

CCRS MODIS Albedo Over Canada at 250-m Resolution and 10-day Intervals: Descriptive Documentation

1. Product Overview

The **CCRS MODIS albedo over Canada at 250-m resolution** (called below for brevity as **CCRS MODIS albedo**) product provides regional, long-term, and consistent time series of surface spectral and broadband reflectances and albedo as well as associated quality layer and some associated parameters produced at 10-day intervals (three per month).

This product is an Earth Observation (EO) analysis-ready dataset, generated from the Moderate Resolution Imaging Spectroradiometer (MODIS) level 1B imagery from the MODIS imager aboard the Terra satellite collection (6.1).

- **Temporal Resolution:** 10-day composite product.
- **Spatial Resolution:** 250 meters.
- **Key Indices:** Spectral and broadband albedo and reflectances.
- **Data Format:** Cloud Optimized GeoTIFF (COG)

2. Data Access and Organization

The dataset is publicly hosted on the Amazon Web Services (AWS) Open Data Registry.

2.1 S3 Bucket Location

- **Bucket Name:**
- **Access:**

2.2 File Naming Convention

Each COG file follows the naming convention as below:

Terra_MODIS_BX_Albedo.Noon_250m_YYYYMMDD.tif
 Terra_MODIS_BX_BRDF.Norm_250m_YYYYMMDD.tif
 Terra_MODIS_Index_BRDF.Norm_250m_YYYYMMDD.tif
 Terra_MODIS_NDVI_250m_YYYYMMDD.tif
 Terra_MODIS_VIS_BB_Albedo.Noon_250m_YYYYMMDD.tif
 Terra_MODIS_NIR_BB_Albedo.Noon_250m_YYYYMMDD.tif
 Terra_MODIS_SW_BB_Albedo.Noon_250m_YYYYMMDD.tif
 Terra_MODIS_Snow_Fraction_250m_YYYYMMDD.tif
 Terra_MODIS_Snow_GrainSize_1.0km_YYYYMMDD.tif
 Terra_MODIS_State_Mask_250m_YYYYMMDD.tif

Component	Description	Example
BX_Albedo.Noon	Band X spectral albedo, where X may have values from 1 to 7, which are used to identify MODIS land bands 1 to 7. Spectral albedo values computed at the local solar noon geometry. Stored as two-byte integer values scaled by factor 10,000	B1_Albedo.Noon
BX_BRDF.Norm	Band X spectral reflectances for MODIS land bands 1 to 7. Spectral reflectance values correspond to spectral reflectances for band BX(X=1-7) normalized to a nadir view and overhead sun geometry. Stored as two-byte integer values scaled by factor 10,000	B1_BRDF.Norm
Index_BRDF	Index file that contains 2-byte integer value (I2) used for BRDF sampling and fitting and computed as described in the data format description document https://data.eodms-sgdot.nrcan-rncan.gc.ca/public/CCRS/Trishchenko_MODIS_Albedo/	Index_BRDF
NDVI	Normalized Difference Vegetation Index. Stored as two-byte integer values scaled by factor 10,000.	NDVI
VIS_BB_Albedo.Noon	Broadband visible albedo computed at the local solar noon geometry. Stored as two-byte integer values scaled by factor 10,000.	VIS_BB_Albedo.Noon
NIR_BB_Albedo.Noon	Broadband NIR albedo computed at the local solar noon geometry. Stored as two-byte integer values scaled by factor 10,000.	NIR_BB_Albedo.Noon
SW_BB_Albedo.Noon	Broadband SW (shortwave) albedo computed at the local solar noon geometry. Stored as two-byte integer values scaled by factor 10,000.	SW_BB_Albedo.Noon
Snow_Fraction	Snow fraction stored as 1-byte signed integer that varies from 0 to 100, i.e., corresponds to snow fraction expressed in percent	Snow_Fraction
Snow_GrainSize	The estimates of snow grain size in [um] averaged over 4 × 4 original 250-m pixels, i.e. over 1km × 1km area	Snow_GrainSize
State_Mask	contains the following values coded as 1-byte integers: 1 – vegetated land, 2 – barren land, 3 – water/land mix, 4 - water, 5 -snow/ice, 10 – cloud.	State_Mask
YYYYMMDD	Start date of the composite interval	20000501

3. Data Dictionary and Schema

Each file contains one science data set.

The CCRS Albedo dataset includes times series of 10-day composite products derived at 250-m spatial resolution over Canadian territory and neighboring areas produced at the Canada Centre for Remote Sensing (CCRS) since February 2000. The datasets contain spectral and broadband reflectances and albedo for MODIS bands B1-B7 designed primarily for land applications. The input level 1B imagery for all spectral bands was downscaled and re-projected into the Lambert Conformal Conic (LCC) projection at 250-m spatial resolution. The area size is 5,700 km × 4,800 km. The specialized MODIS processing system was developed at CCRS to fully utilize the high quality of MODIS L1B swath imagery over the northern latitudes. As such, the CCRS Albedo product is different from the standard NASA product. The differences are related to temporal and spatial scaling, shape of kernel functions employed to fit data, as well as details of scene identification, atmospheric correction, and data fitting methodology.

The regular temporal composite intervals start on day 1, 11, and 21 of each month. There are three composite intervals per month. The last composite interval of the month may include 10 or 11 days, except in February, where it may include 8 or 9 days depending on whether it is a regular or a leap year.

Key Data Layers (Science Data Sets)

Dataset Name	Type	Description	Units/Interpretation	Scale Factor	Fill Value
BX_Albedo.Noon	16-bit signed integer	Band X spectral albedo, where X may have values from 1 to 7, which are used to identify MODIS land bands 1 to 7. Spectral albedo values computed at the local solar noon geometry	Unitless. Range: 0 to +1.0	0.0001	0
BX_BRDF.Norm	16-bit signed integer	Band X spectral reflectances for MODIS land bands 1 to 7. Spectral reflectance values correspond to spectral reflectances for band BX(X=1-7) normalized to a nadir view and overhead sun geometry.	Unitless. Range: 0 to +1.0	0.0001	0

Index_BRDF	16-bit unsigned integer	Quality assessment (QA) flag for BRDF sampling and fitting process	Bit Flags (Requires Bitwise Decoding)	N/A	0
NDVI	16-bit signed integer	Normalized Difference Vegetation Index.	Unitless. Range: 0 to +1.0	0.0001	32767 (#7FFF)
VIS_BB_Albedo. Noon	16-bit signed integer	Broadband visible albedo computed at the local solar noon geometry.	Unitless. Range: 0 to +1.0	0.0001	0
NIR_BB_Albedo. Noon	16-bit signed integer	Broadband NIR albedo computed at the local solar noon geometry.	Unitless. Range: 0 to +1.0	0.0001	0
SW_BB_Albedo. Noon	16-bit signed integer	Broadband Sw albedo computed at the local solar noon geometry.	Unitless. Range: 0 to +1.0	0.0001	0
Snow_Fraction	1-byte signed integer that varies from 0 to 100	Snow fraction stored as 1-byte signed integer that varies from 0 to 100, i.e., corresponds to snow fraction expressed in percent	Unitless. Range: 0 to +1.0	0.01	255 (#FF)
Snow_GrainSize	16-bit signed integer	The estimates of snow grain size in [um] averaged over 4 × 4 original 250-m pixels, i.e. over 1km × 1km area	Micron, typical range from ~ 30 um to 2000 um	1	0
State_Mask	8-bit unsigned integer	Surface state of cloud flag	1 – vegetated land, 2 – barren land, 3 – water/land mix, 4 – water, 5 – snow/ice, 10 – cloud.	N/A	255 (#FF)

Data Interpretation

To convert the raw digital numbers (DN) to physical values (PV) of albedo, reflectance or NDVI, users **MUST** apply the scale factor:

$$PV = DN * 0.0001$$

For example, DN=1500 means 0.15 for PV.

The Fill Value represents invalid or non-existing data.

Quality Assurance

The Quality Assurance (QA) information is essential. This information is available from the State Mask and Index_BRDF file.

4. Geographic and Spatial Information

4.1 Projection System

The imagery is produced in the Lambert Conformal Conic (LCC) projection at 250-m spatial resolution. The area size is 5,700 km × 4,800 km. The parameters of the Lambert Conformal Conic (LCC) projection used for output imagery over Canada are given in Table 1

Table 1. The parameters of the map projection

Parameter	Value
<i>Projection</i>	Lambert Conformal Conic (LCC)
1 st parallel	49.00 [degree]
2 nd parallel	77.00 [degree]
Central meridian	-95.00 [degree]
Upper left corner	(-2600000.0 E [m]; 10500000.0 N [m])
Lower right corner	(3100000.0 E [m]; 5700000.0 N [m])
Easting	0
Northing	0
Gridbox size, x	250 [m]
Gridbox size, y	250 [m]
Number of pixels along x	22800
Number of pixels along y	19200

The georeferencing details in GEOTIFF files are provided in the ENVI header files generated together with data files. This information is included in the header file as follows:

map info = {Lambert Conformal Conic, 1, 1, -2600000, 10500000, 250, 250,WGS-84})

projection info = {4, 6378137, 6356752.314245179, 0, -95, 0, 0, 49, 77,WGS-84, Lambert Conformal Conic})

coordinate system string =

```
{PROJCS["Lambert_Conformal_Conic",GEOGCS["GCS_WGS_1984",DATUM["D_WGS_1984",
SPHEROID["WGS_1984",6378137.0,298.257223563]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.017453292519943295]],PROJECTION["Lambert_Conformal_Conic"],PARAMETER["False_Easting",0.0],PARAMETER["False_Northing",0.0],PARAMETER["Central_Meridian",-95.0],PARAMETER["Standard_Parallel_1",49.0],PARAMETER["Standard_Parallel_2",77.0],PARAMETER["Scale_Factor",1.0],PARAMETER["Latitude_Of_Origin",0.0],UNIT["Meter",1]]}
```

4.2 Tiling System

The data is delivered as one map (file) for the entire area for each parameter. An example, of the false color image is given in Figure 1.

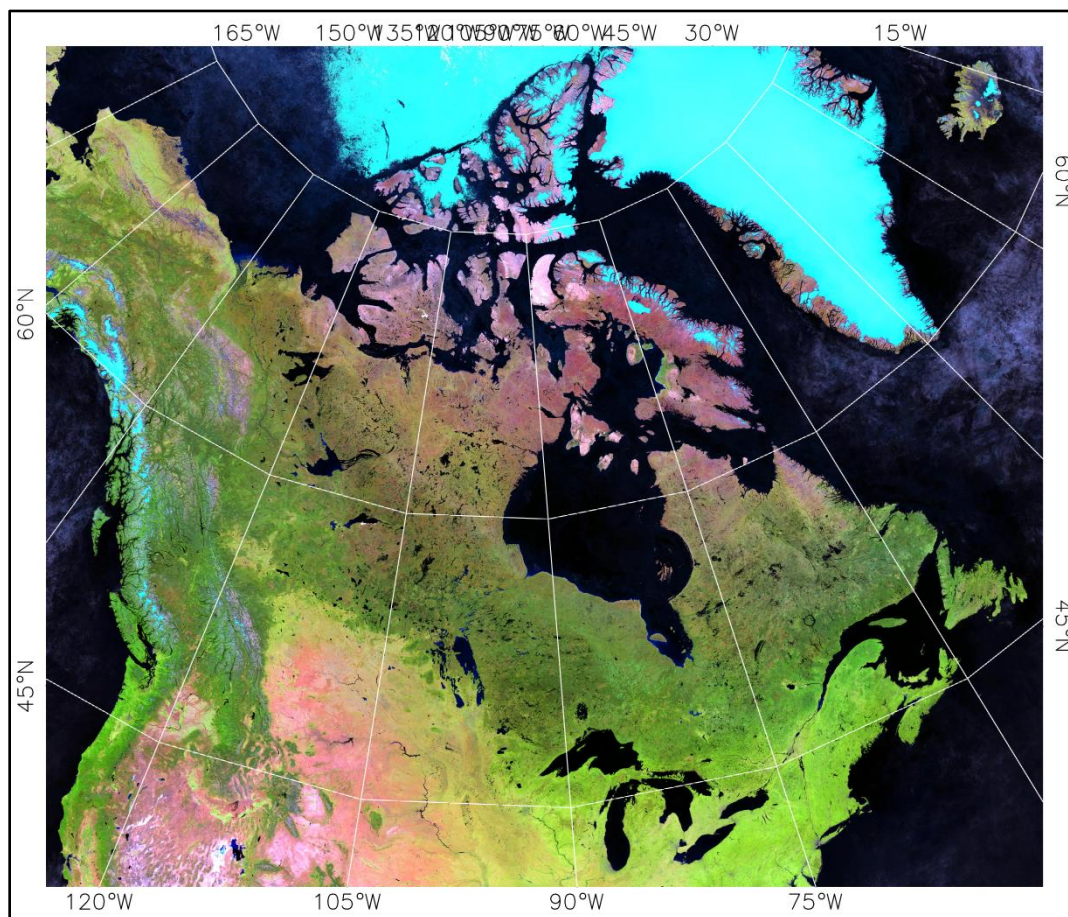


Figure 1. An example of the false colour image for coverage area used for CCRS albedo mapping.