CLPX-Satellite: MODIS Radiances, Reflectances, Snow Cover and Related Grids, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Haran, T. 2003. *CLPX-Satellite: MODIS Radiances, Reflectances, Snow Cover and Related Grids, Version 1* [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/E9PAQOER1YQA. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0151

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

1.1 Format

This data set provides Moderate Resolution Imaging Spectroradiometer (MODIS) data as part of the Cold Land Processes Field Experiment (CLPX). These MODIS data are provided in Geographic (GEO) and Universal Tranverse Mercator (UTM) grids, covering the Large-Regional Study Area (LRSA). Data cover the time period Feb 15 (day 046) through May 15 (day 135), a total of 90 days, for both study years (2002-2003).

Gridded data are provided in two formats: raw binary (including an ASCII header) and GeoTiff. Both formats are provided as output from the MODIS Reprojection Tool, which is used to regrid MODIS gridded data in HDF-EOS forma

1.1.1 Raw Binary Format

Raw binary data are stored in individual data files, with one file per band. Within each file, data are stored in row-major order, starting at the upper-left corner of the image. The data type may be 8-bit integer, 16-bit integer, or 32-bit integer, as specified in the corresponding header file. Integer values may be signed or unsigned. Two-byte and four-byte data types are stored in big-endian order (high byte followed by low byte).

Header Format

The header file contains information produced by the MODIS Reprojection Tool for data in the raw binary file format. An ODL-like format is used, as illustrated by the following file named mod09q1.2002049.003.01.lrsa_geo007.5cc.hdr for the 7.5 arcsecond GEO grid:

PROJECTION_TYPE = GEOGRAPHIC

PROJECTION_PARAMETERS = (

0.000000000 0.000000000 0.000000000

0.000000000 0.000000000 0.000000000

0.000000000 0.000000000 0.000000000

0.000000000 0.000000000 0.000000000

0.000000000 0.000000000 0.000000000)

COORDINATE_ORIGIN = UL

UL_CORNER_LATLON = (42.050000000 -108.550000000)

UR_CORNER_LATLON = (42.050000000 -103.950000000)

LL_CORNER_LATLON = (38.450000000 -108.550000000)

LR_CORNER_LATLON = (38.450000000 -103.950000000)

UL_CORNER_XY = (-108.550000000 42.050000000)

UR_CORNER_XY = (-103.950000000 42.050000000)

LL_CORNER_XY = (-108.550000000 38.450000000)

LR_CORNER_XY = (-103.950000000 38.450000000)

NBANDS = 2

BANDNAMES = (sur_refl_b01 sur_refl_b02)

DATA_TYPE = (INT16 INT16)

NLINES = (1728 1728)

NSAMPLES = (2208 2208)

PIXEL_SIZE = (0.002083 0.002083)

MIN_VALUE = (-100 -100)

MAX_VALUE = (16000 16000)

BACKGROUND_FILL = (-28672 -28672)

DATUM = WGS84

The corresponding raw binary files corresponding to the above header file are named:

mod09q1.2002049.003.01.lrsa_geo007.5cc.sur_refl_b01.dat

mod09q1.2002049.003.01.lrsa_geo007.5cc.sur_refl_b02.dat

For a full description of the header file format, see Appendix B of the MODIS Reprojection Tool User's Manual found on the MODIS Reprojection Tool Web site.

1.1.2 GeoTiff Format

GeoTiff data are stored in individual data files, one file per band. Included within each file is metadata that allows GeoTiff-enabled software (such as ENVI) to determine the pixel width, byte-ordering, and geolocation of the data. See the GeoTiff home page for a further explanation of the GeoTiff data format.

1.1.3 Metadata and Attributes

In addition to gridded data, two ASCII text files are provided (for each MODIS HDF-EOS product file) containing MODIS metadata and attributes, respectively.

Metadata Files

Metadata files are created along with the HDF-EOS product files. The metadata file contains some of the same metadata as in the product file, but also includes other information regarding archiving, user support, and post production quality assurance (QA) relative to the granule ordered.

Attribute Files

Attribute files contain the following information extracted from the corresponding product file:

- Dimensions of the data arrays
- Names of the data arrays
- List of local attributes and their values
- List of global attributes and their values

Of particular importance are local attributes that pertain to individual data arrays in the HDF-EOS product files. Some of these local attributes include scale and offset values that can be used to

convert the integer values contained in the corresponding grids into meaningful scientific quantities such as radiances, reflectances, and emissivities.

1.2 File Naming Convention

1.2.1 Files Containing Gridded Data

Files containing MODIS data resampled to the MODIS CLPX grids have names in the following form:

<dataset>.<year><day>[.<time>].<modis_version>.<clpx_version>.<grid>[<resample>][.<band>].<extension>

where

<dataset> is the name (mapped to lowercase) of the MODIS dataset corresponding to the granule from which the data were extracted and (re)gridded, e.g., "mod09q1" or "mod10_l2".

<year> is the four digit year the data were acquired, e.g., "2000".

<day> is the three digit day of year the data were acquired, e.g., "052".

[.<time>] is the four digit UTC time of the start of acquisition for the five minute swath granule from which the data were gridded, e.g., "1725". For Level 3 datasets (i.e., daily and multiple day datasets), this field, including the leading period, is omitted.

.<modis_version> is the three-digit version number (also referred to as a collection number) of the original MODIS data granule from which the data were resampled.

.<clpx_version> is the two-digit version number of the CLPX MODIS processing software which resampled the data.

<grid> is the name of the grid to which the data have been resampled, e.g., "lrsa_geo007.5".

[<resample>] is the resampling method and is one of:

- "cc" for cubic convolution resampling used in MRT.
- "nn" for nearest neighbor resampling used in MRT.

For Level 2 datasets (i.e., those derived from swath data), this field is omitted.

[.<band>] is the name of an individual band in the dataset, e.g., "sur_refl_b01" or "Snow_Cover". For header files (see below), this field, including the leading period, is omitted since the header contains information for all bands for a particular dataset granule for a particular resampling method.

<extension> is one of:

- "dat" for raw binary data file.
- "hdr" for an ASCII header file.
- "tif" for a GeoTiff file.

Examples:

mod021km.2002087.1755.004.01.lrsa_geo030.0.hdr

mod021km.2002087.1755.004.01.lrsa_geo030.0.ch01.dat

mod021km.2002087.1755.004.01.lrsa_geo030.0.ch01.tif

mod10a1.2002088.003.01.lrsa_utm00500nn.hdr

mod10a1.2002088.003.01.lrsa_utm00500nn.Day_Tile_Snow_Cover.dat

mod10a1.2002088.003.01.lrsa_utm00500nn.Day_Tile_Snow_Cover.tif

1.2.2 Files Containing MODIS Metadata

Files containing MODIS metadata are ASCII text files having names in the following form:

<granule>.met

where **<granule>** is the name of the MODIS HDF-EOS file described by the metadata file.

Examples:

MOD09Q1.A2002049.h09v04.003.2002062162758.hdf.met

MOD10_L2.A2002052.1725.003.2002055102744.hdf.met

1.2.3 Files Containing MODIS Attributes

Files containing MODIS attributes extracted from corresponding MODIS HDF-EOS product files are ASCII text files having names in the following form:

<granule>.atr

where **<granule>** is the name of the MODIS HDF-EOS file from which the attributes were extracted using the ncdump tool.

Examples:

MOD09Q1.A2002049.h09v04.003.2002062162758.hdf.atr

MOD10_L2.A2002052.1725.003.2002055102744.hdf.atr

1.3 Spatial Coverage

MODIS data were collected over the Cold Land Processes Field Experiment (CLPX) Large Regional Study Area (LRSA), defined by a latitude-longitude bounding box as follows:

Upper Left: 42 N, 108.5 W

Lower Right: 38.5 N, 104 W

1.3.1 Spatial Resolution

MODIS data were resampled into two families of grids: Geographic (GEO) and Universal Tranverse Mercator (UTM), and span a range of resolutions. Each grid at a particular resolution is intended to be a relatively close match to a set of MODIS (or other sensor) products at a similar resolution.

1.3.2 Projection and Grid Description

The Cold Land Processes Field Experiment (CLPX) Large Regional Study Area (LRSA) is defined by a latitude-longitude bounding box as follows:

Upper Left: 42 N, 108.5 W

Lower Right: 38.5 N, 104 W

MODIS data were resampled into two families of grids: Geographic (GEO) and Universal Tranverse Mercator (UTM), that cover the LRSA and span a range of resolutions. Each grid at a particular

resolution is intended to be a relatively close match to a set of MODIS (or other sensor) products at a similar resolution.

Note that in the following descriptions, Upper Left refers to the latitude-longitude coordinates of the upper left corner of the upper left pixel, and Lower Right refers to the latitude-longitude coordinates of the lower right corner of the lower right pixel. When defined in this way, all grids in a family have the same Upper Left and Lower Right latitude-longitude coordinates.

Grid names marked with * in the tables below indicate grids that will not be used for MODIS data but may be suitable for other sensors such as SSM/I or Landsat.

The formulas below for calculating Column, Row, Latitude, Longitude, X, and Y follow the ENVI convention of specifying the upper left corner of the upper left pixel in a grid as having a row value of 1 and a column value of 1.

Geographic (GEO) Grid

Upper Left: 42.05 N, 108.55 W
Lower Right: 38.45N 103.95 W
Datum: WGS84
Approximate Coverage: 4.6 degrees x 3.6 degrees =~ 400 km x 400 km

Name	MODIS Products	Resolution arcseconds	Resolution degrees	X Resolution meters (appx.)	Y Resolution meters (appx.)	Cols	Rows
lrsa_geo720.0*	None	720	0.2	16974	22239	23	18
lrsa_geo360.0*	None	360	0.1	8487	11120	46	36
lrsa_geo180.0	MOD10C1 MOD10C2	180	0.05	4243	5560	92	72
lrsa_geo030.0	MOD021KM MOD03 MOD11A1 MOD35_L2	30	0.00833333	707	927	552	432

lrsa_geo015.0	MOD02HKM MOD09A1 MOD10_L2 MOD10A1 MOD10A2	15	0.0041666 7	354	463	1104	864
lrsa_geo007.5	MOD02QKM MOD09Q1 MOD13Q1	7.5	0.0020833 3	177	232	2208	1728
lrsa_geo001.0*	None	1.0	0.0002777 78	23.6	30.9	16560	12960
lrsa_geo000.5*	None	0.5	0.0001388 89	11.8	15.4	33120	25920

Row = (42.05 - Latitude) / Resolution_in_degrees + 1

Column = (Longitude + 108.55) / Resolution_in_degrees + 1

Latitude = 42.05 - (Row - 1) * Resolution_in_degrees

Longitude = (Column - 1) * Resolution_in_degrees - 108.55

Universal Transverse Mercator (UTM) Grids

Zone: 13

Semi-Major Axis of Ellipsoid: 6378137.000000 meters

Semi-Minor Axis of Ellipsoid: 6356752.314245 meters

Scale Factor at C. Meridian: 0.999600

Longitude of Central Meridian: -105.000000 degrees

Upper Left XY: 175000.0, 4675000.0 = 42.159677085 N, 108.933826235 W

Lower Right XY: 600000.0, 4250000.0 = 38.392627781 N, 103.854898585 W

Datum: WGS84

Approximate Coverage: 5.1 degrees x 3.8 degrees =~ 425 km x 425 km

Name	MODIS Products	Resolution	Cols	Rows
lrsa_utm25000*	None	25000 meters	17	17
lrsa_utm12500*	None	12500 meters	34	34
lrsa_utm05000	MOD10C1 MOD10C2	5000 meters	85	85
lrsa_utm01000	MOD021KM MOD03 MOD11A1 MOD35_L2	1000 meters	425	425
lrsa_utm00500	MOD02HKM MOD09A1 MOD10_L2 MOD10A1 MOD10A2	500 meters	850	850
lrsa_utm00250	MOD02QKM MOD09Q1 MOD13Q1	250 meters	1700	1700
lrsa_utm00025*	None	25 meters	17000	17000
lrsa_utm00012*	None	12.5 meters	34000	34000

Row = (4675000.0 - Y) / Resolution_in_meters + 1
Column = (X - 175000.0) / Resolution_in_meters + 1
Y = 4675000.0 - (Row - 1) * Resolution_in_meters
X = 175000.0 + (Column - 1) * Resolution_in_meters

1.4 Temporal Coverage

Data were collected 15 February (day 046) through 15 May (day 135), a total of 90 days, for both study years (2002-2003).

Some data products may be missing for certain time periods due to intermittent problems with the satellite, sensor, or ground systems. A comprehensive list of these data gaps will be documented in a future version of this document after the data products are resampled. Here is a tentative list of data gaps:

March 19, 2002 (2002078) through March 28, 2002 (2002087) - first 4 days of IOP2 are missing.
April 14, 2002 (2002104) through April 15, 2002 (2002105).
March 7, 2003 (2003066)

1.5 Parameter or Variable

One of three sample datasets is available at https://daacdata.apps.nsidc.org/pub/DATASETS/CLP/data/satellite/nsidc0151_modis/MOD_LRSA_2002_04_V11/. Included are all 8-day and 16-day data for 2002049 (2002/02/18) and all 1-day data for 2002052 (2002/02/21). The 1-day data for 2002049 is not included, so the total sample represents the maximum amount of data expected for a single day. Total number of bytes for the entire sample dataset is about 693 MB.

1.5.1 Viewing Sample Data

Using a web browser to view sample data

The GeoTiff files in the sample dataset can be viewed using any web browser that has been enabled to read Tiff files using either a plugin or an image viewing application. Starting with the URL above, go to the GEOTIFF directory, select a grid family (e.g., UTM), select a day (e.g., 2002049), and then click on one of the tif files (e.g., mod09a1.2002049.003.01.lrsa_utm00500cc.sur_refl_b01.tif). If you're on a Unix or Linux platform you shouldn't have any problems. However Windows users may not be able to view the two-byte-per-pixel files (such as mod09a1.2002049.003.01.lrsa_utm00500cc.sur_refl_b01.tif) correctly. This is probably because the images were created on a big-endian machine and most freeware Windows image viewers apparently are not smart enough to interpret the big-endian tag in the Tiff file correctly. One-byte-per-pixel files (such as mod10a2.2002049.003.01.lrsa_utm00500nn.Maximum_Snow_Extent.tif) should look ok on Windows platforms. On Macintosh platforms, the QuickTime viewer apparently can't view Tiff files at all.

None of the web-enabled image viewers that the author has used can geolocate the data in the GeoTiff files or read out individual pixel values.

Using a standalone program to view sample data

The best way the author has found to view the GeoTiff files in the sample dataset using a freeware program is to download the sample data files you wish to view to your computer using ftp, and then install a current version of ENVI. (Of course, if you already have a working version of ENVI, use that version.) All the above mentioned problems using web-enabled image viewers on Windows platforms go away, and you can even view the latitude-longitude and (for UTM grids) X-Y coordinates of any pixel together with the value of the pixel.

If you want to download some sample data to view with a standalone program, and you don't want to download the entire sample dataset (about 693 MB), you might want to settle for just the 2002049 and 2002052 directories in GEOTIFF/UTM (about 149 MB).

1.6 Sample Images

The following four images were created with ENVI using data from the sample dataset. Each image shows 500 meter MODIS data resampled to the lrsa_utm00500 grid. UTM grid lines and lat-lon grid crosses have been drawn on the images. State and county boundaries and interstate highways have been overlaid as well.

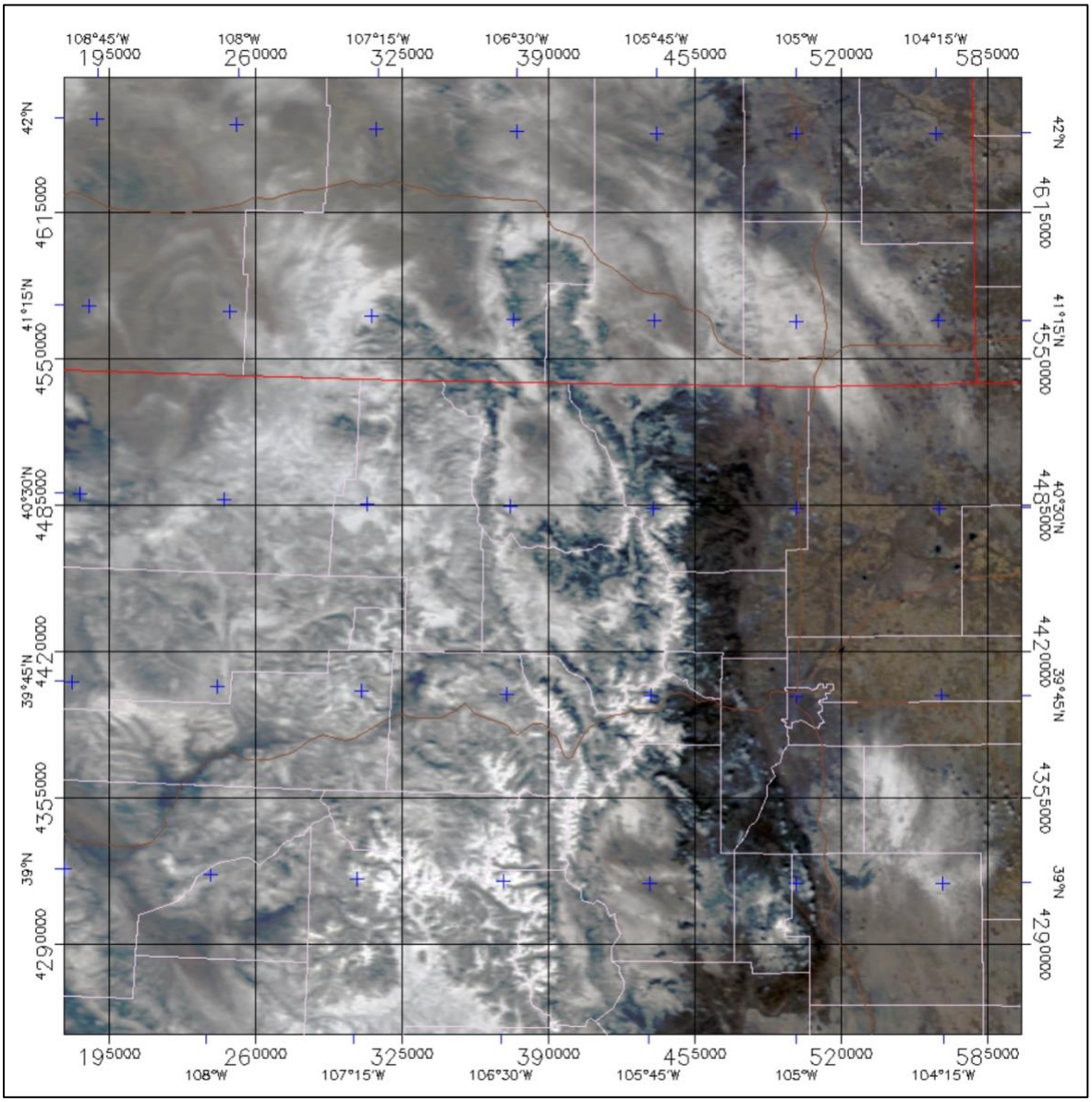

Figure 1. Consists of MODIS channels 1, 4, and 3 mapped to red, green, and blue, respectively. It represents a portion of a single 5-minute swath of MOD02HKM Calibrated Radiances data acquired on Feb 21, 2002

(day 052) during day 3 of IOP1 at about 10:25 MST, and resampled to the lrsa_utm00500 grid. A Gaussian stretch was applied to the image. The image is somewhat blurred due to the fact that the LRSA was considerably off nadir during this satellite pass, but the image is relatively cloud-free.

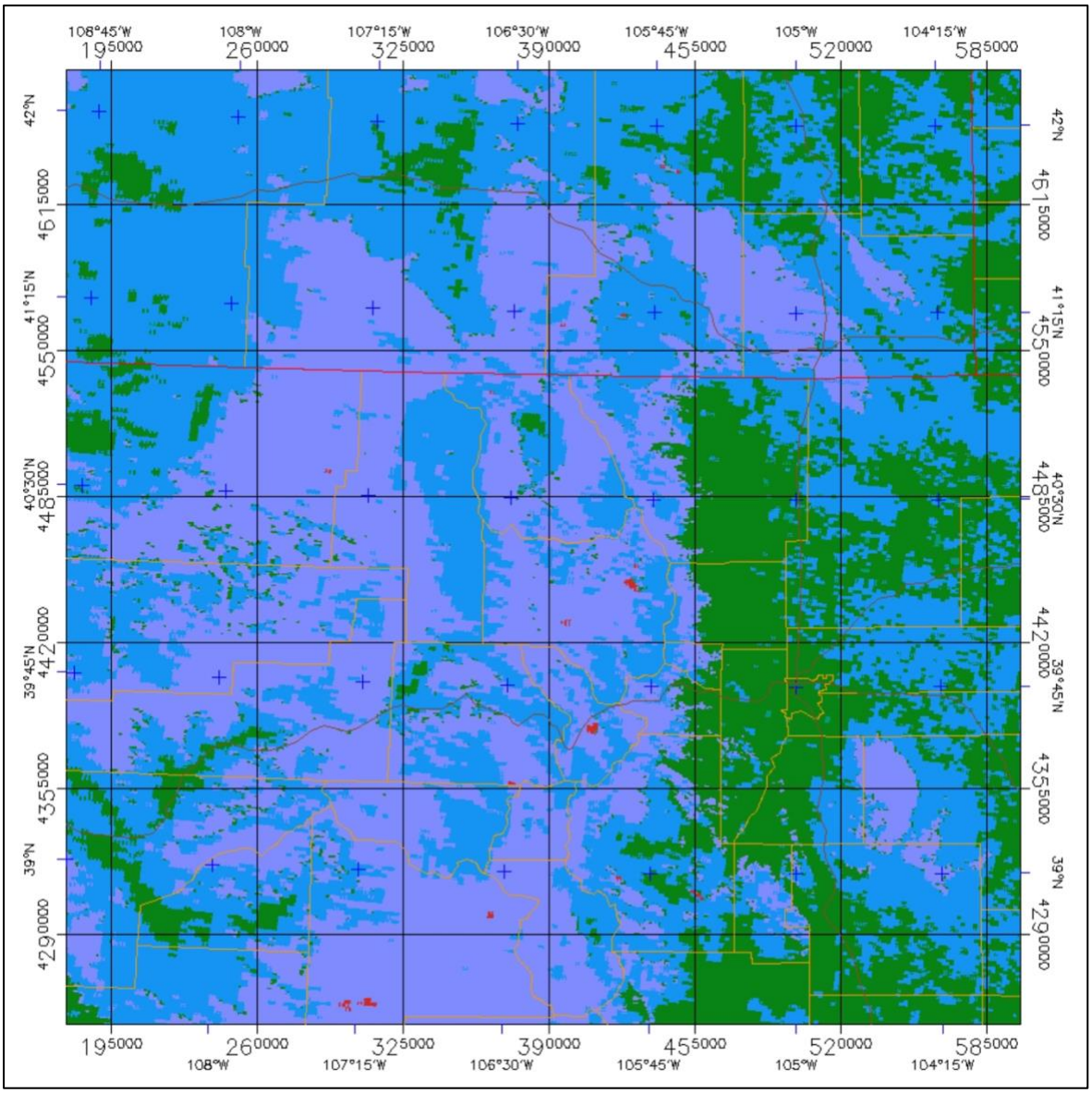

Figure 2. Consists of the MOD10_L2 Snow Cover band acquired at the same time as image #1. A linear 0-255 stretch was applied to the image and the ENVI "Volcano" palette was used to map the single byte Snow Cover coded values to colors. The colors are as follows: violet = 200 = snow, blue = 50 = CloudObscured, red = 100 = LakeIce, green = 25 = NoSnow

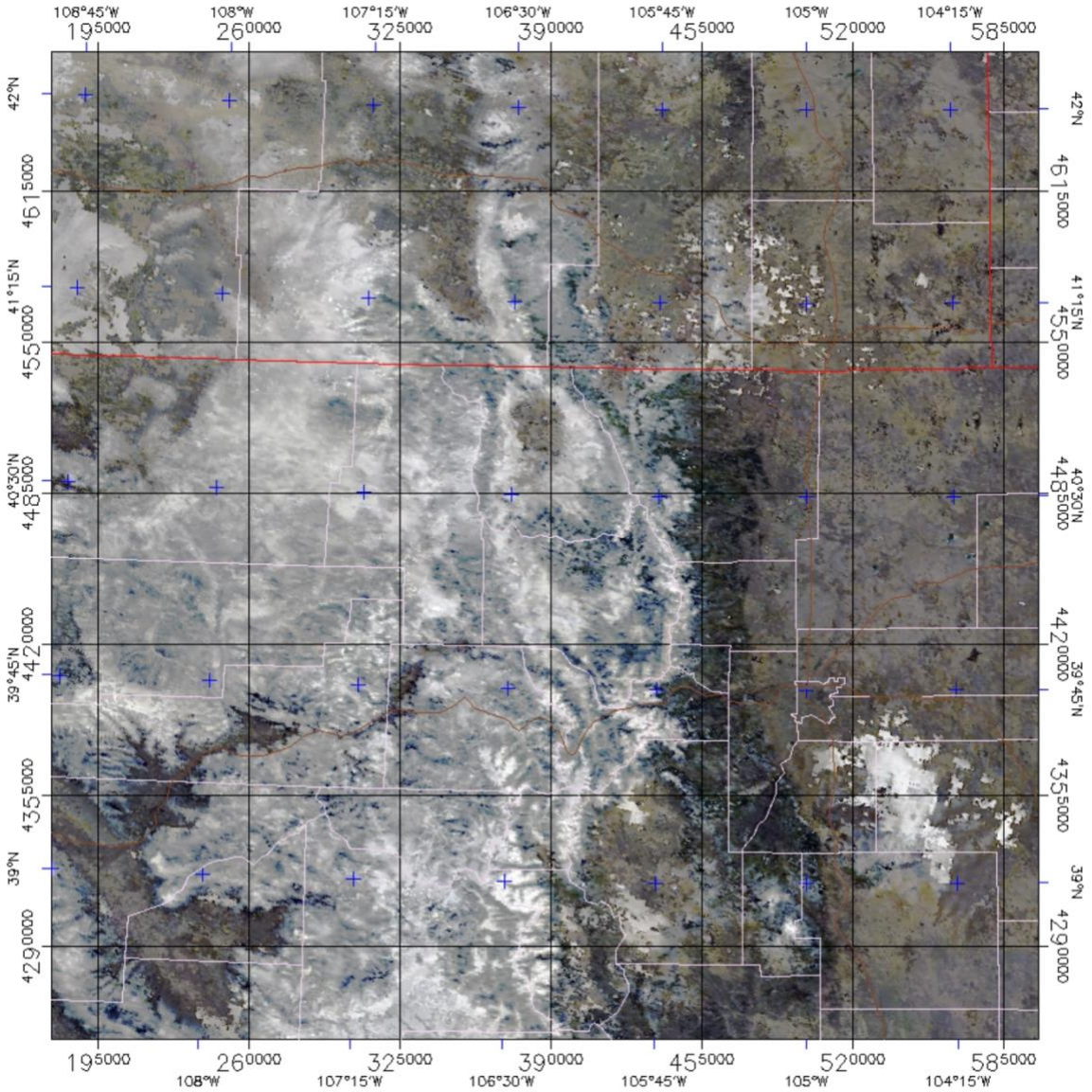

Figure 3. Consists of MODIS channels 1, 4, and 3 mapped to red, green, and blue respectively, just as in image #1 above; however this image is taken from MOD09A1 Surface Reflectance data and thus represents an eight-day composite of cloud-cleared reflectances starting on Feb 18, 2002 (day 049) through Feb 25 (day 56) so it includes all of IOP1. Note that this image looks sharper than image #1. This is due in part to the use of data that were acquired closer to nadir.

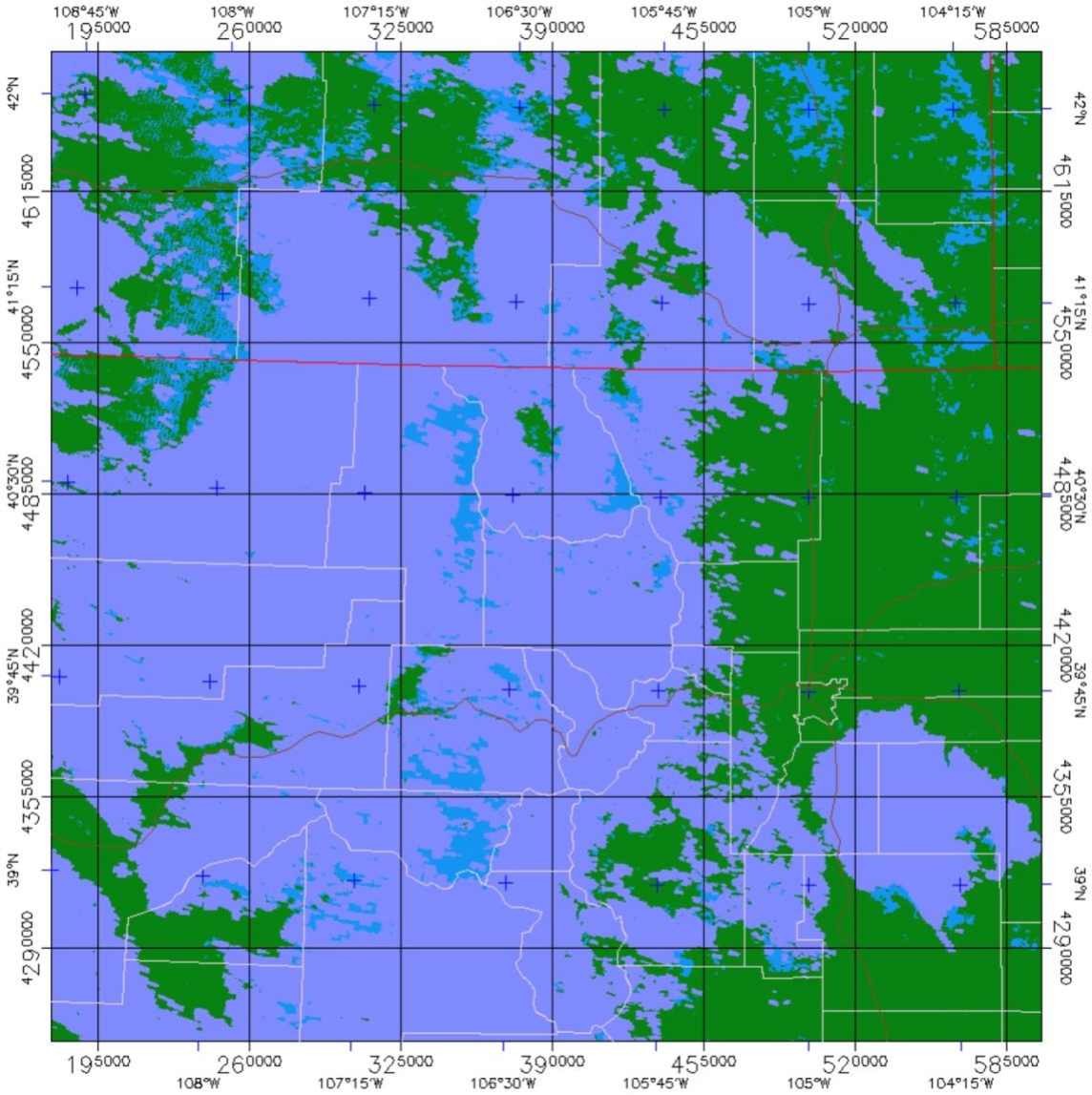

Figure 4. Consists of the MOD10A2 Maximum Snow Extent band for the same eight day period as in image #3 and using the same color coding as in image #2. Notice that there are fewer pixels marked as cloudy in this image compared to image #2 since it is less likely that a particular pixel would be truly cloudy for all eight days. However, there are areas containing what is probably marginal snow (such as in North Park) that are marked as cloudy in this image. This is probably due to lingering problems in distinguishing marginal snow from clouds.

2 DATA ACQUISITION AND PROCESSING

2.1 Data Acquisition Methods

Data were resampled from the original HDF-EOS product files containing either swath data or gridded data. Original gridded data are contained in either the Integerized Sinusoidal (ISIN)

grid (for collection 003 data, currently all 2002 data) or the more simple Sinusoidal (SIN) grid (for collection 004 data, all 2003 data)

Usually one, but sometimes two, swath product files are required to produce a single corresponding LRSA grid file. Four ISIN or SIN gridded tile files are required to create each corresponding LRSA grid file.

2.1.1 MODIS Bands

The following list shows the band names and data types included in each MODIS product for which grids were produced. The band names are grouped according to the type of resampling that was done:

- For swath data gridded with the MODIS Swath-to-Grid Toolbox (MS2GT):
  - Elliptical Weighted Averaging for continuously coded data.
  - Elliptical Maximum Weighting for discretely coded data.
- For gridded data regridded with the MODIS Reprojection Tool (MRT):
  - Cubic Convolution for continuously coded data.
  - Nearest Neighbor for discretely coded data.

Data types include the following:

- UINT32 - Unsigned 32-bit integer
- INT16 - Signed 16-bit integer
- UINT16 - Unsigned 16-bit integer
- UINT8 - Unsigned 8-bit integer

- MOD021KM- MODIS/Terra Calibrated Radiances 5-min L1B Swath 1 km
  - Elliptical Weighted Averaging
    - ch01 - ch36: UINT16
- MOD02HKM - MODIS/Terra Calibrated Radiances 5-min L1B Swath 500 m
  - Elliptical Weighted Averaging
    - ch01 - ch07: UINT16
- MOD02QKM - MODIS/Terra Calibrated Radiances 5-min L1B Swath 250 m
  - Elliptical Weighted Averaging
    - ch01 - ch02: UINT16
- MOD03 - MODIS/Terra Geolocation Fields 5-min L1A Swath 1 km
  - Elliptical Weighted Averaging
    - Height: INT16
    - SensorZenith: INT16
    - SensorAzimuth: INT16
    - Range: UINT16
    - SolarZenith: INT16
    - SolarAzimuth: INT16
  - Elliptical Maximum Weighting
    - LandSeaMask: UINT8
    - gflag: UINT8
- MOD09A1 - MODIS/Terra Surface Reflectance 8-day L3 Global 500 m SIN Grid
  - Cubic Convolution

        - sur_refl_b01 - sur_refl_b07: INT16
        - sur_refl_szen: INT16
        - sur_refl_vzen: INT16
        - sur_refl_raz: INT16
    - Nearest Neighbor
        - sur_refl_qc_500m: UINT32
        - sur_refl_state_500m: UINT16
        - sur_refl_day_of_year: UINT16
- MOD09Q1 - MODIS/Terra Surface Reflectance 8-day Global L3 250 m Sinusoidal Grid
    - Cubic Convolution
        - sur_refl_b01 - sur_refl_b02: INT16
    - Nearest Neighbor
        - sur_refl_qc_250m: UINT16
- MOD10_L2 - MODIS/Terra Snow Cover 5-min L2 Swath 500 m
    - Elliptical Maximum Weighting
        - Snow_Cover: UINT8
        - Snow_Cover_PixelQA: UINT8
        - Snow_Cover_Reduced_Cloud: UNIT8 (only for modis_version 004 and higher)
- MOD10A1 - MODIS/Terra Snow Cover Daily L3 Global 500 m Sinusoidal Grid
    - Nearest Neighbor
        - Day_Tile_Snow_Cover: UINT8
        - Snow_Spatial_QA: UINT8
- MOD10A2 - MODIS/Terra Snow Cover 8-day L3 Global 500 m Sinusoidal Grid
    - Nearest Neighbor
        - Maximum_Snow_Extent: UINT8
        - Eight_Day_Snow_Cover: UINT8
- MOD10C1 - MODIS/Terra Snow Cover Daily L3 Global 0.05 degree Climate Modeler's Grid
    - Nearest Neighbor
        - Day_CMG_Snow_Cover: UINT8
        - Day_CMG_Confidence_Index: UINT8
        - Day_CMG_Cloud_Obscured: UINT8
        - Snow_Spatial_QA: UINT8
- MOD10C2 - MODIS/Terra Snow Cover 8-day L3 Global 0.05 degree Climate Modeler's Grid
    - Nearest Neighbor
        - Eight_Day_CMG_Snow_Cover: UINT8
        - Eight_Day_CMG_Confidence_Index: UINT8
        - Eight_Day_CMG_Cloud_Obscured: UINT8
        - Snow_Spatial_QA: UINT8
- MOD11A1 - MODIS/Terra Land Surface Temperature/Emissivity Daily L3 Global 1 km Sinusoidal Grid
    - Cubic Convolution
        - LST_Day_1km: UINT16
        - Day_view_time: UINT8
        - Day_view_angl: UINT8
        - LST_Night_1km: UINT16
        - Night_view_time: UINT8
        - Night_view_angl: UINT8
        - Emis_31: UINT8
        - Emis_32: UINT8
        - Clear_day_cov: UINT16
        - Clear_night_cov: UINT16
    - Nearest Neighbor
        - QC_Day - UINT8
        - QC_Night - UINT8

- MOD13Q1 - MODIS/Terra Vegetation Indices 16-Day L3 Global 250 m Sinusoidal Grid
    - Cubic Convolution
        - 250m_16_days_NDVI: INT16
        - 250m_16_days_EVI: INT16
        - 250m_16_days_red_reflectance: INT16
        - 250m_16_days_NIR_reflectance: INT16
        - 250m_16_days_blue_reflectance: INT16
        - 250m_16_days_MIR_reflectance: INT16
        - 250m_16_days_average_view_zenith_angle: INT16
        - 250m_16_days_average_sun_zenith_angle: INT16
        - 250m_16_days_average_relative_azimuth_angle: INT16
    - Nearest Neighbor
        - 250m_16_days_NDVI_Quality: UINT16
        - 250m_16_days_EVI_Quality: UINT16
- MOD35_L2 - MODIS/Terra Cloud Mask and Spectral Test Results 5-min L2 Swath 250 m and 1 km
  NOTE: Only 250 m MOD35_L2 data bands will be gridded to 30 arcsecond (GEO) and 1 km (UTM) resolution, maintaining their packed byte format.
    - Elliptical Maximum Weighting
        - Cloud_Mask_byte0 - Cloud_Mask_byte5: UINT8
        - Quality_Assurance_byte0 - Quality_Assurance_byte9: UINT8

2.1.2 Resampling Tools and Methods

Two different tools were used to resample the data contained in the MODIS HDF-EOS files into the LRSA grids.

The MODIS Swath-to-Grid Toolbox (MS2GT)

The MODIS Swath-to-Grid Toolbox (MS2GT) was used to resample MODIS swath data contained in HDF-EOS files into both the LRSA GEO and UTM grids in the raw binary format. GeoTiff formatted data were then produced by processing the raw binary data using the MRT. In MS2GT, discretely valued data (e.g., Snow Cover or QC flags) are resampled using elliptical maximal weighting (analogous to nearest neighbor resampling); continuously valued data (e.g., radiances or temperatures) are resampled using an elliptical weighted averaging technique.

The MODIS Reprojection Tool (MRT)

The MODIS Reprojection Tool (MRT) was used to resample gridded MODIS data into both the LRSA GEO and UTM grids. It was used to resample MODIS gridded data contained in HDF-EOS files into the raw binary and GeoTiff formats. It was also used to convert the LRSA GEO and UTM raw binary gridded output of MS2GT into the LRSA GEO the GeoTiff format. Discretely valued data were resampled using nearest neighbor resampling; continuously valued data were resampled using cubic convolution resampling.

A third tool called ncdump was used to extract attributes from each MODIS HDF-EOS product file.

3 REFERENCES AND RELATED PUBLICATIONS

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5 DOCUMENT INFORMATION

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