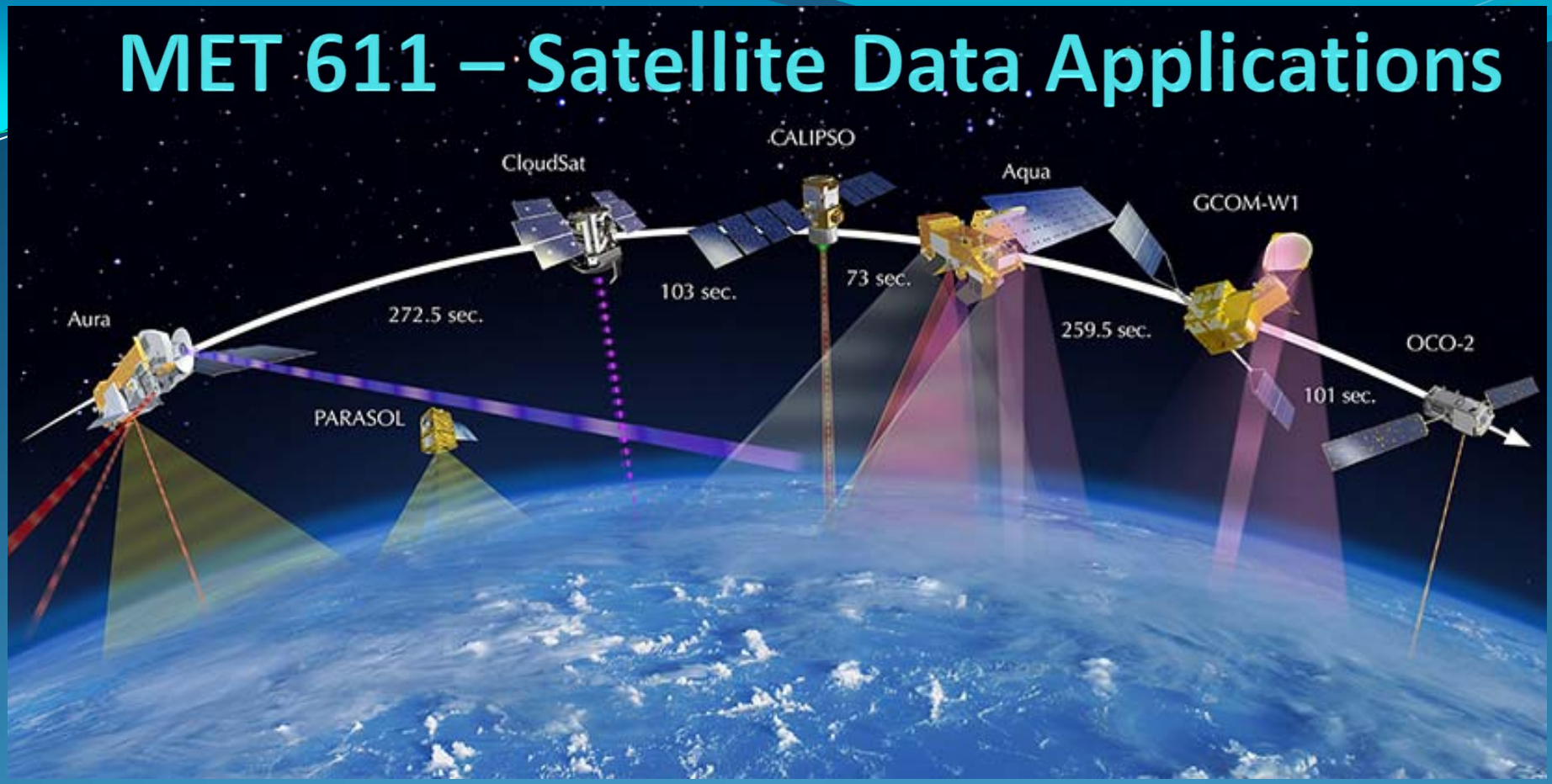
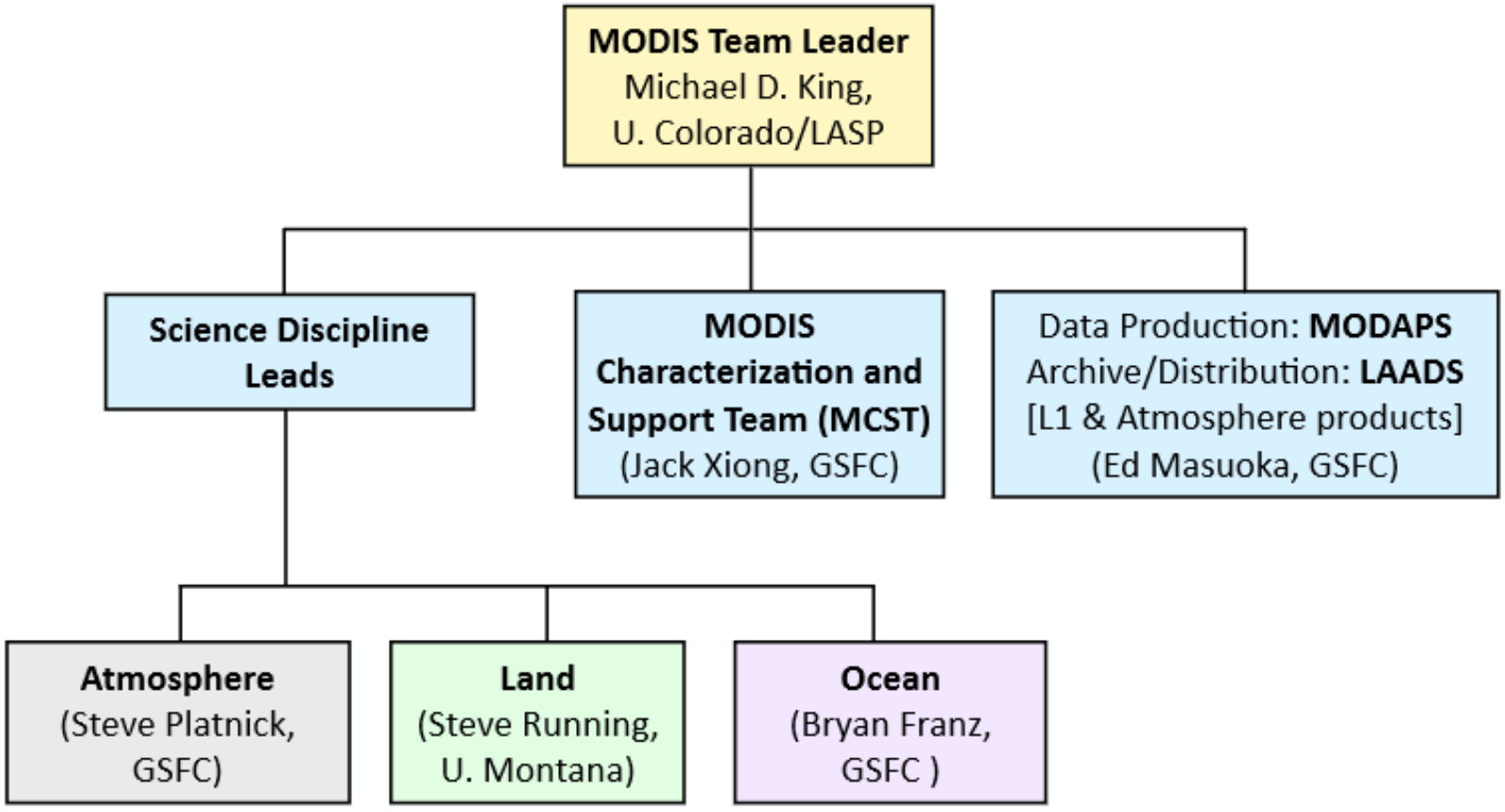
MET 611 – Satellite Data Applications



MODIS Data Access

Jennifer D. S. Griswold

MODIS Organization and People



Nomenclature and Acronyms

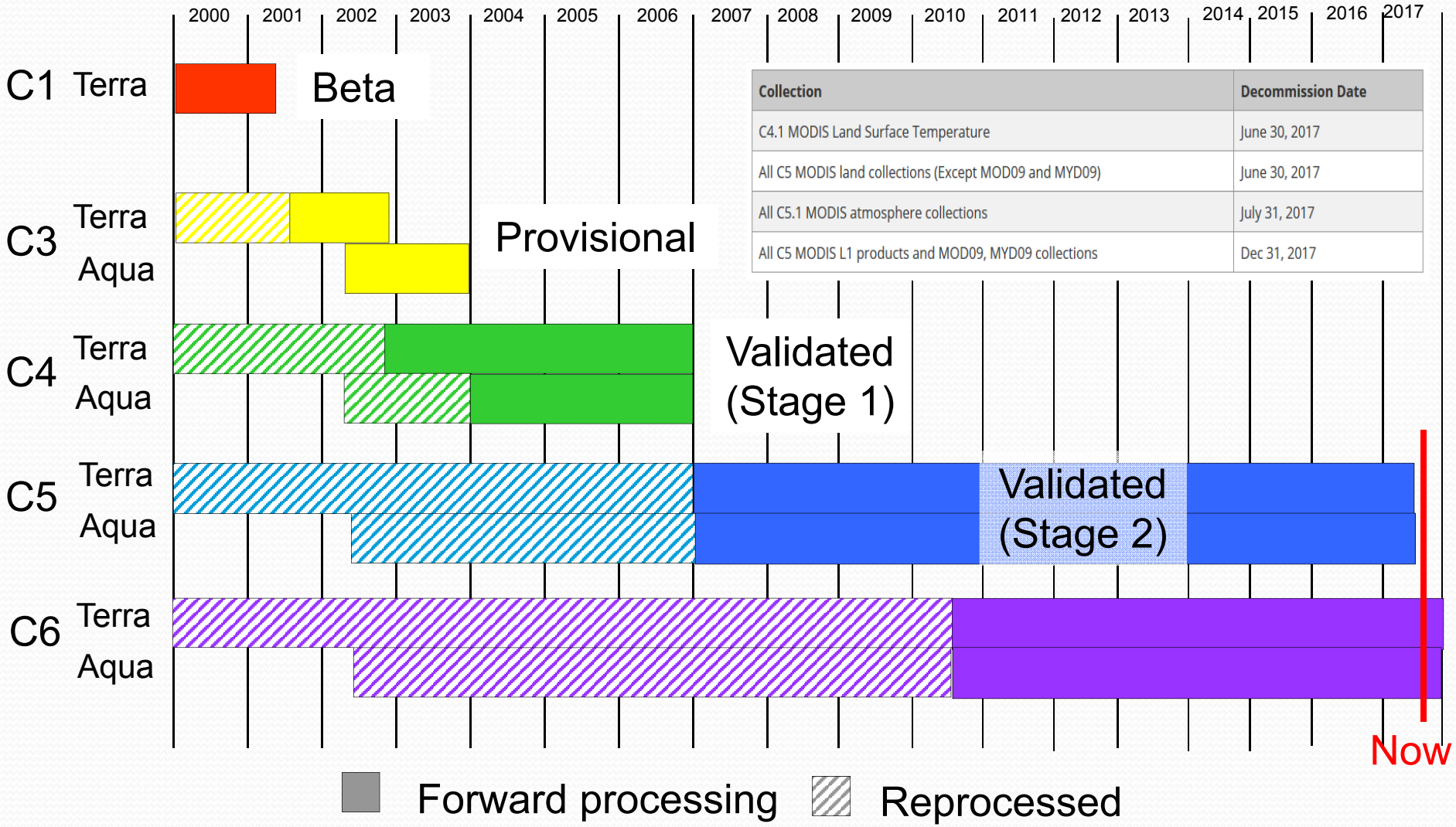
- **Product "Level" designations**
  - Level-0 (L0): raw instrument data (digital counts)
  - Level-1B (L1B): calibrated/geolocated instrument data
  - Level-2 (L2): derived geophysical retrieval data ("pixel" level)
  - Level-3 (L3): gridded data (spatial and/or temporal aggregation of geophysical products)
  - Level-4: combination of model and measured/retrieved data (not generated by atmosphere team)

Nomenclature and Acronyms

- **MODIS "Collection"**
  - refers to a (re)processing production run with consistent algorithms (or nearly consistent)
  - C5 production began in summer 2006, reprocessing completed about a year later.
  - C51 update in late 2008. Collection 6 (C6) Aqua L2 production began in Dec 2013.

- **See next slide for MODIS Production Version Timelines**

MODIS Production Versions



Collection	Decommission Date
C4.1 MODIS Land Surface Temperature	June 30, 2017
All C5 MODIS land collections (Except MOD09 and MYD09)	June 30, 2017
All C5.1 MODIS atmosphere collections	July 31, 2017
All C5 MODIS L1 products and MOD09, MYD09 collections	Dec 31, 2017

Each collection represents an improvement in science quality

MODIS Standardized Filenaming Convention

NASA Earth Science Data filenames for MODIS

Terra MODIS: **MOD06_L2.AYYYYDDD.HHMM.CCC.YYYYDDDHHMMSS.hdf**

Aqua MODIS: **MYD06_L2.AYYYYDDD.HHMM.CCC.YYYYDDDHHMMSS.hdf**

Definition of highlighted text:

MOD06 = Earth Science Data Type name

L2 = Denotes a Level-2 product (or L3 for Level-3, etc.)

A = indicates following date/time information is for the acquisition (observation)

YYYYDDD = acquisition year and day-of-year

HHMM = acquisition hour and minute start time

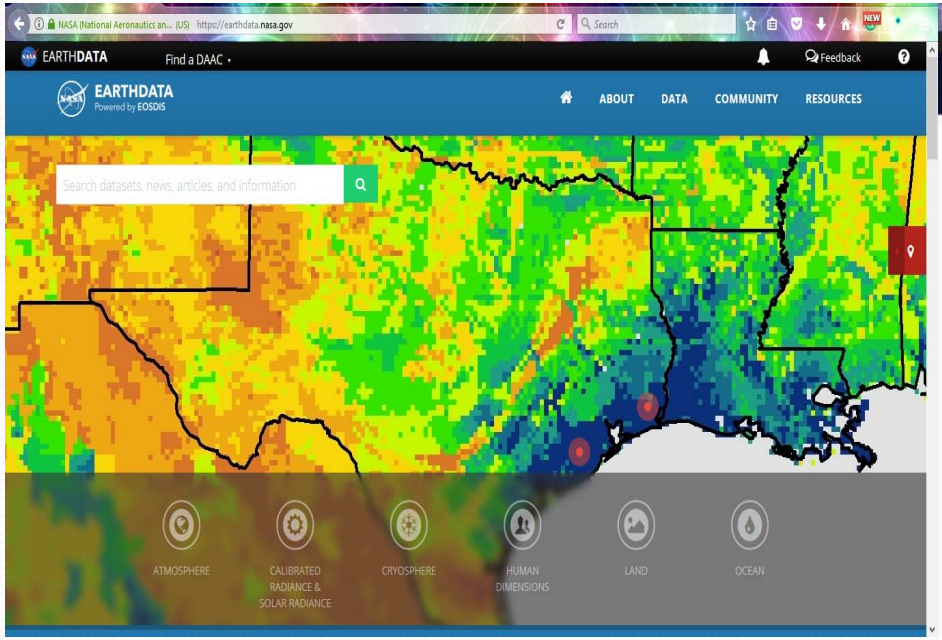
CCC = collection (e.g., '006' for Collection 6)

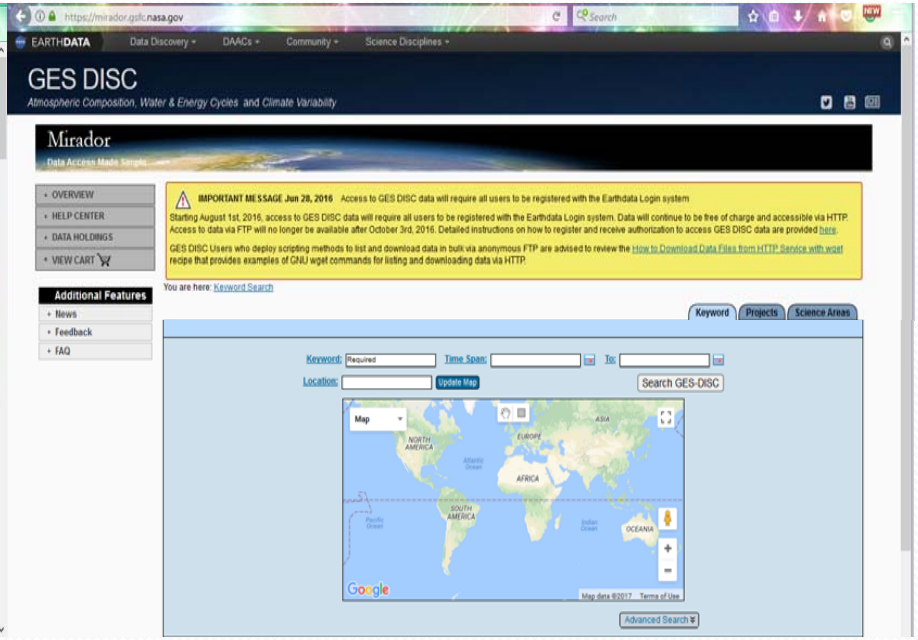
YYYYDDDHHMMSS = production data and time

hdf = denotes HDF file format

Ordering MODIS and other Satellite Products

- EarthData - https://earthdata.nasa.gov/
- Mirador - https://mirador.gsfc.nasa.gov/
- **LAADS** - https://ladsweb.modaps.eosdis.nasa.gov/



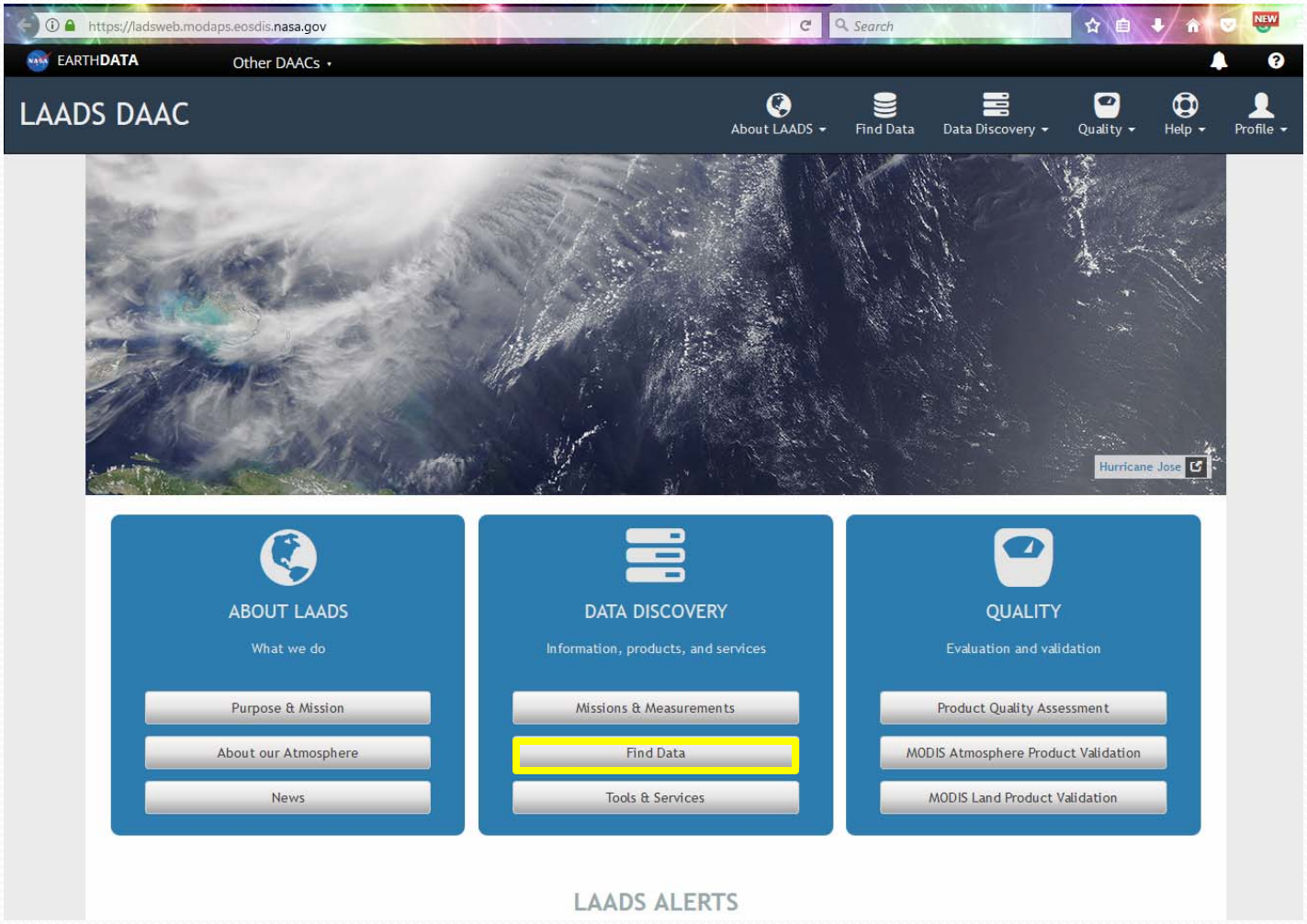


LAADS DAAC

Level-1 and Atmosphere Archive and Distribution System (LAADS) Distributed Active Archive Center (DAAC)

https://ladsweb.modaps.eosdis.nasa.gov/

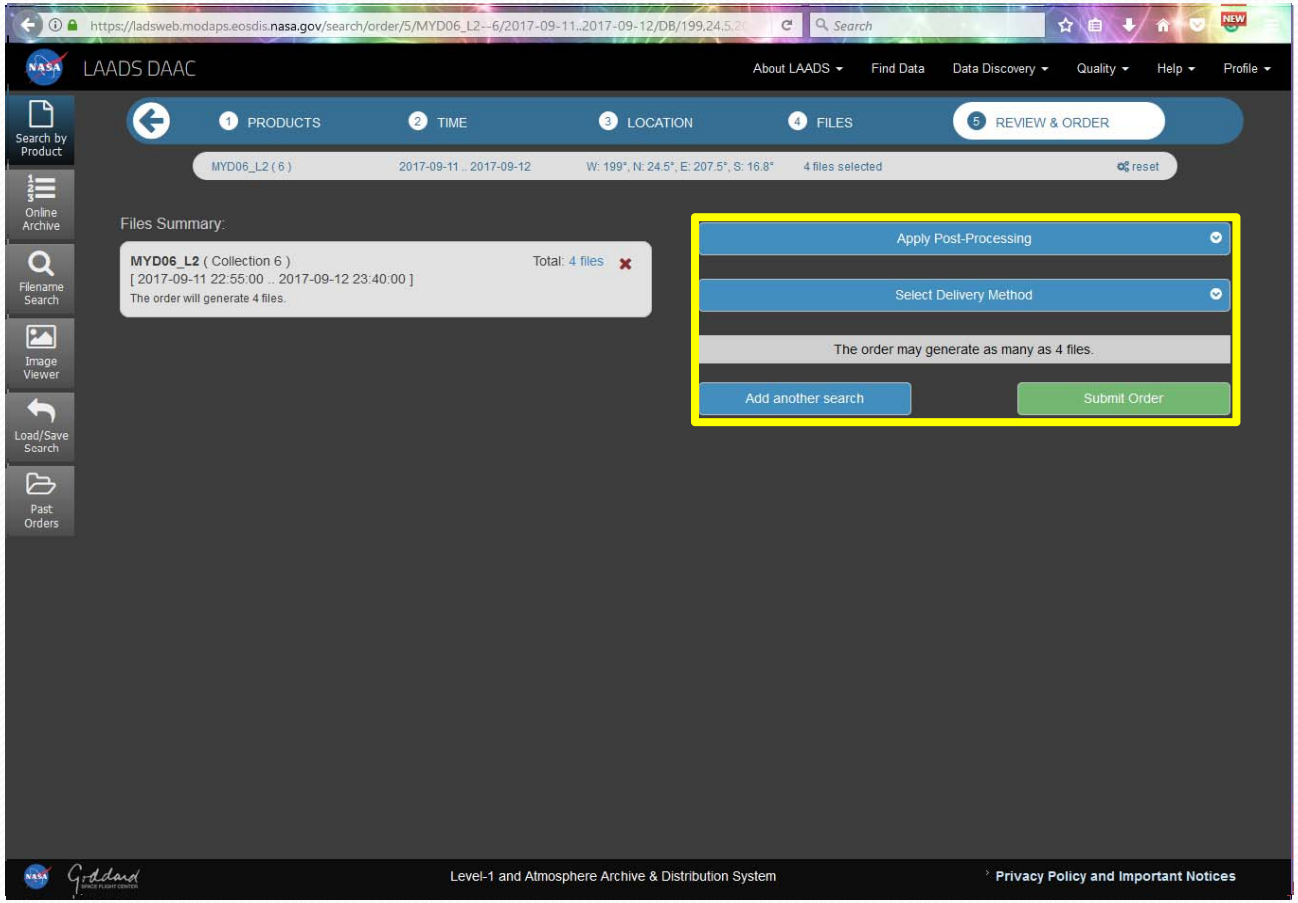
LAADS is the DAAC that archives and distributes Atmosphere products from MODIS Terra, Aqua, VIIRS, and more.



LAADS DAAC

Level-1 and Atmosphere Archive and Distribution System (LAADS) Distributed Active Archive Center (DAAC)

1. Select Sensor
2. Select Collection
3. Select Product
4. Select Time
    1. Single Day or a Range of Days
5. Select Location
    1. Can scroll map to choose a box or type in lat and lon values, choose a country, or the whole globe!
6. View Files
    1. You can sneak a peek at the figures.
    2. Click on “Search by Product” to go back to the list
    3. To order the files you have to “select them”
7. Review and Order Data
    1. You need to make an account



Your order notification

LAADS Web Order Notification Inbox x

apache user for nonltp servers <apache@modx.nascom.nasa.gov> 2:37 PM (2 minutes ago)

to me

Your Order ID is: 501173010

The data you ordered will be staged (in about 10 minutes), and you can retrieve the data through anonymous FTP using:

ftp ladsweb.modaps.eosdis.nasa.gov
username: anonymous
password: smalljen@hawaii.edu

cd /orders/501173010
binary
prompt
mget *

Order 501173010 contains 4 file

- if your submission required additional post-processing you will be notified when these files become available

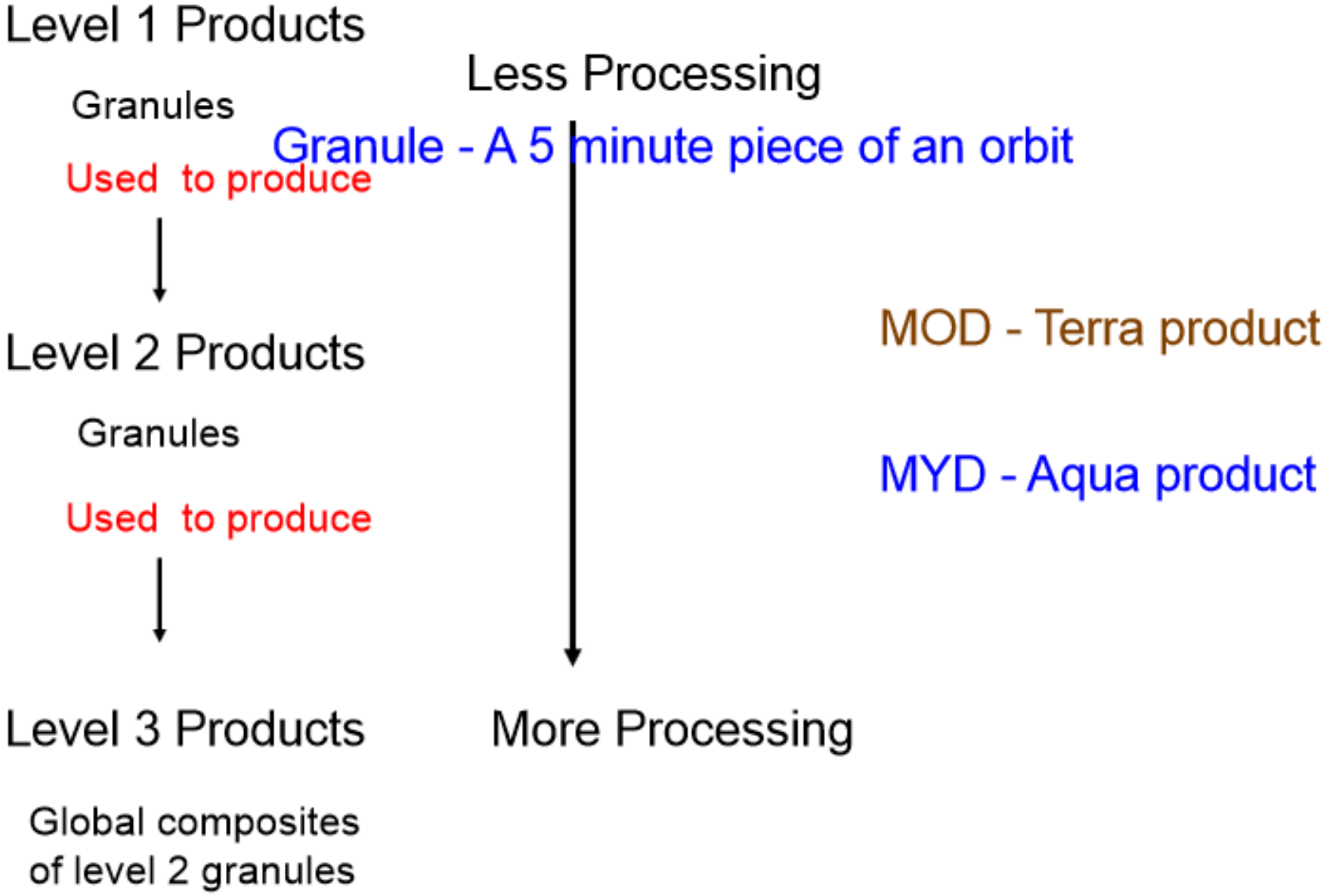
*NOTE: The files will be deleted after 5 days, please download the files before they get deleted.

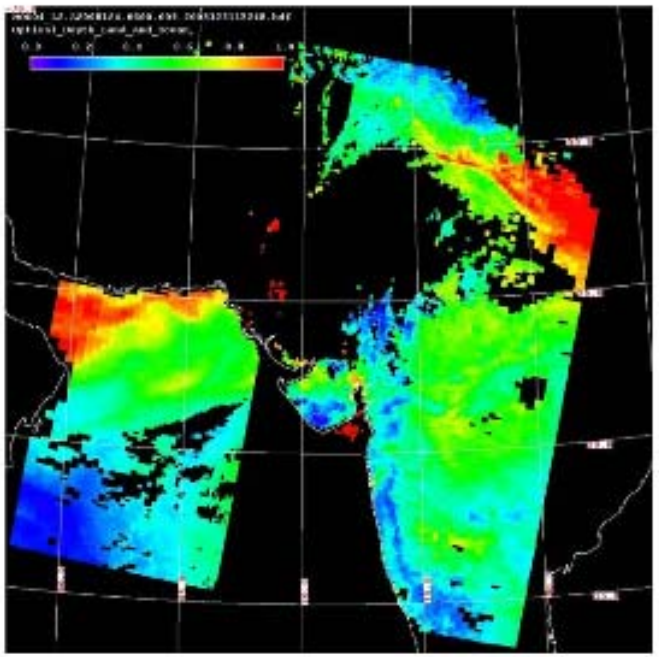
For help, please contact us at modapsuso@lists.nasa.gov

Thank you,

The LAADS Support Team

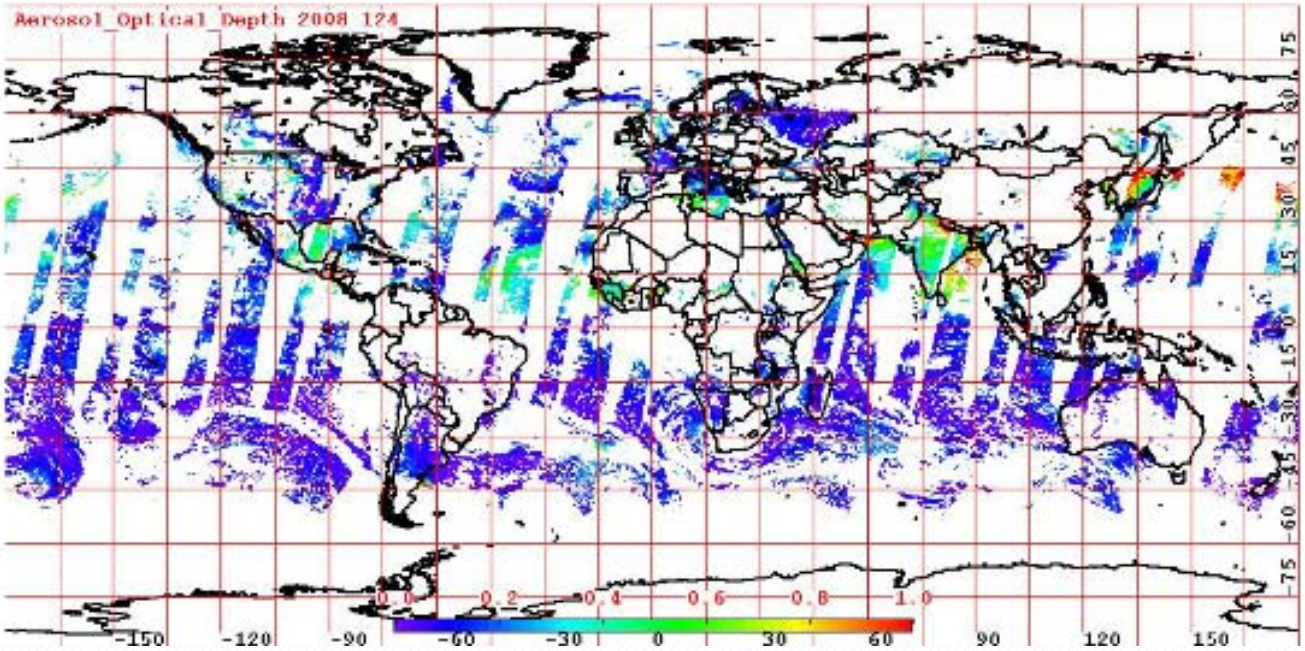
MODIS Product Hierarchy





Level 2
Aerosol
Product
(AOD)

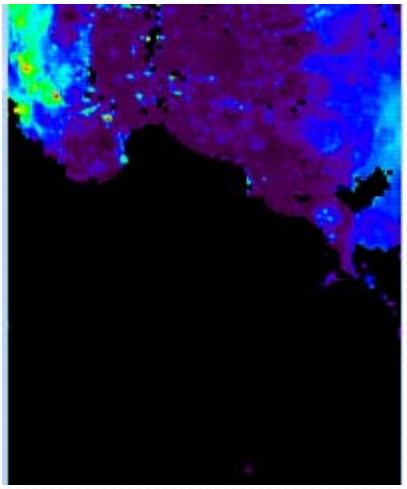
Level 1 (RGB)



Level 3
Aerosol
Product
(AOD)

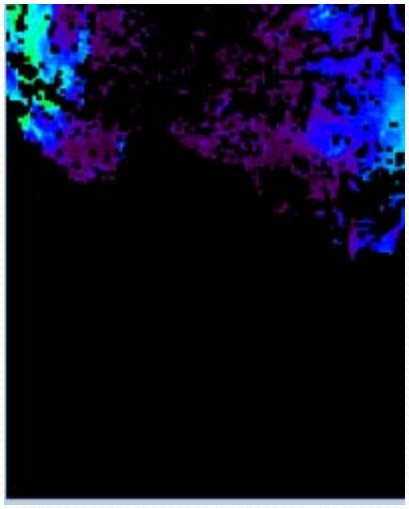
Data Quality Screening Service

Original Image



Mask

Screened Image

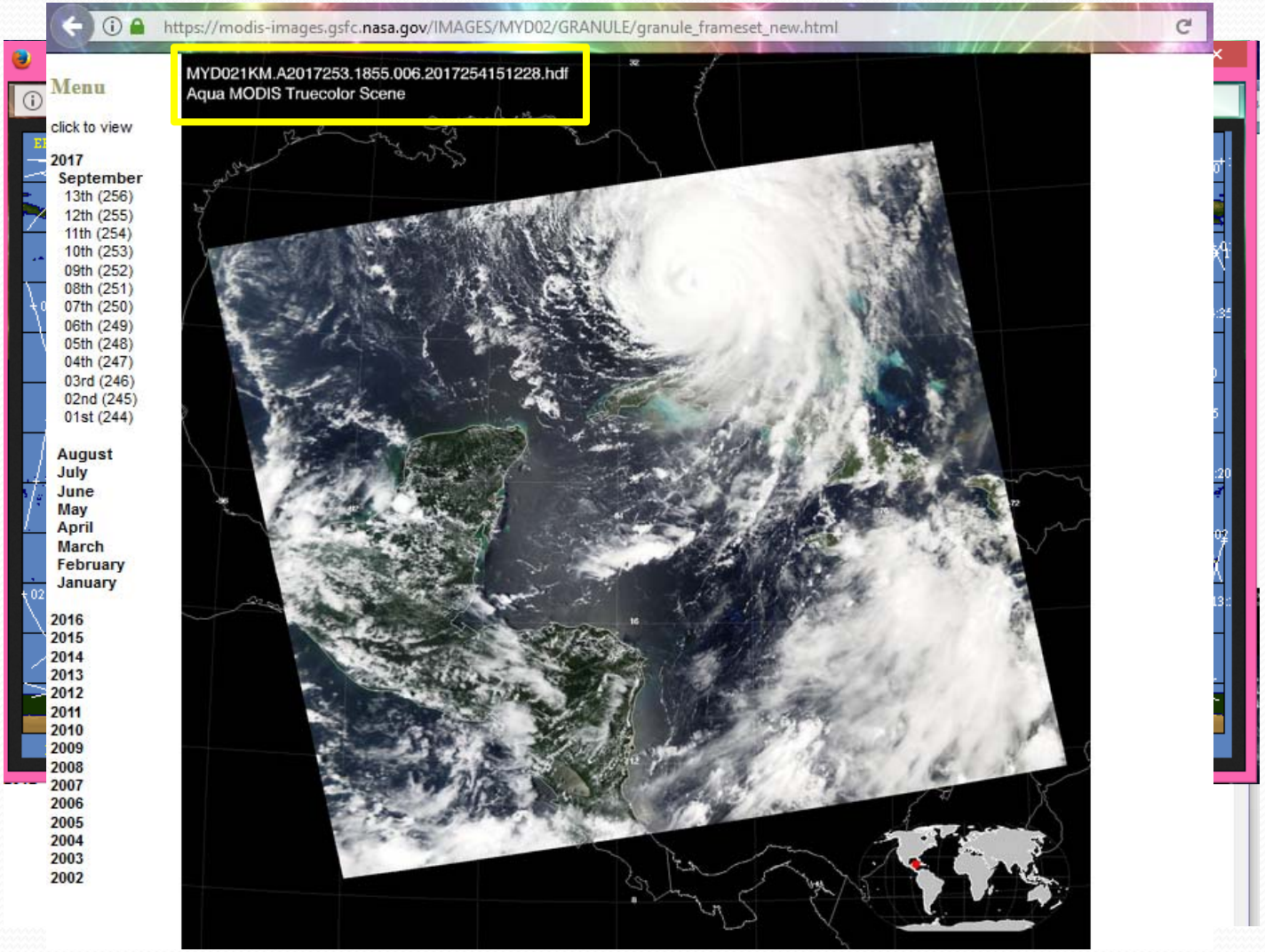


Mask is white (1) where data meet the quality threshold specified (in this example, Good or Very Good) and black (0) where data fall below threshold. Observations that correspond to black (0) elements in the mask are replaced with fill values in the screened product.

Legacy Image Search

https://modis-images.gsfc.nasa.gov/IMAGES/02_1km_main.html

- Great way to preview L2 granules and help you choose the right file for a specific event!
- You can choose the Year, Month and Day.
- By clicking on the map it'll help you identify the best time (HH:MM) to check



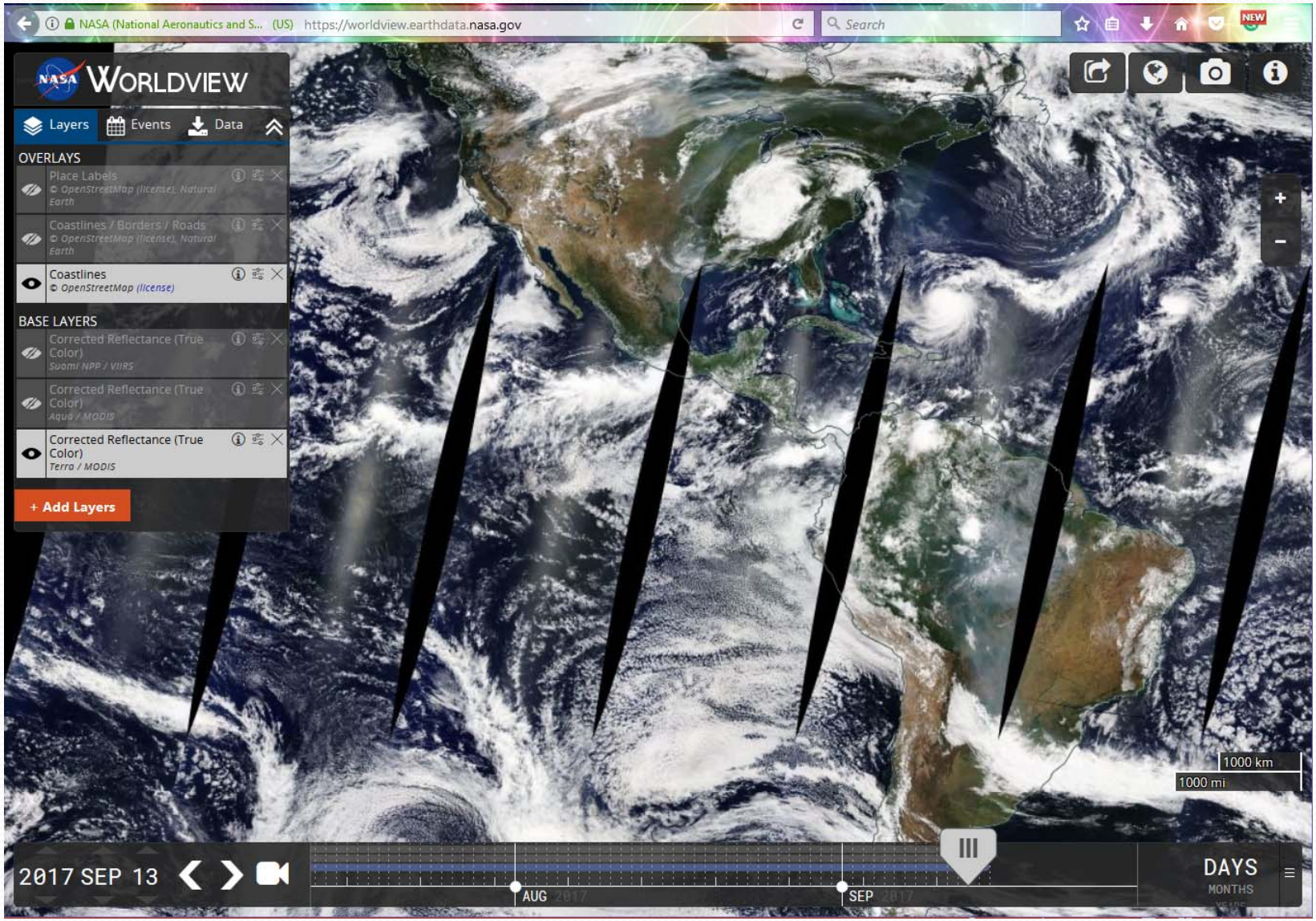
MODIS Level 2 Data Summary

- **Key Science Applications:**
  - Aerosol climatology
  - biomass-burning aerosols
  - cloud radiative properties
  - hydrological cycle climatology
  - effect on aerosol and clouds
  - atmospheric correction
  - characterization of the atmosphere
  - cloud parameterization
  - climate modeling & monitoring
  - precipitable water
  - cloud determination and screening.

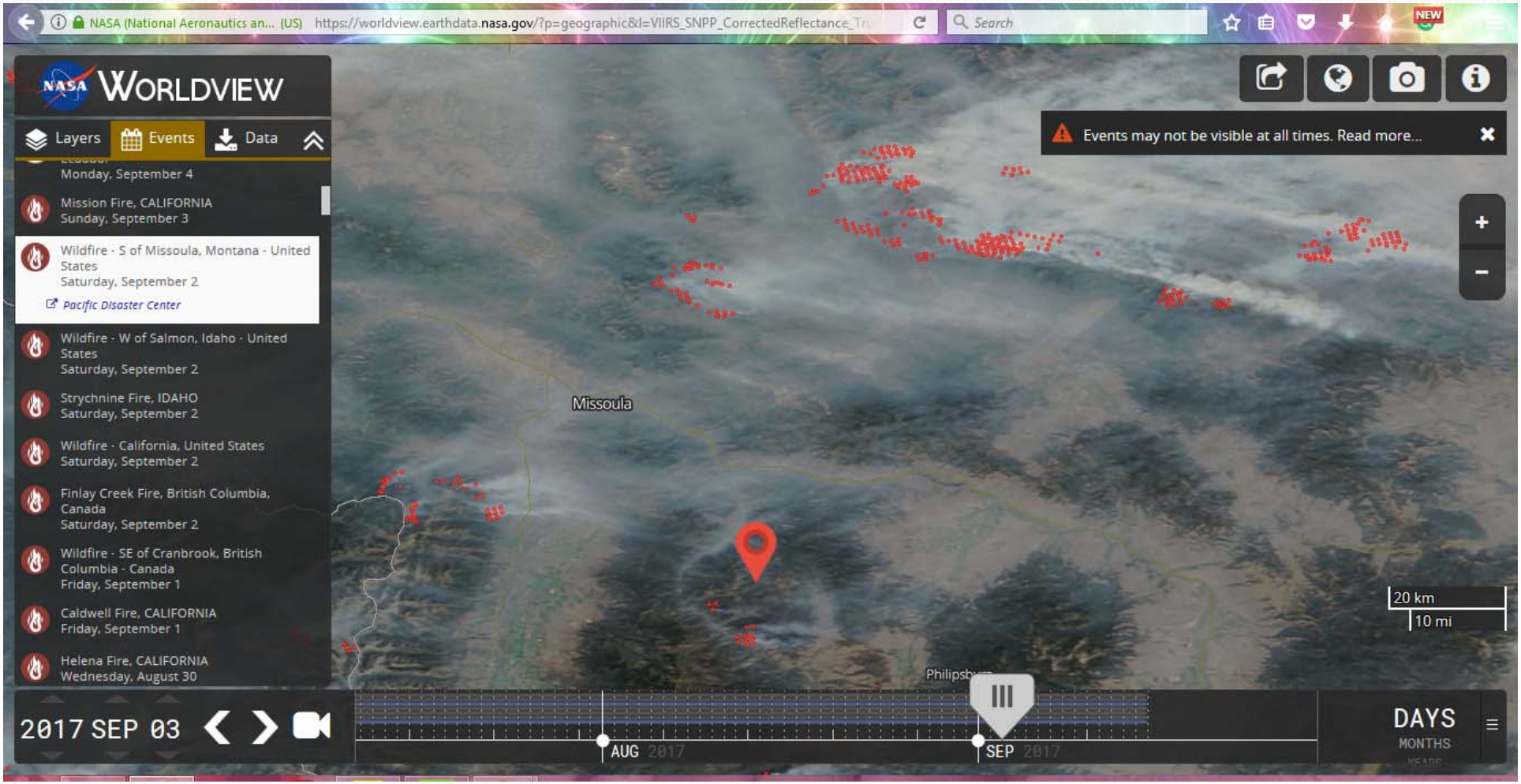
MODIS Level 2 Data Summary

- **Key Geophysical Parameters:**
  - Atmospheric aerosol optical depth
  - aerosol size distribution over oceans
  - cloud particle phase
  - cloud particle size
  - cloud optical thickness at 0.66 μm
  - cirrus reflectance at 0.66 μm
  - cloud top temperature
  - cloud top pressure
  - clear-sky total-column precipitable water derived from both infrared and near-infrared algorithms
  - and cloud fraction.

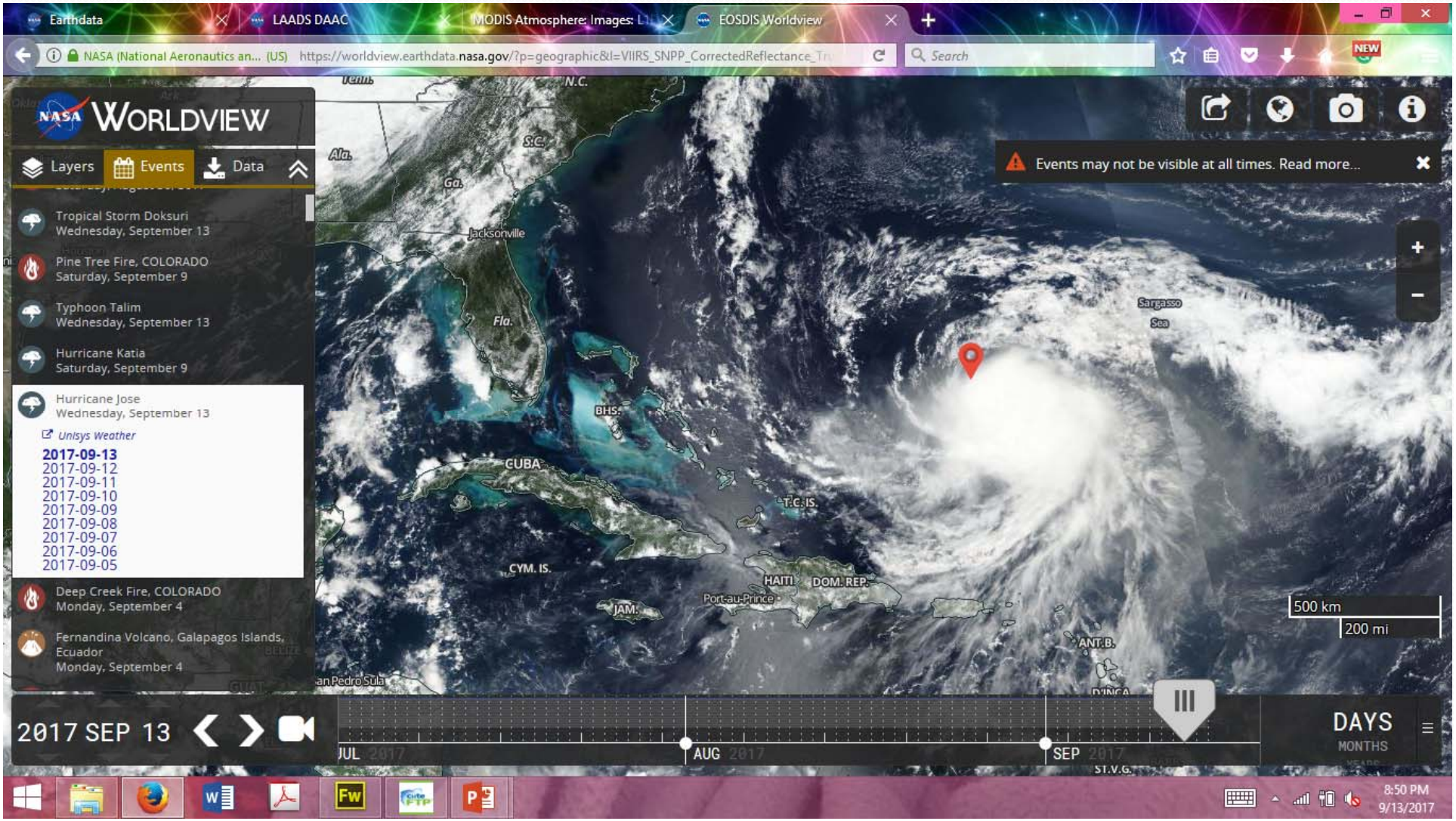
World View


NASA (National Aeronautics and S... (US) https://worldview.earthdata.nasa.gov
Search
NEW
NASA WORLDVIEW
Layers
Events
Data
OVERLAYS
Place Labels
© OpenStreetMap (license), Natural Earth
Coastlines / Borders / Roads
© OpenStreetMap (license), Natural Earth
Coastlines
© OpenStreetMap (license)
BASE LAYERS
Corrected Reflectance (True Color)
Suomi NPP / VIIRS
Corrected Reflectance (True Color)
Aqua / MODIS
Corrected Reflectance (True Color)
Terra / MODIS
+ Add Layers
+
−
1000 km
1000 mi
2017 SEP 13
AUG 2017
SEP 2017
DAYS
MONTHS

World View – Wildfires, Montana



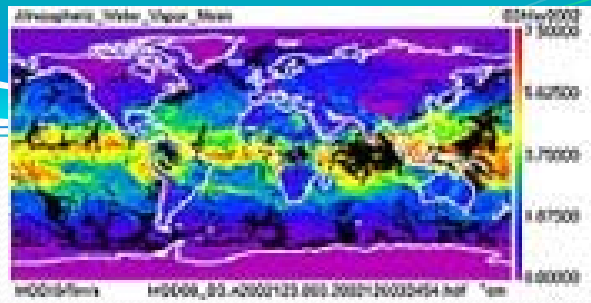
World View – Hurricane Jose



Why Level 3 products?

- Level 2 data is difficult to work with because of:
  - Formats
  - Volume
  - Number of files
- Level 3 data are easy to use … but might lead to wrong conclusions if not being careful
- Level 3 products are mostly used by modelers, application users, climate scientists

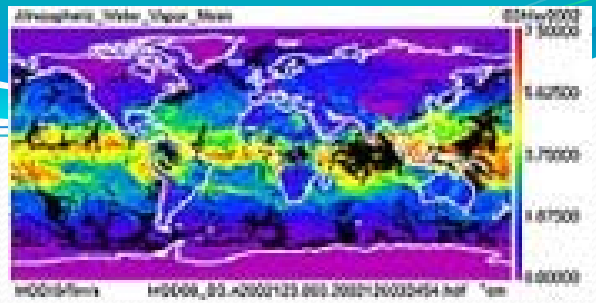
MODIS L3 Daily Product Descriptions



- The Level-3 MODIS Atmosphere Daily Global Product contains roughly 600 statistical datasets that are derived from approximately 80 scientific parameters from four Level-2 MODIS Atmosphere Products:
  - Aerosol
  - Water Vapor
  - Cloud
  - Atmosphere Profile.

- There are two MODIS Daily Global data product files:
  - **MOD08_D3**, containing data collected from the Terra platform
  - **MYD08_D3**, containing data collected from the Aqua platform.

MODIS L3 Daily Product Descriptions

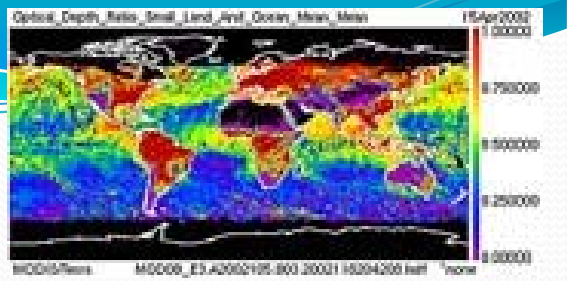


- A range of statistical summaries are computed, depending on the parameter being considered. Statistics for a given measurement might include:
  - Simple (mean, minimum, maximum, standard deviation) statistics
  - Parameters of normal and log-normal distributions
  - Fraction of pixels that satisfy some condition (e.g. cloudy, clear)
  - Histograms of the quantity within each grid box
  - Histograms of the confidence placed in each measurement
  - Histograms and/or regressions derived from comparing one science parameter to another, statistics may be computed for a subset that satisfies some condition

- Statistics are sorted into 1 by 1 degree cells on an equal-angle grid that spans a 24-hour (0000 to 2400 Greenwich Mean Time) interval and then summarized over the globe.

- It should be noted that browse images are available in both the native equal-angle (lat-lon) grid as well as an equal-area (hammer-aitoff) grid.

MODIS L3 8-Day Product Descriptions

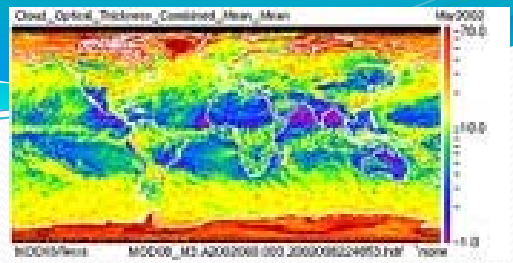


- **Computed Statistics**
  - Statistics are sorted into 1x1 degree cells on an equal-angle grid that spans an 8-day interval and then summarized over the globe. It should be noted that the eight-day interval start date is reset to January 1st at the beginning of every new year.

  - A range of statistical summaries are computed, depending on the parameter being considered. Statistics for a given measurement might include:

    - Simple (mean, minimum, maximum, standard deviation) statistics
    - Parameters of normal and log-normal distributions
    - Fraction of pixels that satisfy some condition (e.g. cloudy, clear)
    - Histograms of the quantity within each grid box
    - Histograms of the confidence placed in each measurement
    - Histograms and/or regressions derived from comparing one science parameter to another, statistics may be computed for a subset that satisfies some condition

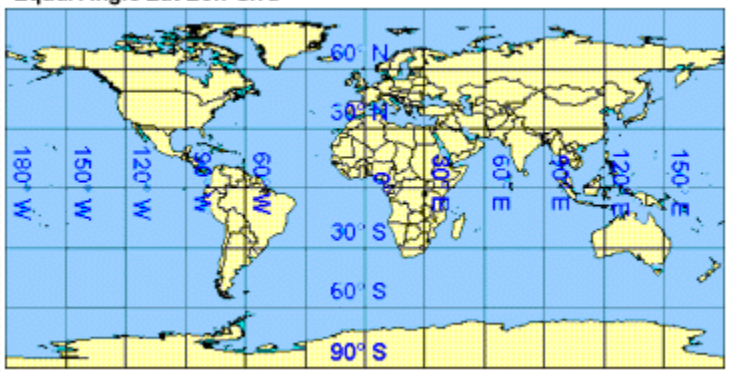
MODIS L3 Monthly Computed Statistics



- **Computed Statistics**
  - Statistics are sorted into **1x1 degree cells** on an equal-angle grid that spans a (calendar) monthly interval and then summarized over the globe.
  - A range of statistical summaries are computed, depending on the parameter being considered. Statistics for a given measurement might include:
    - Simple (mean, minimum, maximum, standard deviation) statistics
  - Parameters of normal and log-normal distributions
    - Fraction of pixels that satisfy some condition (e.g. cloudy, clear)
    - Histograms of the quantity within each grid box
    - Histograms of the confidence placed in each measurement
    - Histograms and/or regressions derived from comparing one science parameter to another, statistics may be computed for a subset that satisfies some condition

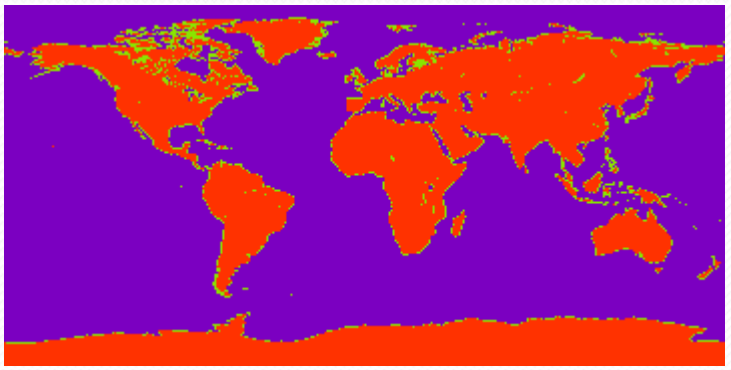
L3 Grids and Mapping

Equal Angle Lat-Lon Grid



The MODIS Atmosphere Daily Global Product is stored on an equal angle lat-lon grid. The grid cells are 1 degree by 1 degree, which means the output grid is always 360 pixels in width and 180 pixels in height.

Hammer-Aitoff Projection



A Land/Ocean Mask for L3 products is provided below. The PNG image is 360 pixels in width and 180 pixels in height. Each image pixel corresponds to one L3 1x1 degree grid cell. Values of 200 represent land grid cells, values of 100 represent mixed grid cells, and values of 0 represent ocean grid cells. This image can be use with analysis programs, such as those written in IDL, to screen L3 results for ocean or land only.