_north, west_east) ;
        ABI_rad_band_09:long_name = "ABI radiance band 09" ;
        ABI_rad_band_09:central_wavenumber = 1439.155f ;
        ABI_rad_band_09:units = "mW/m2/ster/cm-1" ;
        ABI_rad_band_09:missing_value = -999.f ;
    float ABI_rad_band_10(south_north, west_east) ;
        ABI_rad_band_10:long_name = "ABI radiance band 10" ;
        ABI_rad_band_10:central_wavenumber = 1362.101f ;
        ABI_rad_band_10:units = "mW/m2/ster/cm-1" ;
        ABI_rad_band_10:missing_value = -999.f ;
    float ABI_rad_band_11(south_north, west_east) ;
        ABI_rad_band_11:long_name = "ABI radiance band 11" ;
        ABI_rad_band_11:central_wavenumber = 1176.151f ;
        ABI_rad_band_11:units = "mW/m2/ster/cm-1" ;
        ABI_rad_band_11:missing_value = -999.f ;
    float ABI_rad_band_12(south_north, west_east) ;
        ABI_rad_band_12:long_name = "ABI radiance band 12" ;
        ABI_rad_band_12:central_wavenumber = 1041.15f ;
```

```

ABI_rad_band_12:units = "mW/m2/ster/cm-1" ;
ABI_rad_band_12:missing_value = -999.f ;
float ABI_rad_band_13(south_north, west_east) ;
ABI_rad_band_13:long_name = "ABI radiance band 13" ;
ABI_rad_band_13:central_wavenumber = 966.1002f ;
ABI_rad_band_13:units = "mW/m2/ster/cm-1" ;
ABI_rad_band_13:missing_value = -999.f ;
float ABI_rad_band_14(south_north, west_east) ;
ABI_rad_band_14:long_name = "ABI radiance band 14" ;
ABI_rad_band_14:central_wavenumber = 893.1501f ;
ABI_rad_band_14:units = "mW/m2/ster/cm-1" ;
ABI_rad_band_14:missing_value = -999.f ;
float ABI_rad_band_15(south_north, west_east) ;
ABI_rad_band_15:long_name = "ABI radiance band 15" ;
ABI_rad_band_15:central_wavenumber = 813.1498f ;
ABI_rad_band_15:units = "mW/m2/ster/cm-1" ;
ABI_rad_band_15:missing_value = -999.f ;
float ABI_rad_band_16(south_north, west_east) ;
ABI_rad_band_16:long_name = "ABI radiance band 16" ;
ABI_rad_band_16:central_wavenumber = 752.149f ;
ABI_rad_band_16:units = "mW/m2/ster/cm-1" ;
ABI_rad_band_16:missing_value = -999.f ;

// global attributes:
:SoftwareVersion = "abi version" ;
:Comments = "ABI data from simulated GIFTS radiances" ;
:TITLE = "SIMULATED GIFTS TOA RADIANCES FOR FULLDISK 8-KM
DATA" ;
:INSTITUTE = "UNIVERSITY OF WISCONSIN-MADISON SSEC/CIMSS" ;
:FM_AUTHOR = "TOM GREENWALD" ;
:OUTPUT_TIME = "2003-06-25_00:00:00" ;
:FILE_PROCESSED = "8km_0625_2003.0000utc_1_1.nc" ;
:NWP_MODEL = "OUTPUT FROM WRF V2.1 MODEL" ;
:NWP_MODEL_AUTHOR = "JASON OTKIN" ;
:WRF_MICROPHYSICS_SCHEME = 6 ;
:WEST-EAST_GRID_DIMENSION = 1536 ;
:SOUTH-NORTH_GRID_DIMENSION = 1792 ;
:DELTA_X = 8000.f ;
:DELTA_Y = 8000.f ;
:MAP_PROJ = "Mercator" ;
:TRUELAT1 = 0.f ;
:TRUELAT2 = 0.f ;
:CEN_LAT = -0.07194519f ;
:CEN_LON = -75.07196f ;
}

```