



National Aeronautics and Space Administration

**Goddard Earth Science Data Information and
Services Center (GES DISC)**

README Document for

MODIS Thermal Anomalies and Fire 8-Day L3 1km MAIRS Region

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1.0 Introduction

This document provides basic information for using MOD14A2_MAIRS.005 and MYD14A2_MAIRS.005 (MODIS Thermal Anomalies and Fire 8-Day L3 1km over MAIRS region from Terra and Aqua) products.

The data set consists of fire-mask products generated for the focus on regional climate study associated with land cover/land use change over Monsoon Asia regions.

1.1 Dataset/Mission Instrument Description

The dataset were processed from MODIS standard products MOD14A2.005 and MYD14A2.005 (Thermal Anomalies & Fire 8-Day L3 Global 1km, collection-5).

MOD14A2_MAIRS.005 contains fire-mask from MODIS-Terra since February 2000, and MYD14A2_MAIRS.005 contains fire-mask from MODIS-Aqua since July 2002. MODIS fire-mask products are primarily derived from MODIS 4- and 11-micrometer radiances. The fire detection strategy is based on absolute detection of a fire. Detailed information can be found in the MODIS Fire product Algorithm Technical Background Document (http://modis.gsfc.nasa.gov/data/atbd/atbd_mod14.pdf)

1.2 Algorithm Background

The original data (MOD14A2.005 and MYD14A2.005) are stored in 10x10 degree tiled files and is in the sinusoidal projection. In order to integrate the data into NASA GES DISC's online visualization system, Giovanni, and make the data extraction easier for any given point or section within MAIRS study region, the data files are mosaic and re-projected onto equidistant cylindrical projection (or Equi-rectangular projection) with nearest point sampling method. The output data file covers entire Asian Monsoon region ($0^{\circ} - 60^{\circ}\text{N}$, $60^{\circ}\text{E} - 150^{\circ}\text{E}$).

The data sets are processed by using MODIS Re-projection Tool (MRT) release 4.0 from the USGS and NASA land processes and distributed active archive center (LP DAAC). First, Thermal Anomalies & Fire 8-Day L3 Global 1km (MOD14A2.005 and MYD14A2.005) were downloaded for all tiles over the Asian monsoon region. Then, programs **mrtmosaic** and **resample** were run under batch mode with the following setting:

SPATIAL_SUBSET_TYPE = INPUT_LAT_LONG
SPATIAL_SUBSET_UL_CORNER = (60.0 60.0)
SPATIAL_SUBSET_LR_CORNER = (0.0 150.0)
RESAMPLING_TYPE = NN (nearest point)
OUTPUT_PROJECTION_TYPE = ER (equi-rectangular projection)
OUTPUT_PROJECTION_PARAMETERS = (6371007.181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0)
DATUM = NoDatum
OUTPUT_PIXEL_SIZE = 1000

1.3 Data Quality

The original data sets MOD14A2.005 and MYD14A2.005 contain 1-km gridded composite of fire pixels detected in each grid cell over each 8-day compositing period. The 8-day composite is the maximum value of the individual Level 2 pixel classes that fell into each 1-km grid cell over the entire 8-day compositing period. Due to the way the three different fire-pixel confidence levels are defined (Section 3.3), the 8-day fire product is sometimes said to contain the most confident detected fires. This description can sometimes be misleading in that pixel values are defined even for those grid cells in which no fire pixels were detected in a particular day within the 8-day segment.

When generating MOD14A2_MAIRS.005 and T MYD14A2_MAIRS.005, the near point method is used for re-sampling. The data quality of each grid point is remained as the input data.

In Giovanni, no quality filtering is performed. Therefore, all valid data points at all quality levels are participated in analysis.

For more information about validation and data quality of the input data, please read MODIS active fire product user's guide (http://modis-fire.umd.edu/Documents/MODIS_Fire_Users_Guide_2.4.pdf) land validation page: <http://landval.gsfc.nasa.gov/ProductStatus.php?ProductID=MOD14>

1.4 Data Disclaimer

The dataset covers Monsoon Asia region ((0° – 60°N, 60°E – 150°E) only, which were derived from MODIS standard products MOD14A2.005 and MYD14A2.005. The data are not copyrighted and are open to all for both commercial and non-commercial uses. If you use the data for a publication

(research or otherwise), or for any other purpose, we request you to acknowledge data producer (refer to MODIS Active Fire Product User's Guide) and to include the following acknowledgement:

"The data used in this effort were acquired from NASA Goddard Earth Sciences (GES) Data and Information Services Center (DISC)"

We would appreciate receiving a copy of publication reference. Please email to help-disc@listserv.gsfc.nasa.gov.

2.0 Data Organization

Each data file contains parameters of 1-km gridded composite of fire pixels detected in each grid cell over each 8-day compositing period.

2.1 File Naming Convention

The files are named in accordance to the following convention:

MAIRS_<product>_L3_<version>_<YYYYMMDD>.hdf

Where:

<product> = MOD14A2 for data from MODIS/Terra

MYD14A2 for data from MODIS/Aqua

<version> = processing version, the current version is v005

<YYYYMMDD> = year, month, day

Filename Example: MAIRS_MOD14A2_L3_v005_20010101.hdf

The date string in a file denotes the begin date of the 8-day segment. The 8-day segment starts from Jan 1 of each year. The last segment contains 5-days data for non-leap years and 6-days for a leap year.

2.2 File Format and Structure

Files are in HDF-EOS format, which is an extension of the Hierarchical Data Format Version 4 (HDF-4), developed at the National Center for Supercomputing Applications <http://www.hdfgroup.org/>. These extensions facilitate the creation of Grid, Point and Swath data structures, in the case of MOD14A2_MAIRS.005 and MYD14A2_MAIRS.005, it is of the Grid structure.

2.3 Key Science Data Fields

There are two Science Data Fields in each data files

FireMask: Fire Mask at 1km for 8-day composites.

QA: Quality flag of FireMask

Read section 3.3 for details.

3.0 Data Contents

3.1 Dimensions

YDim:MODIS_Grid_8Day_Fire = 6672

XDim:MODIS_Grid_8Day_Fire = 10008 ;

3.2 Global Attributes

The Global attributes in the file are those output from MRT software, which reflects information of inputs files for mosaicing and re-projecting. The output data files have the followings global attributes that are not listed in the file:

NORTH BOUNDING COORDINATE =60°N
SOUTH BOUNDING COORDINATE= 0°
WEST BOUNDING COORDINATE =60°E
EAST BOUNDING COORDINATE= 150°E
First Data Point Location = (60°N, 60°E)

3.3 Products/Parameters

Both MOD14A2_MAIRS.005 and MYD14A2_MAIRS.005 data files contains two science data field (parameter) as listed in the following table:

Name	LongName	Unit	Data Type	Fill Value	Data Range
FireMask	8day Fire Mask 1km	class	8-bit unsigned integer	0	0-9
QA	8day Fire Mask Quality Flag	bits	8-bit unsigned integer		

The FireMask classes are defined as:

- 0 = missing input data
- 1 = not processed (obsolete)
- 2 = not processed (obsolete)
- 3 = water
- 4 = cloud
- 5 = non-fire
- 6 = unknown
- 7 = fire (low confidence)
- 8 = fire (nominal confidence)
- 9 = fire (high confidence)

4.0 Options for Reading the Data

4.1 Command Line Utilities

4.1.1 ncdump

The ncdump tool can be used as a simple browser for 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

Note: the ncdump tool will only display variables whose ranks are great than 1. In other words, you will not see one dimensional vectors such as *satheight* using this tool.

The ncdump program can be found in bin directory of the HDF installation area. Consult your local computer system administrator for the specifics.

4.1.2 hdp

The hdp utility is a HDF dumper developed by HDF group at NCSA.

Usage: hdp [-H] command [command options] <filelist>

-H Display usage information about the specified command.

If no command is specified, -H lists all commands.

Commands:

list	lists contents of files in <filelist>
dumpstds	displays data of SDSs in <filelist>
dumpvtd	displays data of vdatas in <filelist>.
dumpvgr	displays data of vgroups in <filelist>.
dumpri	displays data of RIs in <filelist>.
dumpgr	displays data of RIs in <filelist>.

For more information, please visit the NCSA web site: <http://hdf.ncsa.uiuc.edu/hdp.html>

4.1.3 read_hdf

The read_hdf tool is a command-line utility developed by GES DISC. It allows a user to browse the file structure and display data values if desired.

Command line syntax:

read_hdf [-l] | [[-i | -d] [-a <output> | -b <base>.*.bin]] filename

Options/Arguments:

[-i] -- run in interactive mode (default), or

[-l] -- list a tree of file objects, or

[-d] -- dump all HDF object types (no filtering)

[-a <output>] -- ASCII output file name (default is <filename>.txt)

[-b <base>] -- base binary output file name (default is <filename>)

creates two files per HDF object:

<base>.*.met for metadata, and <base>.*.bin for binary data

(default output to stdout)

filename -- name of the input HDF file

The source code is written in C language and can be obtained from GES DISC ftp server:

ftp://disc1.gsfc.nasa.gov/software/aura/read_hdf

4.2 HDFView

The HDFView is a visual tool for browsing and editing NCSA HDF4 and HDF5 files. Using HDFView, you can:

- (1) view a file hierarchy in a tree structure
- (2) create new file, add or delete groups and datasets
- (3) view and modify the content of a dataset
- (4) add, delete and modify attributes
- (5) replace I/O and GUI components such as table view, image view and metadata view

More information can be found at the official [HDFView](#) web site. There is an add-on [plug-in](#) for handling HDFEOS data specifically.

4.3 GrADS

The Grid Analysis and Display System (GrADS) is an interactive desktop tool developed and maintained by Institute of Global Environment and Society (IGES). GrADS supports many data file formats, including binary (stream or sequential), GRIB (version 1 and 2), NetCDF, HDF (version 4 and 5), and BUFR (for station data). Software download and more information and usages can be found at the [GrADS](#) web site: <http://www.iges.org/grads/grads.html>

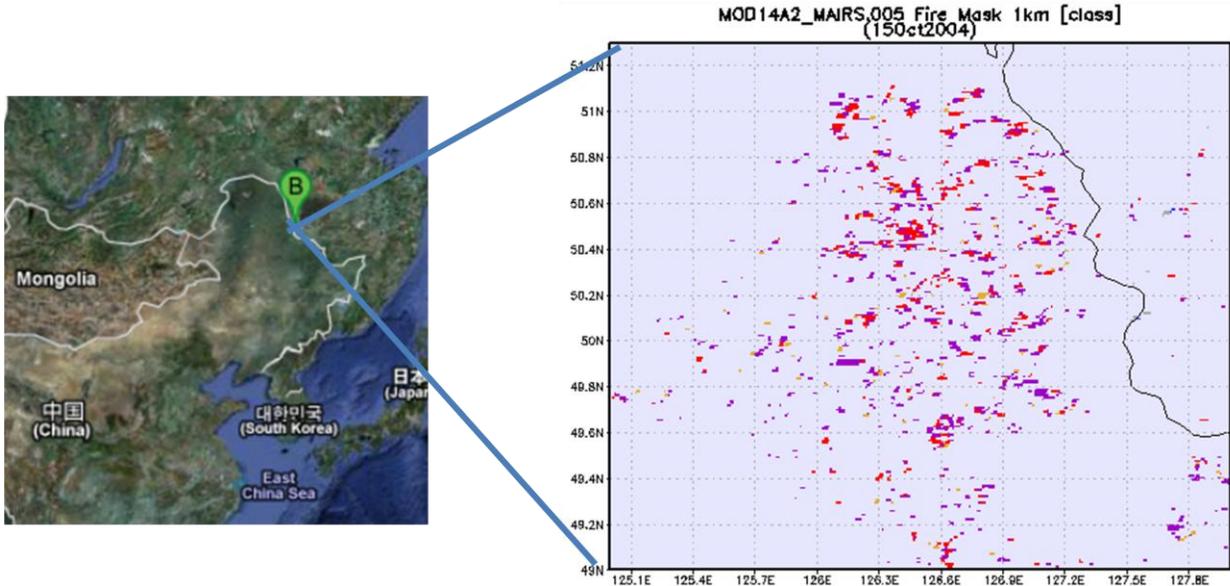
To read the data by using GrADS, it needs to have a GrADS descriptor file that documents data source, structure, etc. For example, the following is the contents of a descriptor file, save it to a file "fire.ctl":

```
dset ^MAIRS_MOD14A2_L3_v005_%y4%m2%d2.hdf
options yrev template
title "Derived MODIS Fire 1km resolution data"
dtype hdfds
undef 0 _FillValue
xdef 10008 linear 60.0 0.008992
ydef 6672 linear 0.0 0.008992
zdef 1 levels 1000
tdef 3650 linear 1Jan2002 1dy
vars 2
FireMask=>fire 0 y,x Fire mask data
QA=>qa 0 y,x Quality data
endvars
```

The following is an example to read and plot the following images by using GrADS:

```
'open fire.ctl'
'set lon 125 130'
```

```
'set lat 48 52'
'set time 15Oct2004'
'set gxout fgrid'
'set mpdset hires'
'set fgvals 0 0 1 0 2 0 3 4 4 15 5 5 6 0 7 7 8 8 9 2'
'd fire'
'draw title 'MODIS 8-day Active Fire'
```



Above Figure show active fire mask (forest fire) during Oct 15-22 2004 over Heilongjiang, northeast China, from MODIS-Terra.

5.0 Data Services

5.1 Access and analysis through Giovanni

Giovanni (GES DISC Interactive Online Visualization ANd aNalysis Infrastructure) is Web-based application that provides a simple and intuitive way to visualize, analyze, and access data. The data sets MOD14A2_MAIRS.005 and T MYD14A2_MAIRS.005 have been integrated into the Giovanni system and are available through the portal named mairs_8day:

http://gdata1.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=mairs_8day

The fire-mask data has displayed with the following pre-defined color palettes:

-  9=fire-high_confidence
-  8=fire_normal_confidence
-  7=fire_low_confidence
-  6=unknown
-  5=non-fire
-  4=cloud
-  3=water
-  2=not_processed
-  1=not_processed
-  0=missing_input_data

5.2 Direct FTP:

The data are available on anonymous FTP site:

<ftp://neespi.gsfc.nasa.gov/data/s4pa/Fire/>

6.0 More Information

MODIS Active Fire Product User's Guide: http://modis-fire.umd.edu/Documents/MODIS_Fire_Users_Guide_2.4.pdf

MODIS Active Fire ATBD: http://modis.gsfc.nasa.gov/data/atbd/atbd_mod14.pdf

Berrick, S., Leptoukh, G., Farley, J., & Rui, H. (2009). Giovanni: A Web services workflow-based data visualization and analysis system. *IEEE Trans. Geosci. Remote Sens.*, 47(1), 106-113.

Any question regarding data, please contact: help-disc@listserv.gsfc.nasa.gov.

7.0 Acknowledgements

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