




ARSET

Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

 @NASAARSET

Remote Sensing for Wildfire Applications

Instructors: Cindy Schmidt and Amber McCullum

Week 2

Course Structure

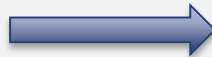
- **One session per week on June 9, 16, 23, and 30, 2016**
 - 11 a.m. – 12 p.m. EDT (UTC-4)
 - 6 p.m. – 7 p.m. EDT (UTC-4)
- **Each session may include**
 - Presentation
 - A homework assignment
- **Q&A following each session or by email to Tim Stough**
(stough@jpl.nasa.gov) or **Amita Mehta** (amita.v.mehta@nasa.gov)

Course Material

<http://arset.gsfc.nasa.gov/disasters/webinars/disaster-overview-2016>

Webinar presentations, exercises, homework assignments, and recordings

Links will be available on the ARSET course page



The screenshot shows the ARSET (Applied Remote Sensing Training) website. The header includes the NASA logo, the text 'ARSET Applied Remote Sensing Training', and navigation links for 'Home', 'About', and 'Trainings'. A search bar is also present. The main content area features a grid of six satellite images illustrating disaster management. Below the grid, the webinar title 'Using NASA Remote Sensing for Disaster Management' is displayed, along with the dates 'Thursday, June 9, 2016 to Thursday, June 30, 2016', times '11:00 a.m.-12:00 p.m. and 6:00-7:00 p.m. EDT (UTC-4)', and registration closing date 'Monday, June 6, 2016'. A sidebar on the right lists 'Disasters' with sub-links for 'Disasters Webinars' and 'Disasters Workshops', and 'Upcoming Training' with a link for 'Using NASA Remote Sensing for Disaster Management' scheduled from 06/09/2016 to 06/30/2016. Other sidebar links include 'Airquality', 'Fundamentals of Satellite Remote Sensing for Health', and 'Remote Sensing for Health'.

Homework and Certificate

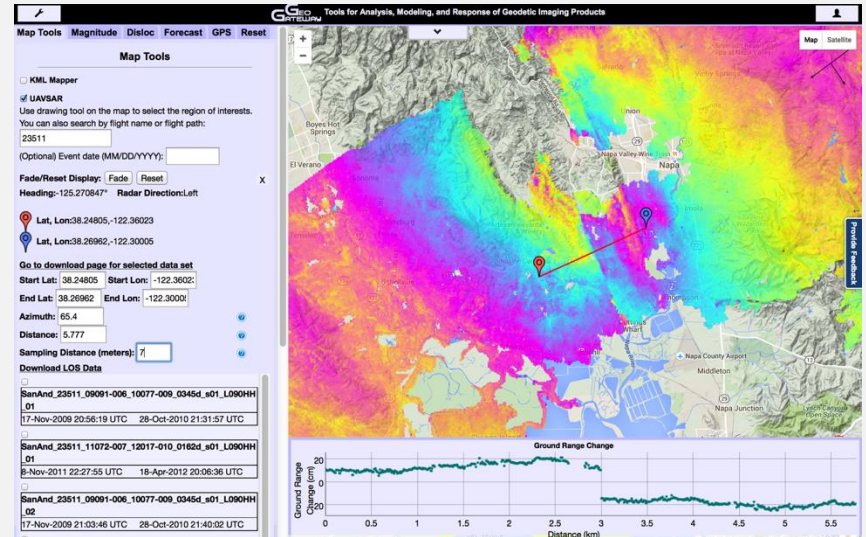
- **Homework**

- Answers to homework questions via Google form
- Available at <http://arset/disasters/webinars/disaster-overview-2016>

- **Certificate of Completion**
- Attend all 4 webinar sessions
- Complete all homework assignments
- Certificates will be emailed approximately 2 months after the course finishes by Marines Martins (marines.martins@ssaihq.com)

Course Objectives

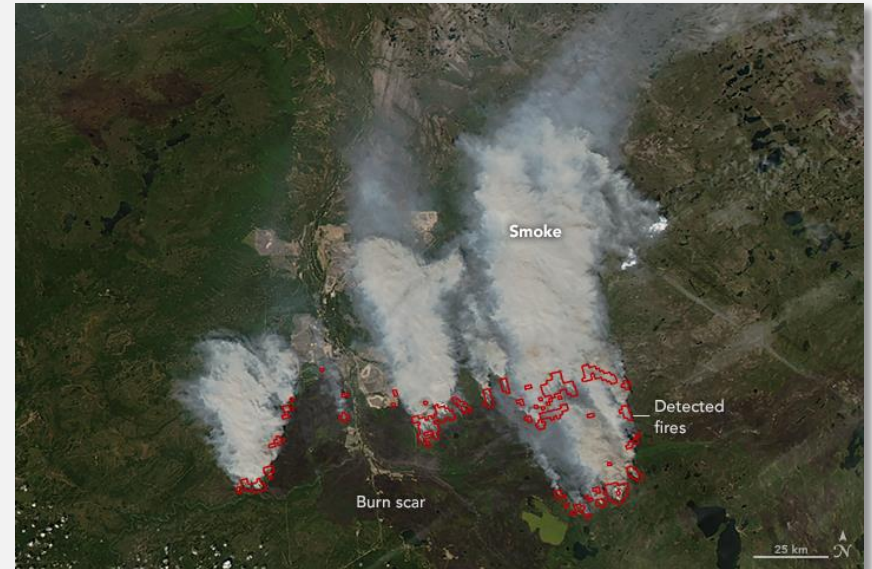
- Participants will become aware of available NASA resources for disaster management
- Participants will learn to access remote sensing observations for local disaster events



GeoGateway interface showing Napa earthquake interferogram with Line of Sight profile across the main rupture.

Wildfire Agenda

- Global Wildfire Issues and Management Questions
- Remote Sensing Wildfire Products
- Remote Sensing Wildfire Tools



Fort McMurray wildfire, May 24, 2016
Image acquired from the MODIS instrument on NASA's Aqua satellite

Wildfires: Global Critical Issues


- Loss of human life and property
- Air pollution
- Habitat loss
- Hydrological regime changes and increased risk of landslides
- Increased frequency, duration, and severity due to fire suppression methods and climate change



Global Wildfire Management Questions

- What are the pre- and post-burn forest conditions?
- What are the social and economic aspects of wildfires?
- How are land use changes affecting fire regimes?
- How can remote sensing be used to improve fire response measures and pre- and post-burn mitigation efforts?
 - What are the tools managers can use to make these assessments?

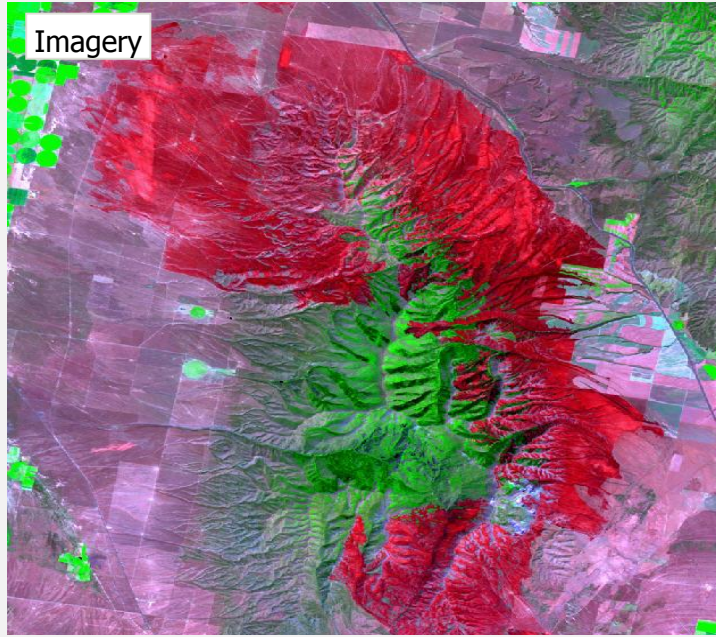


An aerial photograph of a forest landscape. A large, dense plume of white smoke or steam rises from the center-right of the image. In the lower portion of the image, there are several irregularly shaped areas outlined in red, indicating burn severity. The background shows a mix of green forest and brownish ground.

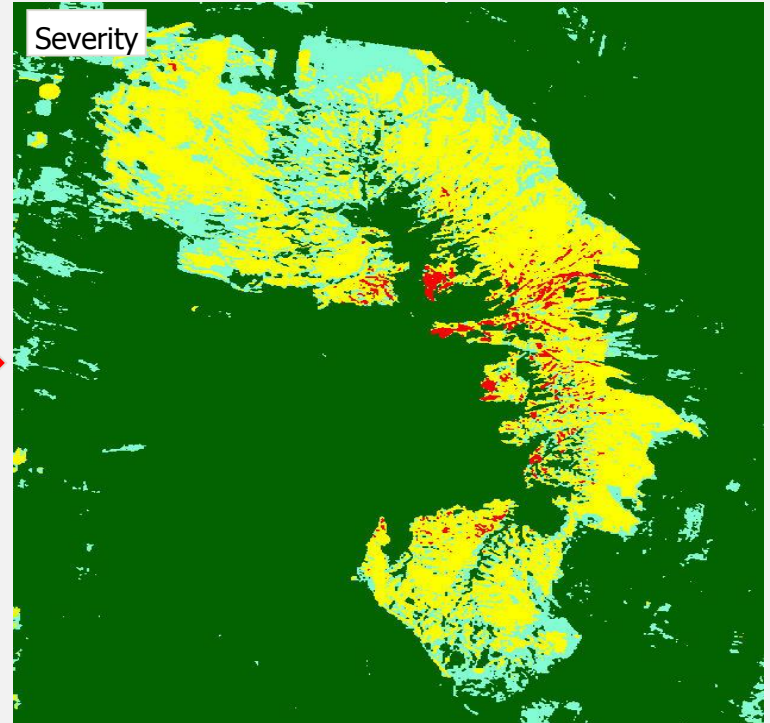
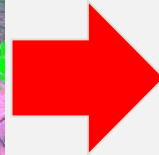
Burn Severity Mapping

Burn Severity Mapping

Burned Area Reflectance Classification

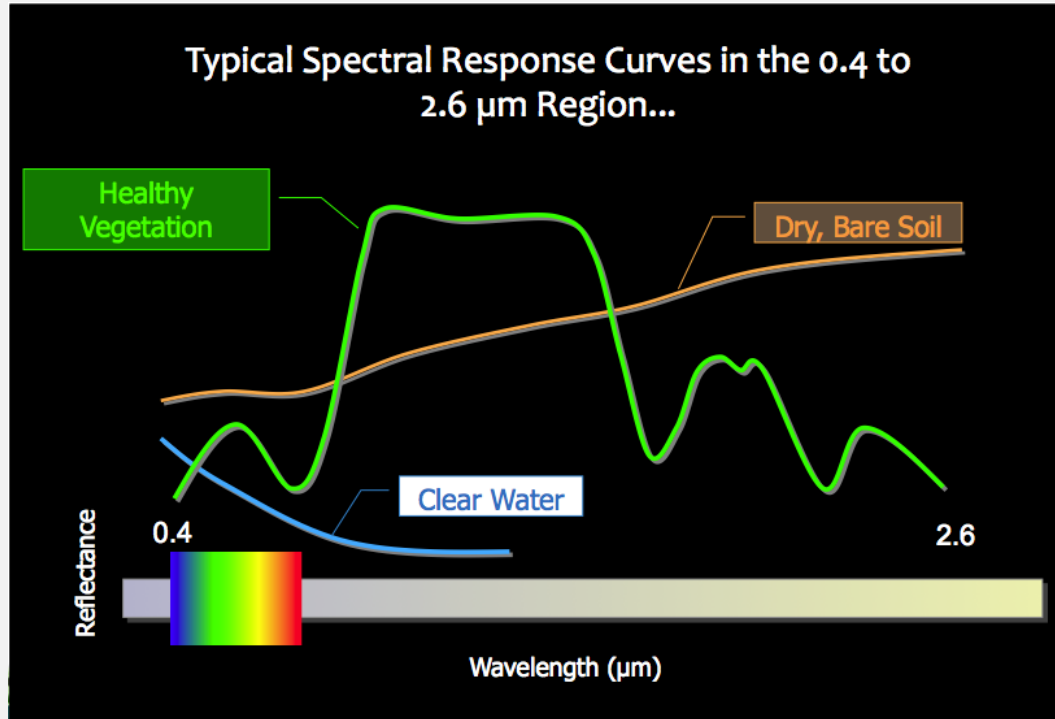


2007 Black Pine 2 Fire, Idaho, USA



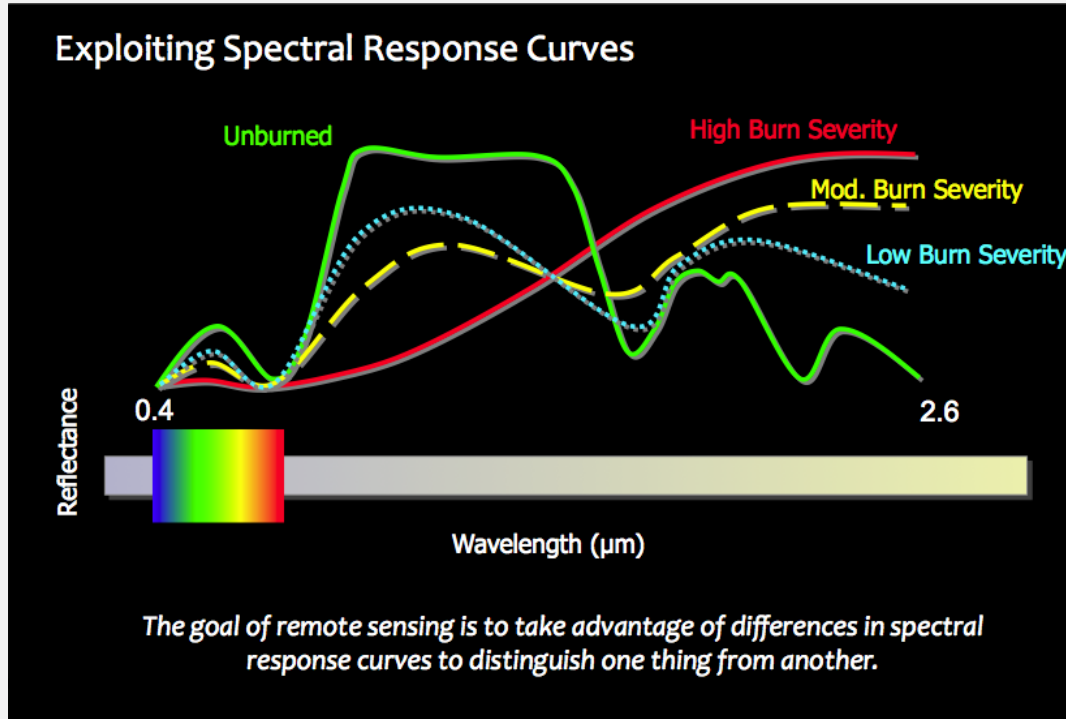
USDA Forest Service, Remote Sensing Applications Center, <http://fsweb.rsac.fs.fed.us>

Typical Spectral Signatures



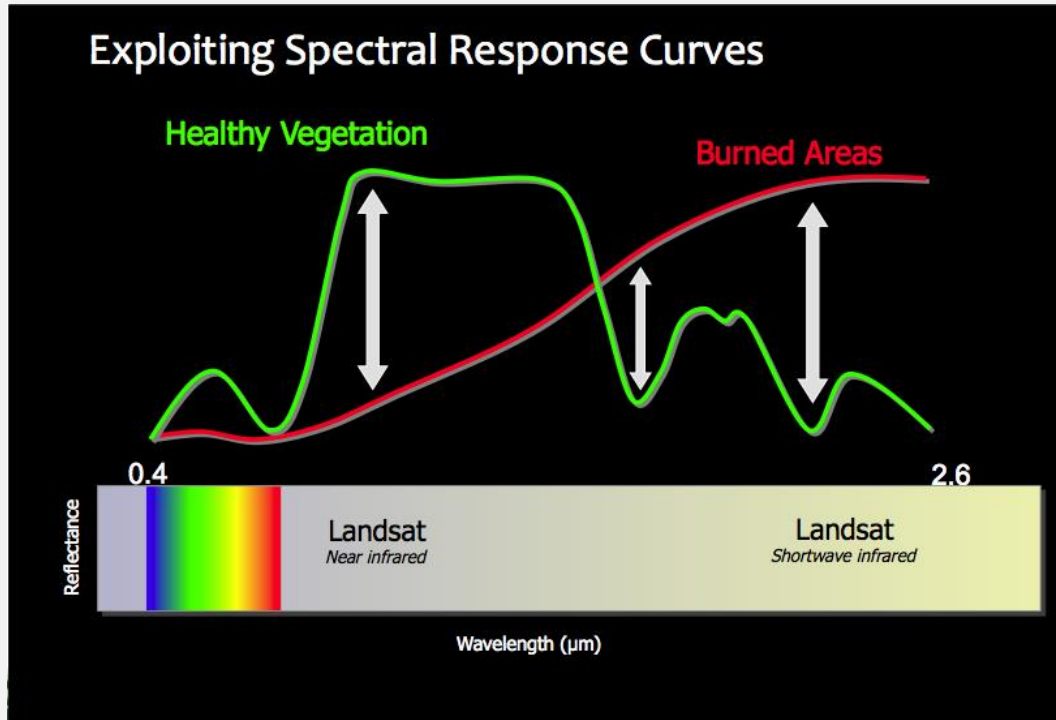
USDA Forest Service, RSAC

Healthy Vegetation vs. Burned Areas



USDA Forest Service, RSAC

Healthy Vegetation vs. Burned Areas



USDA Forest Service, RSAC

Data Processing

- An image processing method depends on which sensor is used...

Normalized Burn Ratio (NBR)

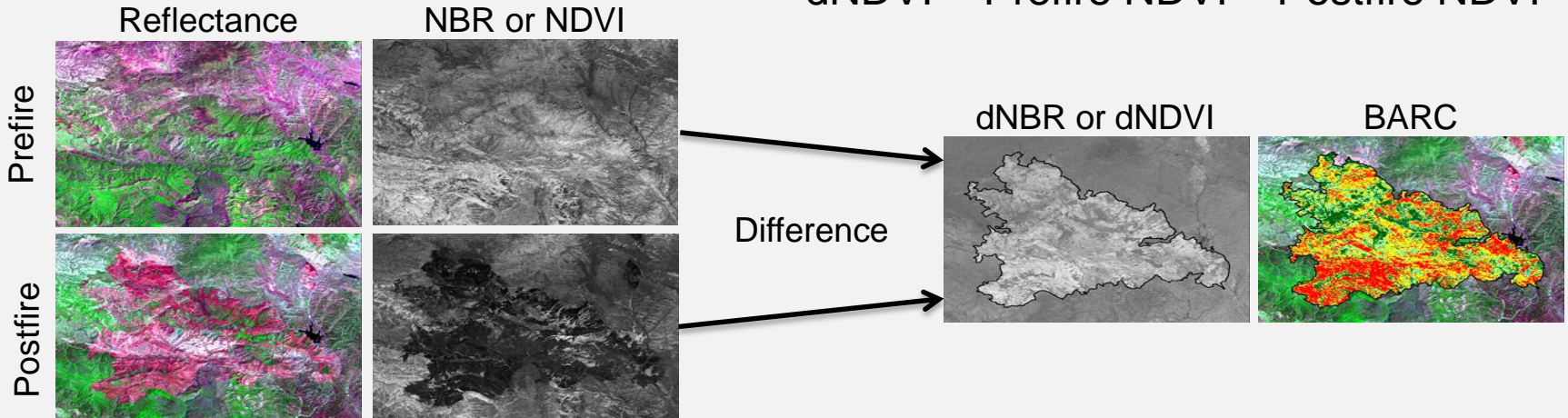
$$\text{NBR} = (\text{NIR} - \text{SWIR}) / (\text{NIR} + \text{SWIR})$$

$$\text{dNBR} = \text{Prefire NBR} - \text{Postfire NBR}$$

Normalized Difference Vegetation Index (NDVI)

$$\text{NDVI} = (\text{NIR} - \text{RED}) / (\text{NIR} + \text{RED})$$

$$\text{dNDVI} = \text{Prefire NDVI} - \text{Postfire NDVI}$$

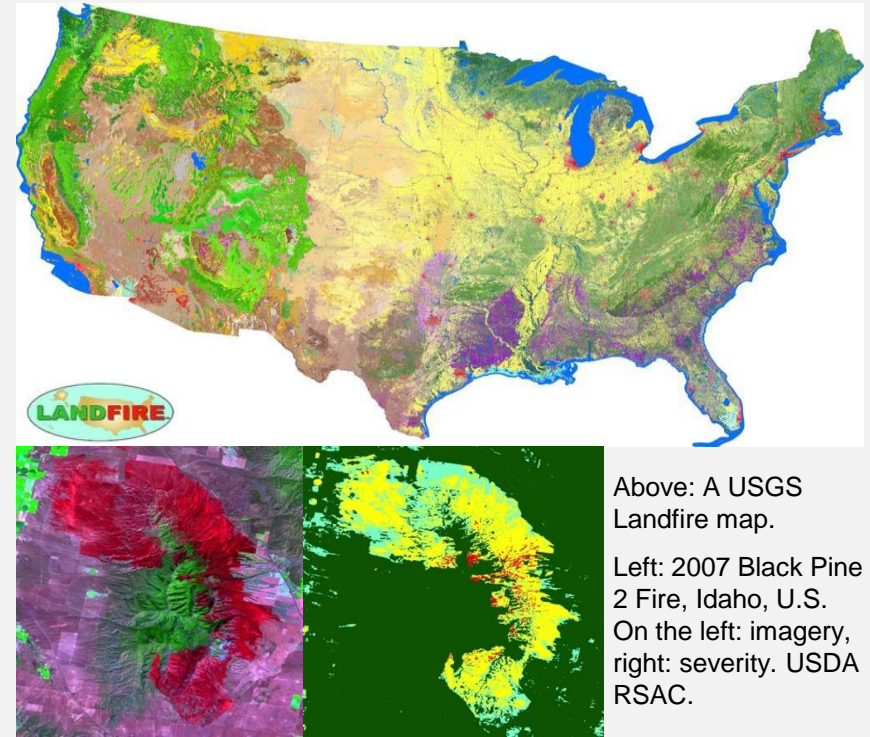


An aerial photograph of a forest fire. The fire is visible as a bright, irregular shape in the lower right quadrant, with red outlines indicating its perimeter. The surrounding forest is dark green. A semi-transparent white rectangular box is overlaid on the upper and middle portions of the image, containing the text 'Remote Sensing Wildfire Products' and a horizontal line below it.

Remote Sensing Wildfire Products

Products Derived from NASA Satellites for Wildfire Management

- Pre-Fire Mapping
 - Vegetation density and extent
 - Soil moisture/drought severity
 - Topography
- Active Fire Mapping
 - Total area currently burning
 - Fire Radiative Power (FRP) using thermal bands
- Post-Fire Mapping
 - Total area burned
 - Burn severity
 - Post-fire vegetation regrowth (NDVI)

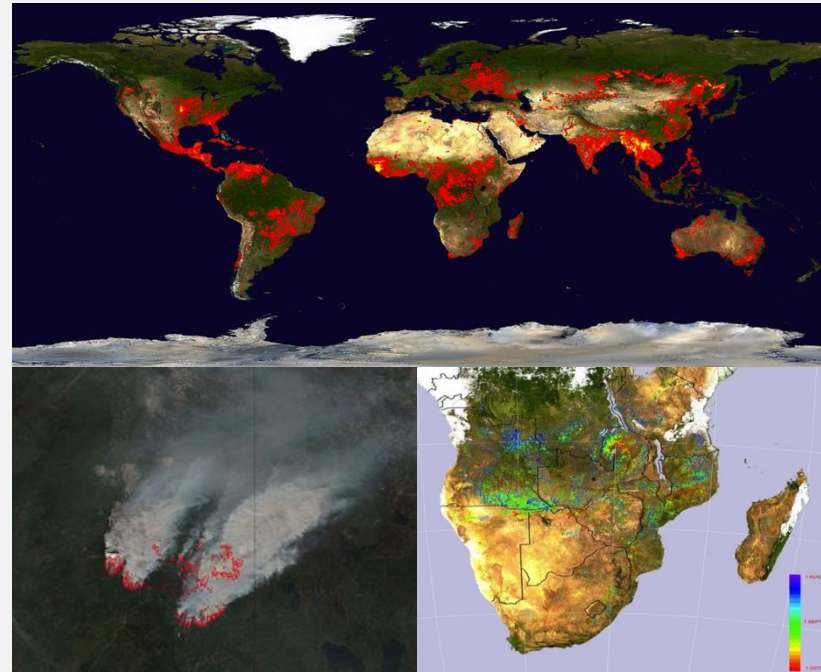


Above: A USGS Landfire map.

Left: 2007 Black Pine 2 Fire, Idaho, U.S.
On the left: imagery, right: severity. USDA RSAC.

Remote Sensing Wildfire Products

- Landsat
 - LANDFIRE
 - Burn Severity Mapping
- MODIS
 - Thermal Anomalies
 - Burned Area
- VIIRS
 - Active Fire Product

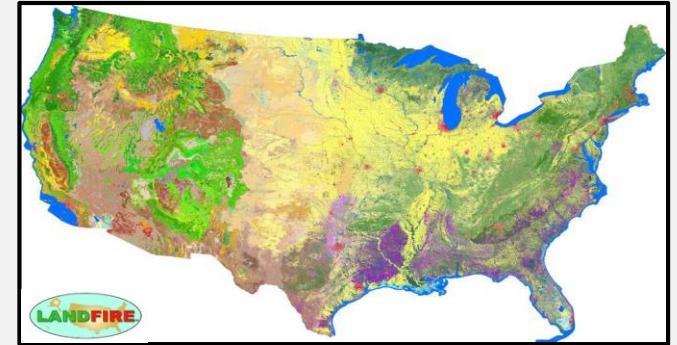


Above: MODIS (Terra) shows fires around the world. NASA; Bottom Left: Image captured by VIIRS (Suomi-NPP) of the Fort McMurray Fires May 16, 2016. NASA; Bottom Right: Mosaic of the MODIS 500m burned area product. MODIS-FIRE/UMD.

LANDFIRE

Interagency Partnership Between USFS and USGS

- Products: delivered at 30m spatial resolution
- Vegetation data layers using Landsat Imagery from 1999-present
 - Current and historic vegetation composition and structure of the entire U.S.
- Fuel and fire regime data layers
 - Fire behavior and fuel loading models for entire U.S. 1999-present
- Disturbance data
 - Fuel, vegetation, natural, and prescribed disturbance by type and year. 1999-present

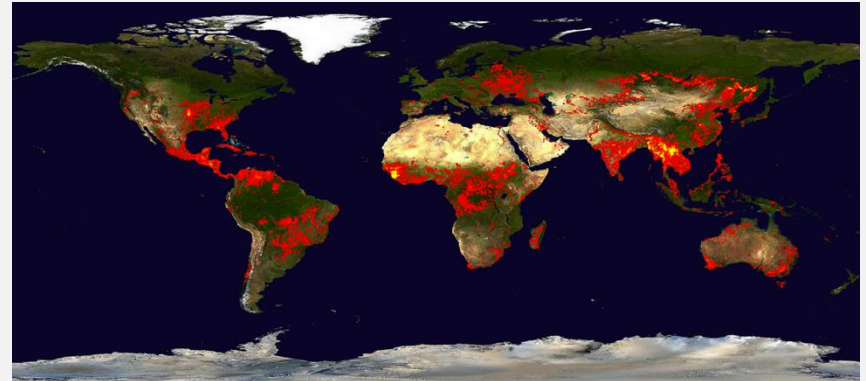


Landfire map. <http://www.landfire.gov>

MODIS Land Products

Thermal Anomalies (MYD14A1)

- Provides snapshots of active burning fires and burned areas
- The Active Fire product: actively burning locations on a daily basis at 1km resolution (additional 8 day and monthly products)
- Fire product: multiple attributes such as fire mask, fire pixel table, and maximum fire radiative power
- The Thermal Anomalies product: detects other thermal anomalies such as volcanic signatures



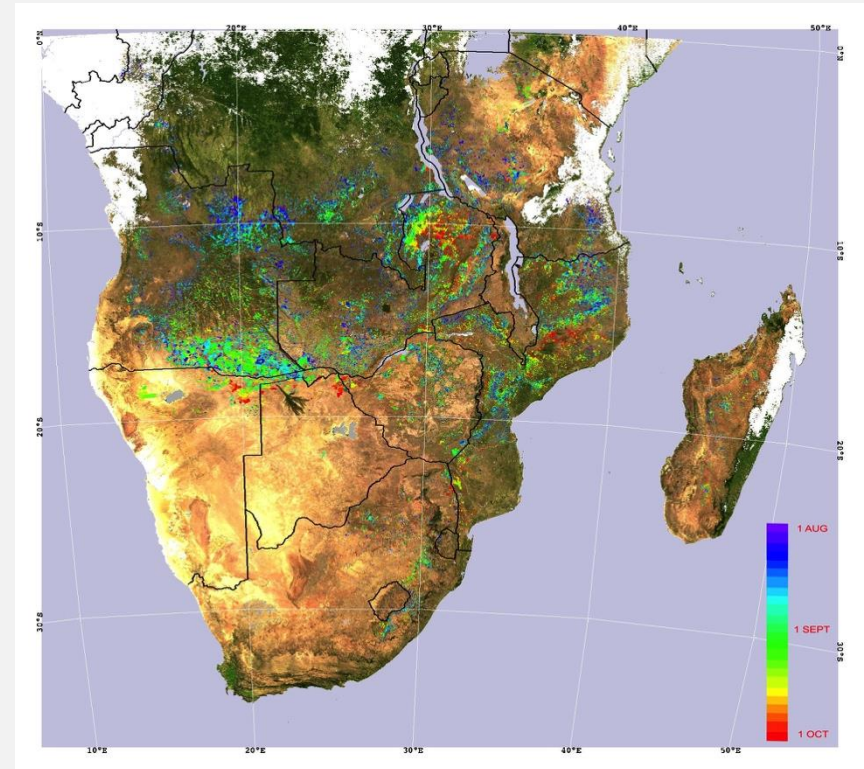
Global Fire Map (Apr 1-10, 2014); NASA FIRMS/NASA LANCE

MODIS Land Products

Burned Area (MCD45A1)

- The combined Terra & Aqua MODIS Burned Area product is a monthly, gridded 500m product
- Detects approximate date of burning
- More info: <http://modis-fire.umd.edu>

(Right) Example of the MODIS 500 m burned area product for sub equatorial Africa. The different colors indicate the approximate day of the burning detected between August and October in 2000. Image Credit: MODIS Fire Team




VIIRS Active Fire Product

- The Visible Infrared Imaging Radiometer Suite (VIIRS) sensor
 - Launched Oct 28, 2011
- VIIRS active fire product released to the public: Oct 22, 2012
- Spatial Resolution:
 - 750m (M-band)
 - 375m (I-band)
- Data is still preliminary and evaluation & calibration continue
- Current research: develop active fire product at 350m (I-band)



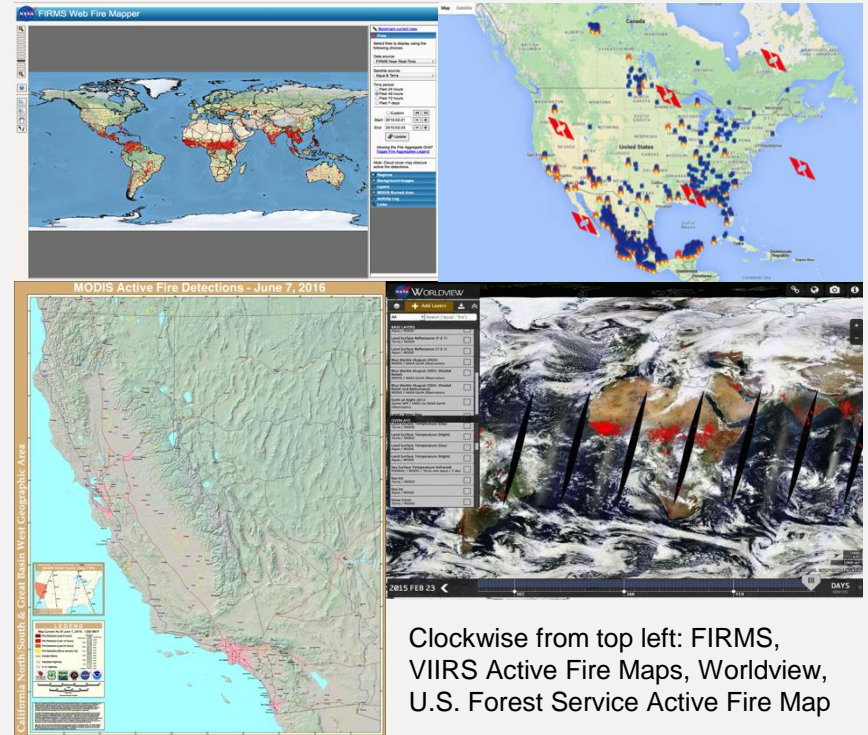
Fort McMurray wildfire in Alberta, Canada, collected by the VIIRS instrument on May 16, 2016.

An aerial photograph of a forest fire. The top half of the image is obscured by a semi-transparent white rectangular box. The bottom half shows a large, irregularly shaped fire area with bright orange and yellow flames, surrounded by dark green forest. The fire's perimeter is marked with a red outline. The text 'Remote Sensing Wildfire Web Tools' is centered in the white box, with a horizontal line underneath it.

Remote Sensing Wildfire Web Tools

Remote Sensing Wildfire Web-Tools

- Fire Information for Resource Management System (FIRMS)
- VIIRS Active Fire Maps (CONUS and Global)
- US Forest Service Active Fire Mapping Program
- NASA Worldview



Fire Information for Resource Management System (FIRMS)

<http://earthdata.nasa.gov/earth-observation-data/near-real-time/firms>

- Delivers
 - Global MODIS & VIIRS hotspots and fire locations
 - MODIS burned area images
- Historical data (more than 7 days) using 'Archive Download' tool
- Available in various formats:
 - Email alerts
 - GIS-friendly format
 - As visualization in **Web Fire Mapper** or **Worldview**


The screenshot shows the Earth Data website's page for the Fire Information for Resource Management System (FIRMS). The page features a search bar, navigation tabs (ABOUT, DATA, COMMUNITY, RESOURCES), and a main heading 'Fire Information for Resource Management System (FIRMS)'. Below the heading, there is a yellow alert box stating: 'The VIIRS 375 m active fire data are available in FIRMS again. The underlying issue that caused the spurious fire data has not yet been resolved but the FIRMS - VIIRS team have developed a workaround which will enable us to start distributing the data again. The workaround uses a threshold to remove data granules with excessive fire counts. In the unlikely event that you notice rows of fires which look unusual, we recommend you disregard them.' Below this, a table lists the availability of data for MODIS and VIIRS products. The table has columns for 'MODIS C5', 'MODIS C6', and 'VIIRS'. The rows include 'Email alerts', 'Shape files (SHP)', 'Comma-separated text files (TXT)', 'KML', 'Archive download tool', 'Web Fire Mapper', 'WMS', and 'Worldview'. A 'Get hotspot/fire locations' button is visible at the bottom of the page.

	MODIS C5	MODIS C6	VIIRS
Email alerts	ending soon	coming soon	coming soon
Shape files (SHP)	✓	✓	✓
Comma-separated text files (TXT)	✓	✓	✓
KML	ending soon	✓	✓
Archive download tool	✓	mid 2016	mid 2016
Web Fire Mapper	✓	✓	✓
WMS	ending soon	✓	✓
Worldview	✓	mid 2016	✓















































































FIRMS

Downloading Active Fire Data

- MODIS (1 km) and VIIRS (375 m)
- Download as Shapefile, KML, WMS, Txt
- Available for the last 24, 48 hours and 7 days

KML 


Download Keyhole Markup Language files for the last 24 hours and 48 hours. If you have Google Earth installed, you can open the KML directly or you can save it to your local disk for later viewing.

	MODIS 1 km	VIIRS 375 m
World	24h  48h  48h* 	24h  48h  48h* 
Alaska	24h  48h  48h* 	24h  48h  48h* 
Australia and New Zealand	24h  48h  48h* 	24h  48h  48h* 
Canada	24h  48h  48h* 	24h  48h  48h* 
Central America	24h  48h  48h* 	24h  48h  48h* 
Europe	24h  48h  48h* 	24h  48h  48h* 
North and Central Africa	24h  48h  48h* 	24h  48h  48h* 
Russia and Asia	24h  48h  48h* 	24h  48h  48h* 
South America	24h  48h  48h* 	24h  48h  48h* 
South Asia	24h  48h  48h* 	24h  48h  48h* 
South East Asia	24h  48h  48h* 	24h  48h  48h* 
Southern Africa	24h  48h  48h* 	24h  48h  48h* 
USA (Conterminous) and Hawaii	24h  48h  48h* 	24h  48h  48h* 















































































FIRMS

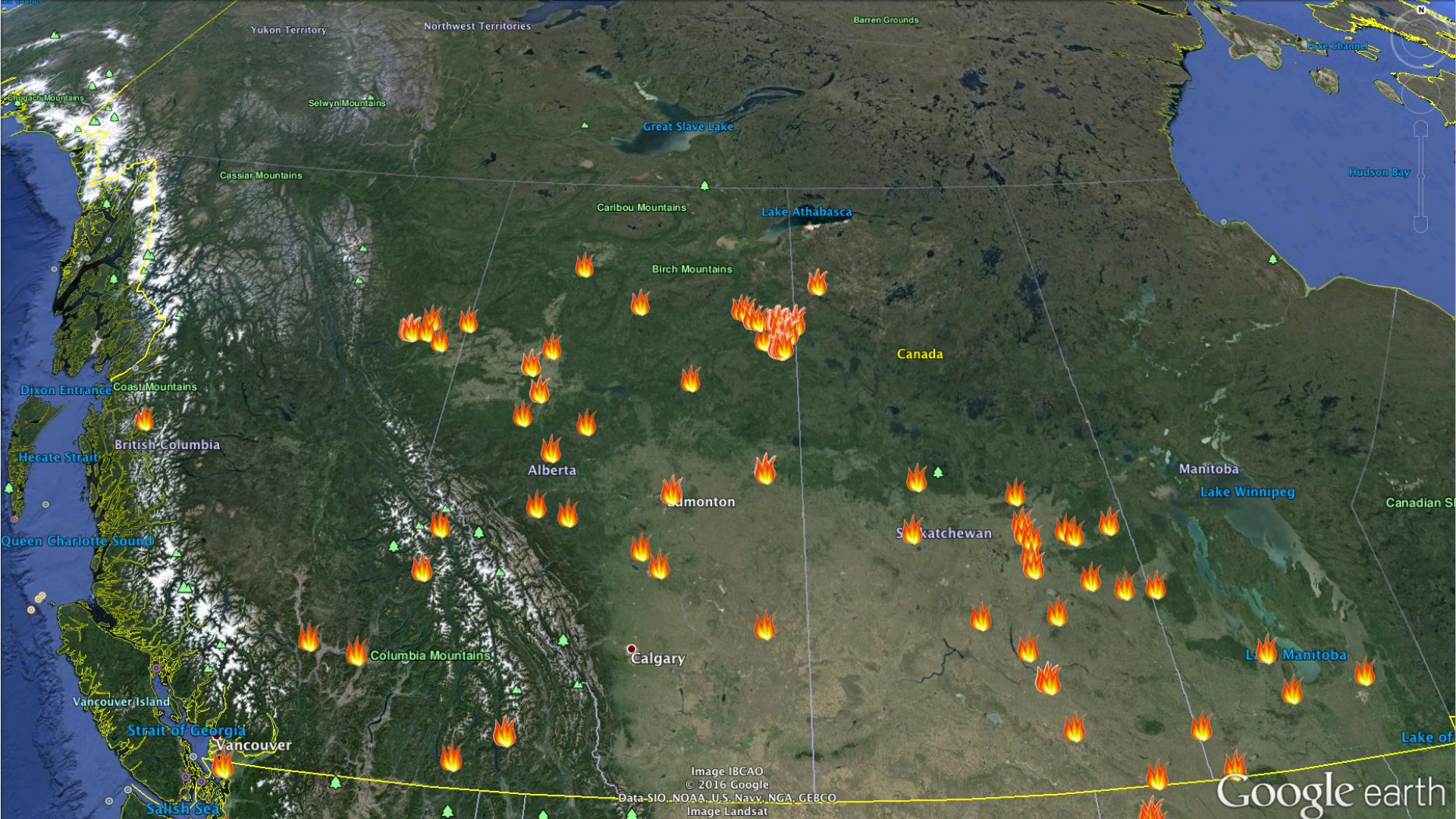
Downloading Active Fire Data

- MODIS (1 km) and VIIRS (375 m)
- Download as Shapefile, KML, WMS, Txt
- Available for the last 24, 48 hours and 7 days

KML 

Download Keyhole Markup Language files for the last 24 hours and 48 hours. If you have Google Earth installed, you can open the KML directly or you can save it to your local disk for later viewing.

	MODIS 1 km	VIIRS 375 m
World	24h  48h  48h* 	24h  48h  48h* 
Alaska	24h  48h  48h* 	24h  48h  48h* 
Australia and New Zealand	24h  48h  48h* 	24h  48h  48h* 
Canada	24h  48h  48h* 	24h  48h  48h* 
Central America	24h  48h  48h* 	24h  48h  48h* 
Europe	24h  48h  48h* 	24h  48h  48h* 
North and Central Africa	24h  48h  48h* 	24h  48h  48h* 
Russia and Asia	24h  48h  48h* 	24h  48h  48h* 
South America	24h  48h  48h* 	24h  48h  48h* 
South Asia	24h  48h  48h* 	24h  48h  48h* 
South East Asia	24h  48h  48h* 	24h  48h  48h* 
Southern Africa	24h  48h  48h* 	24h  48h  48h* 
USA (Conterminous) and Hawaii	24h  48h  48h* 	24h  48h  48h* 



Yukon Territory

Northwest Territories

Barren Grounds

Chinik Mountains

Selwyn Mountains

Great Slave Lake

Cassiar Mountains

Caribou Mountains

Lake Athabasca

Birch Mountains

Canada

Dixon Entrance

Coast Mountains

British Columbia

Alberta

Edmonton

Saskatchewan

Manitoba

Lake Winnipeg

Hecate Strait

Queen Charlotte Sound

Columbia Mountains

Calgary

Lake Manitoba

Vancouver Island

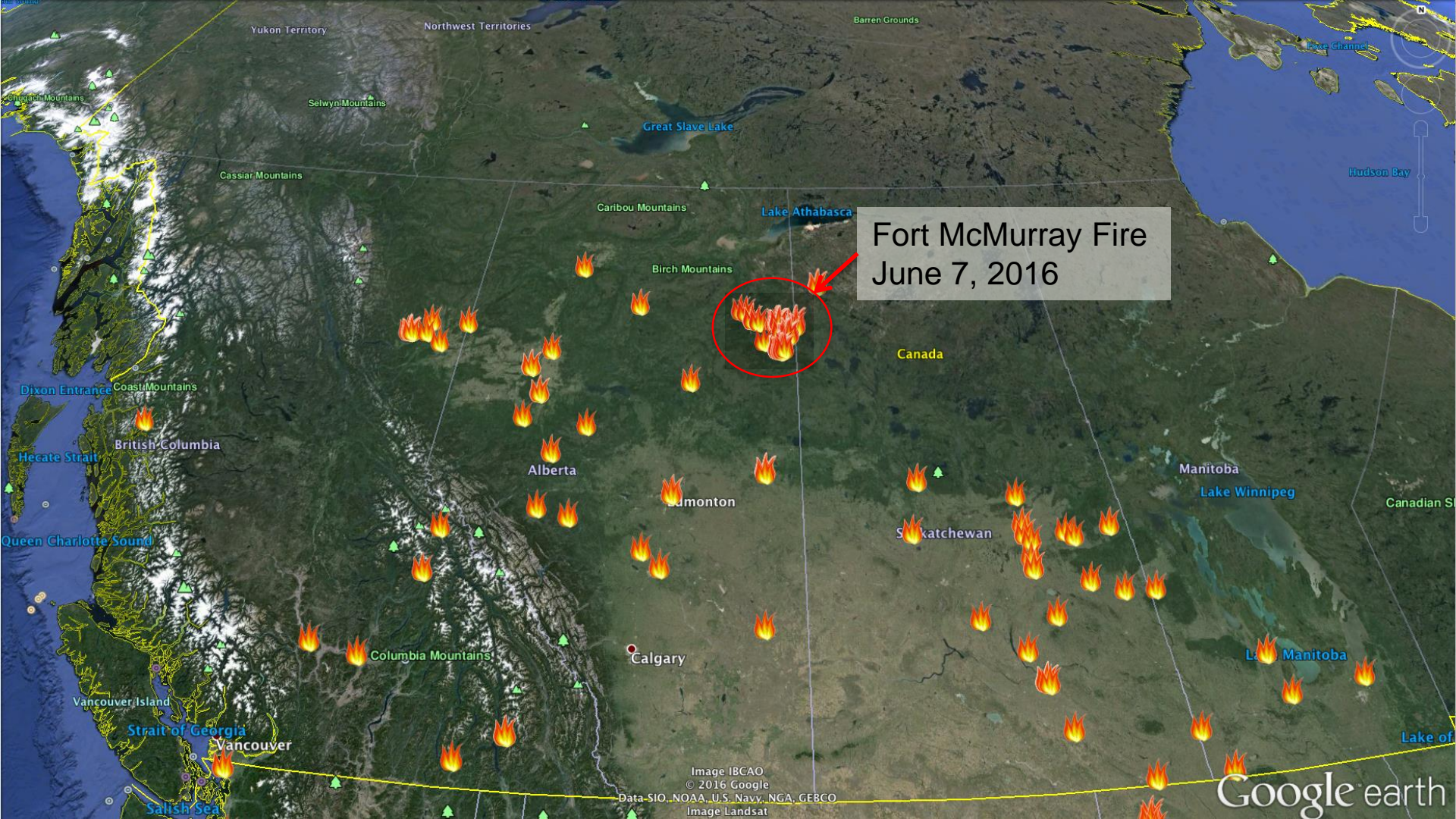
Strait of Georgia

Vancouver

Salish Sea

Image IBCAO
© 2016 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat

Google earth



Fort McMurray Fire
June 7, 2016

FIRMS

Downloading Archived Fire Data

- MODIS (Collection 5) fire/hotspot information older than the last 7 days
- Available as shapefiles or comma-separated text files (.csv)
- Information must be requested
- Once processed, you will receive an email with instructions on how to download your data

Fire Information for Resource Management System

FIRMS MODIS Fire Archive Download

Map Protected Area



Navigate Map Draw Polygon [\(Clear Polygon\[s\]\)](#)

Create Rectangle using Coordinates:

Bottom-Left X, Y:

Top-Right X, Y:

Options

From what date?

To what date?

FIRMS


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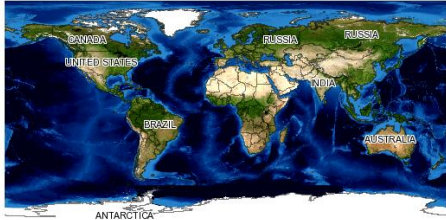
Downloading Archived Fire Data

- MODIS (Collection 5) fire/hotspot information older than the last 7 days
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FIRMS MODIS Fire Archive Download

Map Protected Area



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Create Rectangle using Coordinates:

Bottom-Left X, Y:

Top-Right X, Y:

Options

From what date?

To what date?

FIRMS

Downloading Archived Fire Data

Options

From what date?

To what date?

Output Format

Email Address

Please note: Data from Terra available from Nov. 2000; Aqua from July 2002. All requests are monitored and approved by the FIRMS team. Please provide us with accurate and valid information in order to prevent delays in processing your request.

Submit Your Request

Send email confirmation for this data request

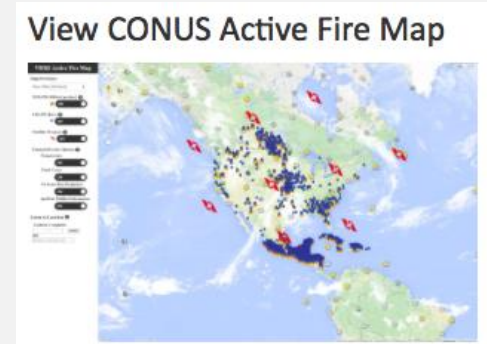
Cancel

Save

VIIRS Active Fire Maps

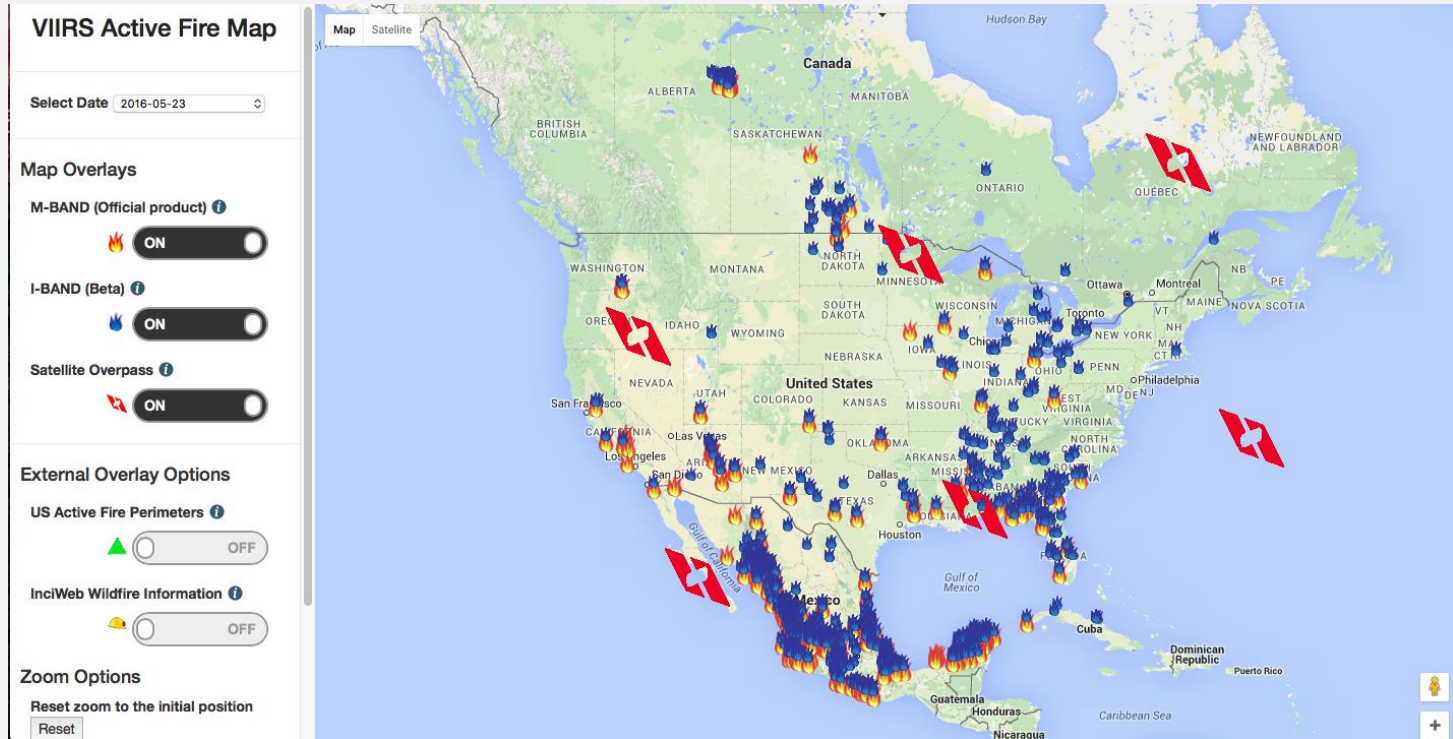
<http://viirsfire.geog.umd.edu/pages/mapsData>

- CONUS Active Fire Map
 - Can view active fire detections
 - Can download VIIRS imagery (M-band and I-band)
 - Available in GeoTIFF, ASCII and KMZ formats
- Global Active Fire Map
 - Can view active and archived fire detections only
- Tutorial available for downloading VIIRS active fire data



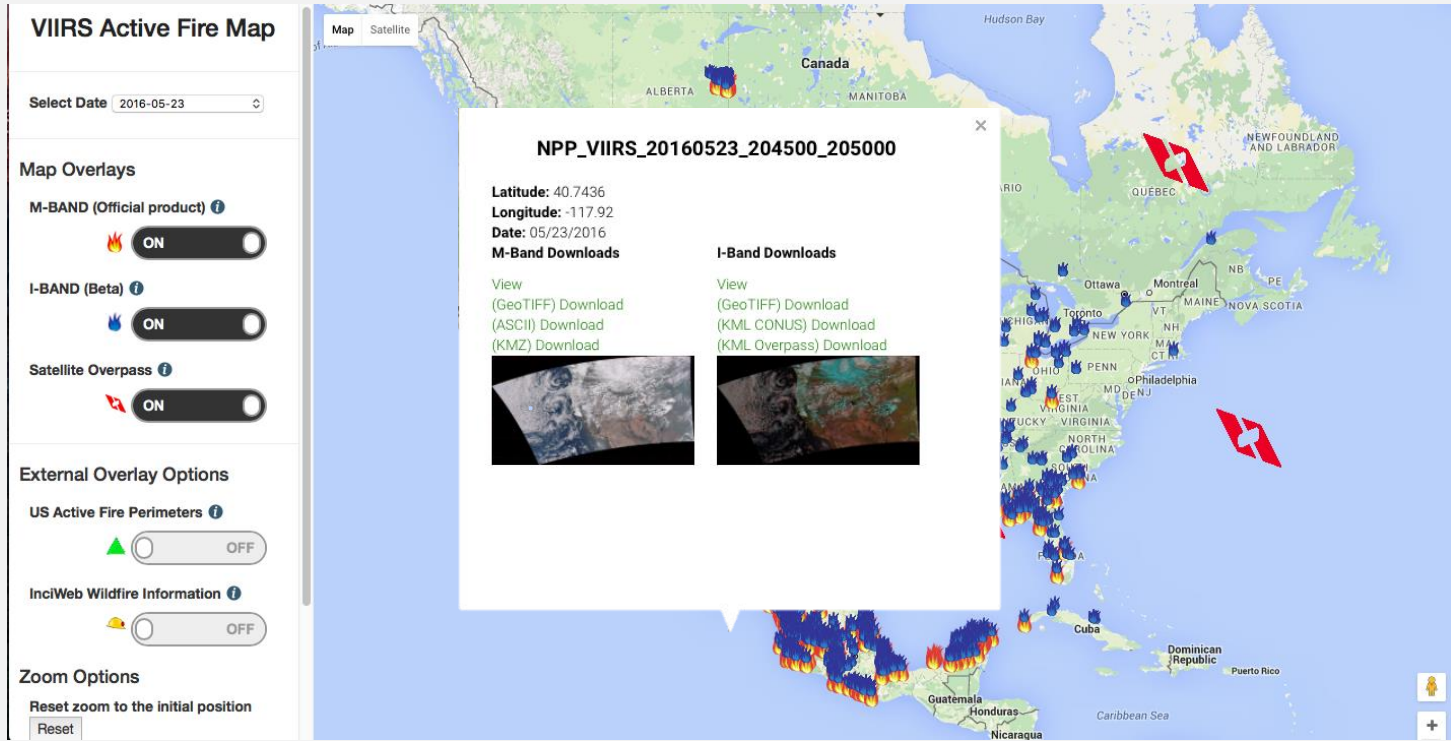
VIIRS Active Fire Map

CONUS



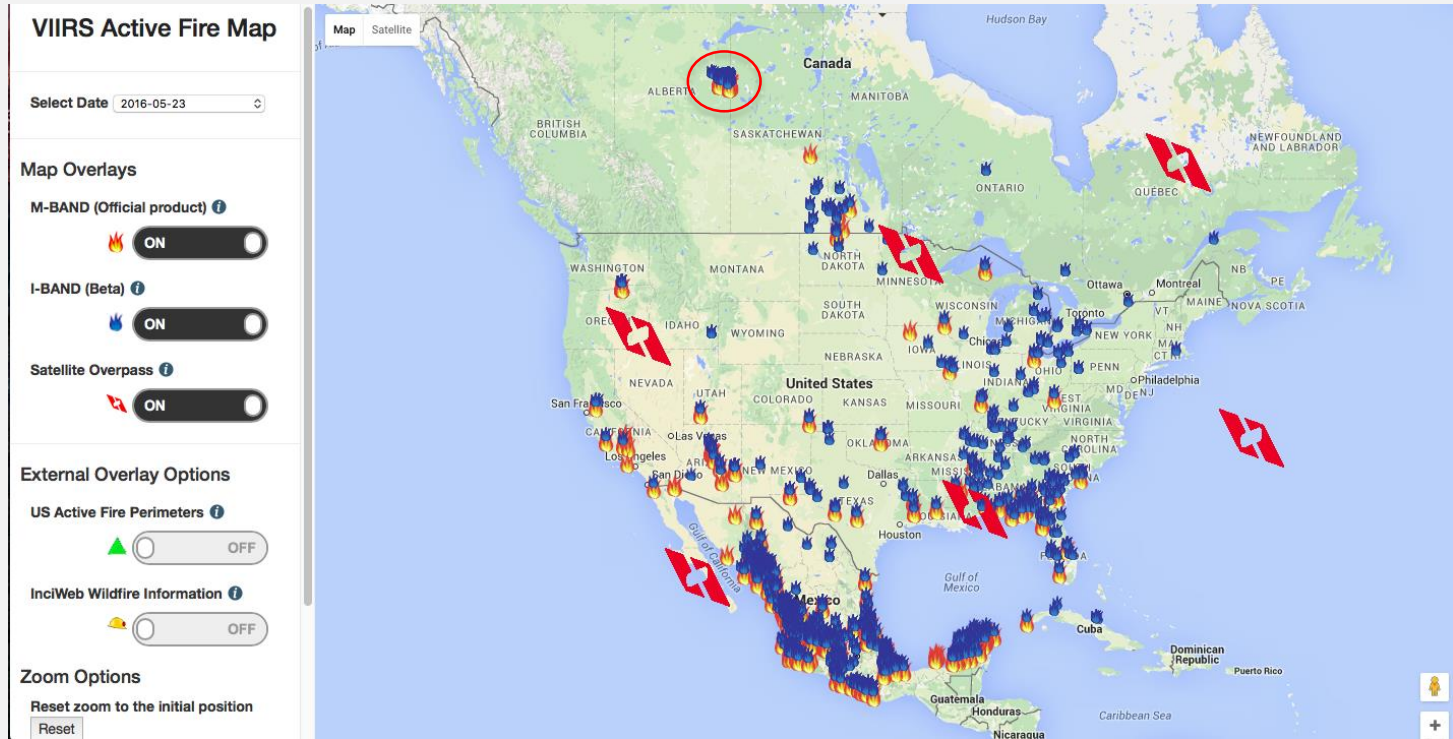
VIIRS Active Fire Map

CONUS



VIIRS Active Fire Map

CONUS

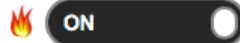


VIIRS Active Fire Map

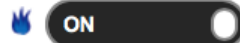
Select Date

Map Overlays

M-BAND (Official product) ?



I-BAND (Beta) ?

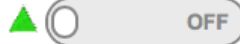


Satellite Overpass ?

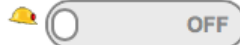


External Overlay Options

US Active Fire Perimeters ?

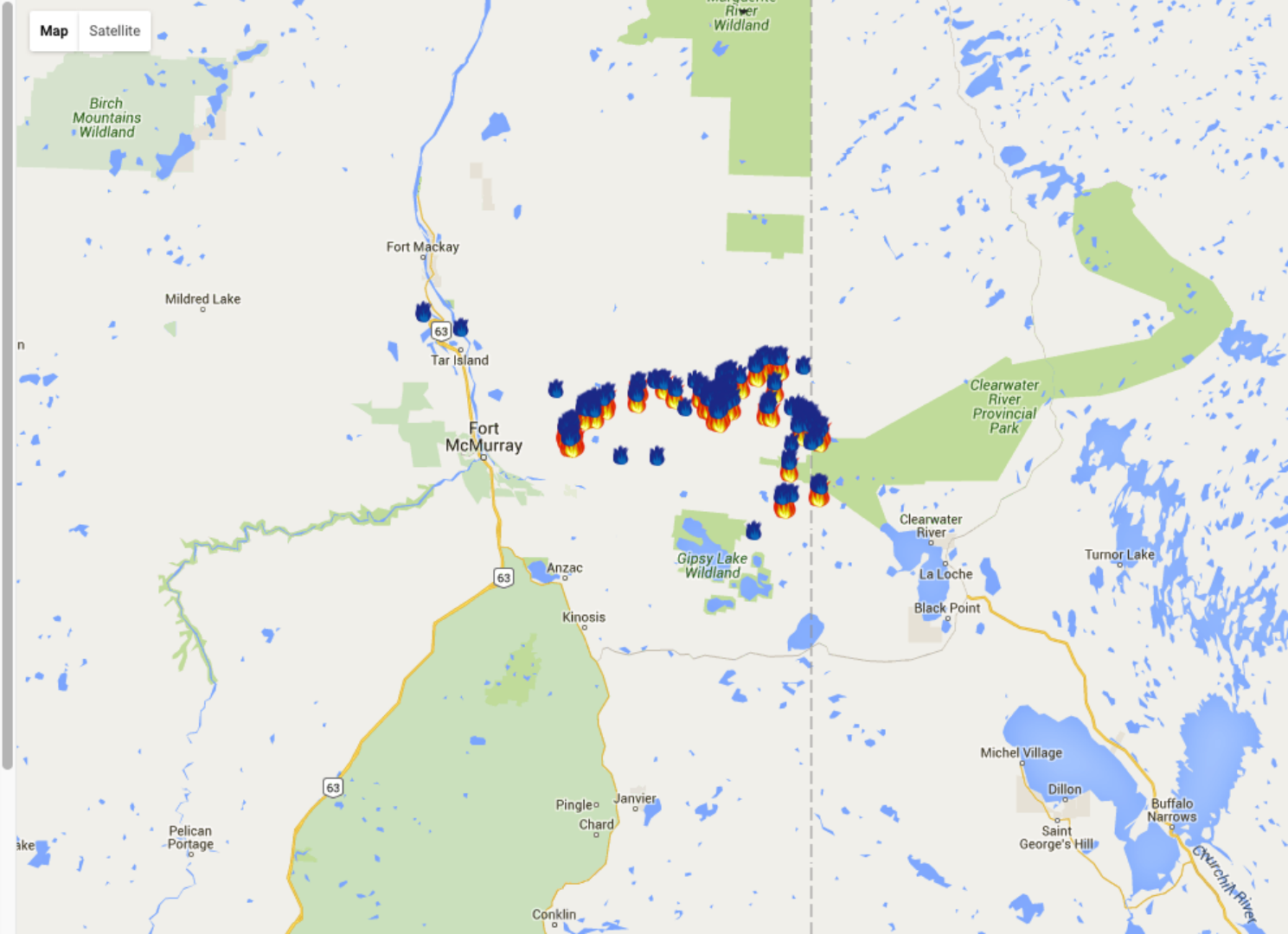


InciWeb Wildfire Information ?



Zoom Options

Reset zoom to the initial position



VIIRS Active Fire Map

Map Satellite

Select Date 2016-05-23

Map Overlays

M-BAND (Official product) *i*



I-BAND (Beta) *i*



Satellite Overpass *i*



External Overlay Options

US Active Fire Perimeters *i*



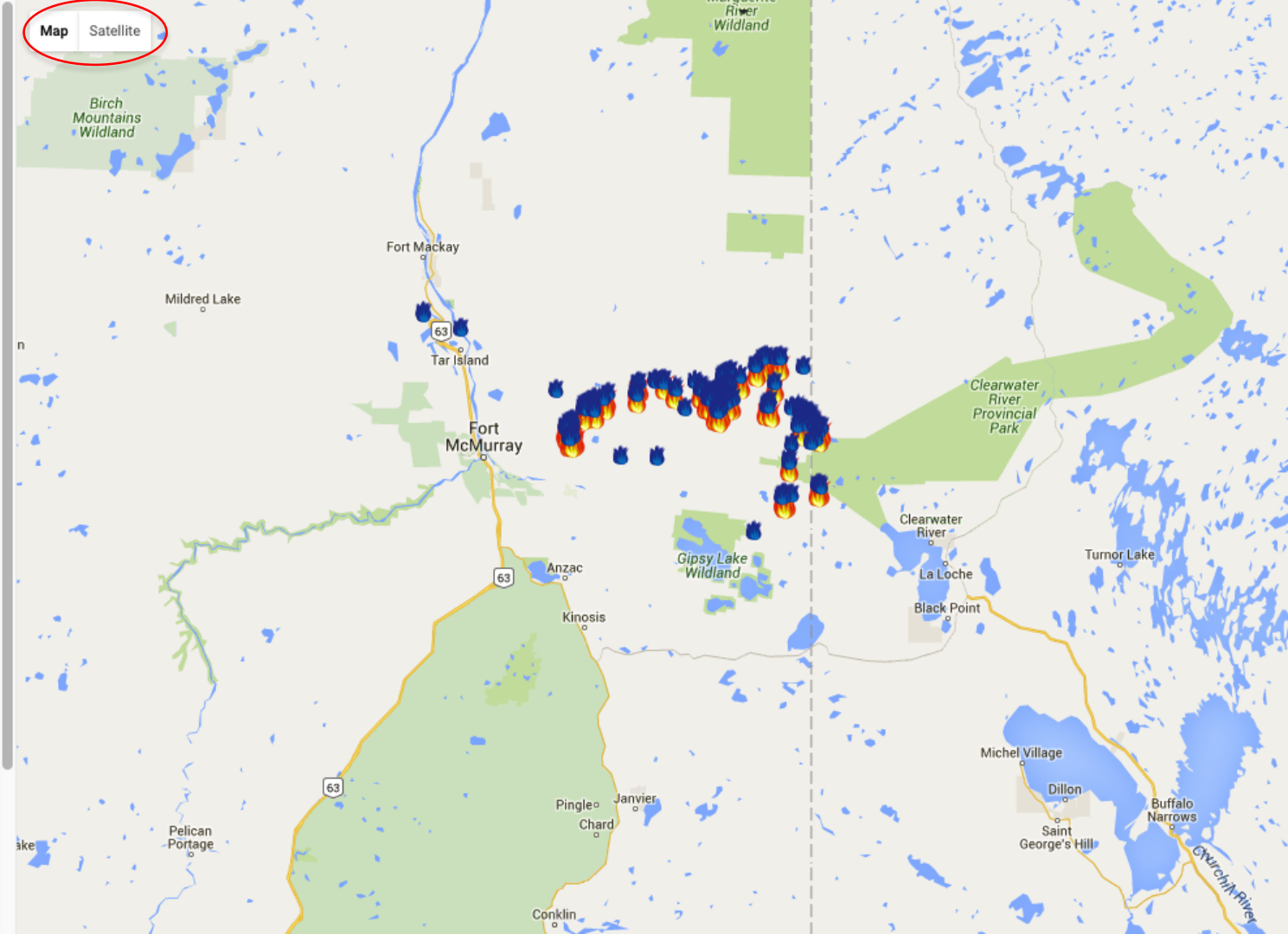
InciWeb Wildfire Information *i*



Zoom Options

Reset zoom to the initial position

Reset



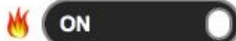
VIIRS Active Fire Map

Map Satellite

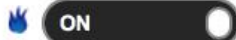
Select Date

Map Overlays

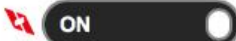
M-BAND (Official product) [i](#)



I-BAND (Beta) [i](#)

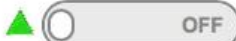


Satellite Overpass [i](#)



External Overlay Options

US Active Fire Perimeters [i](#)



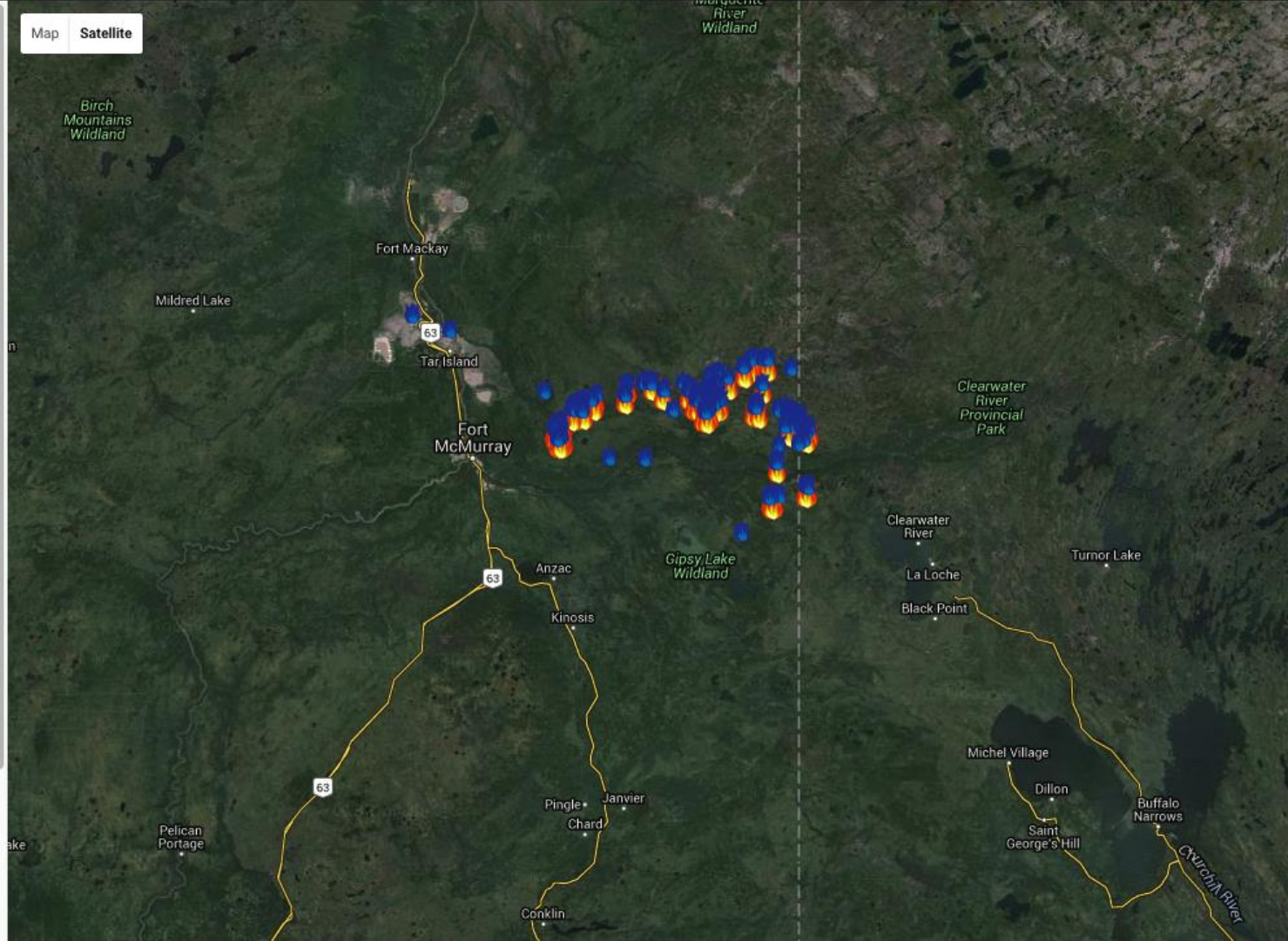
InciWeb Wildfire Information [i](#)



Zoom Options

Reset zoom to the initial position

Reset



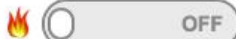
VIIRS Active Fire Map

Map Satellite

Select Date

Map Overlays

M-BAND (Official product) [i](#)



I-BAND (Beta) [i](#)

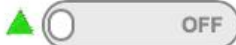


Satellite Overpass [i](#)



External Overlay Options

US Active Fire Perimeters [i](#)



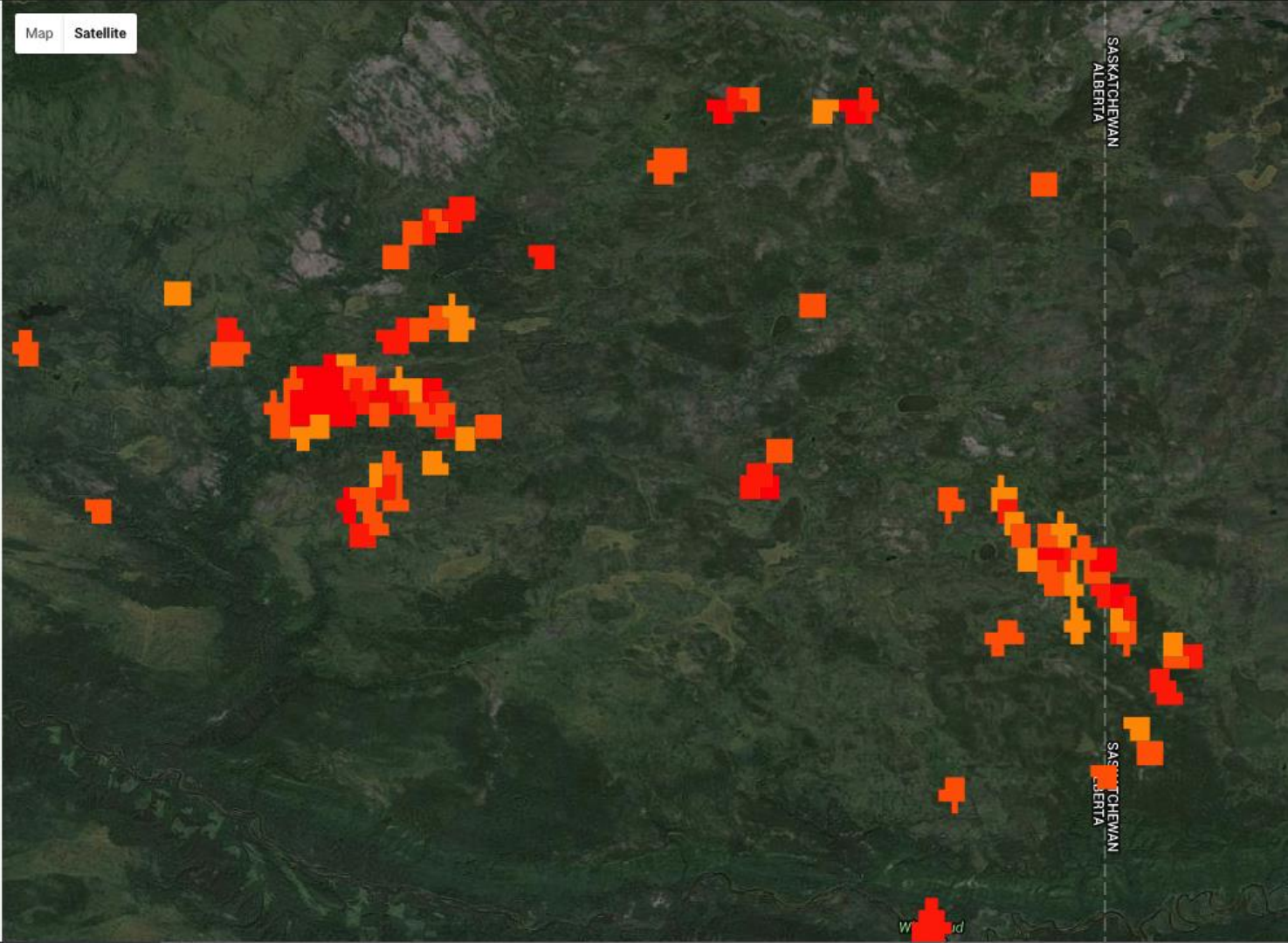
InciWeb Wildfire Information [i](#)



Zoom Options

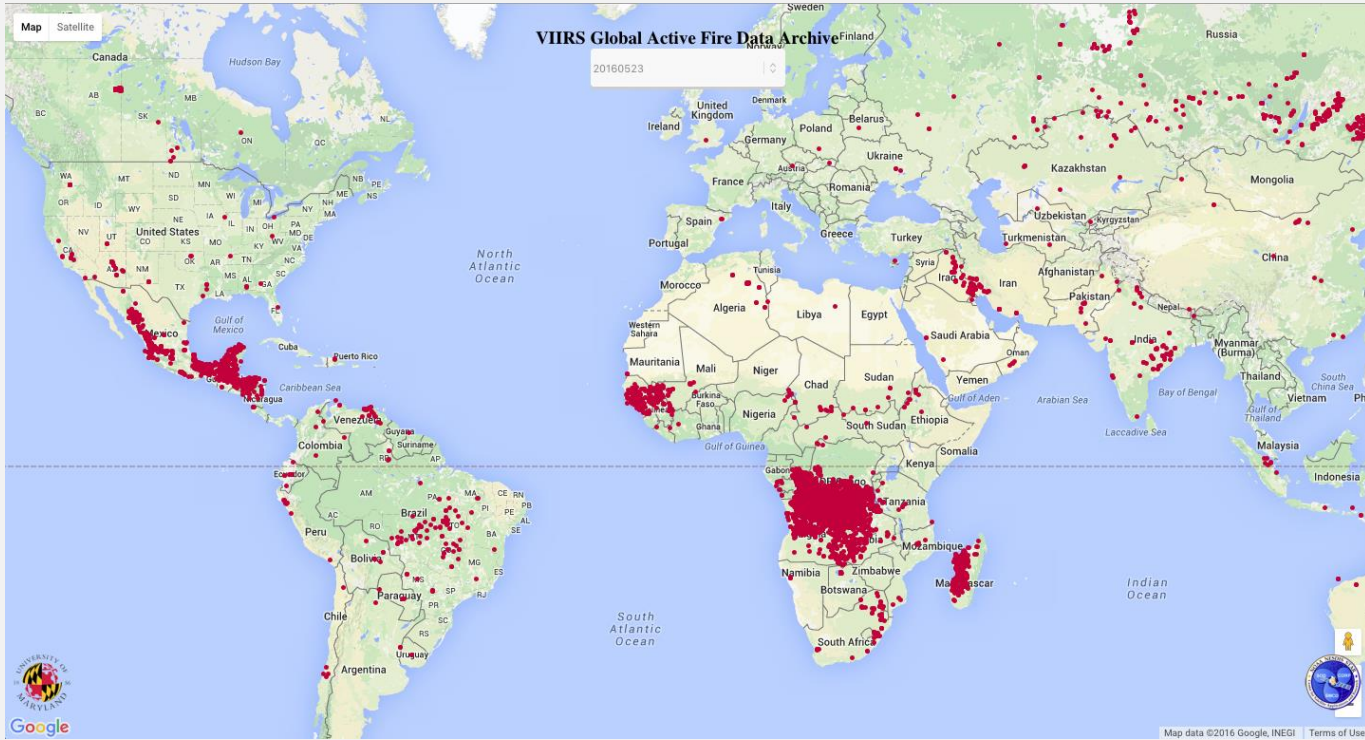
Reset zoom to the initial position

Reset



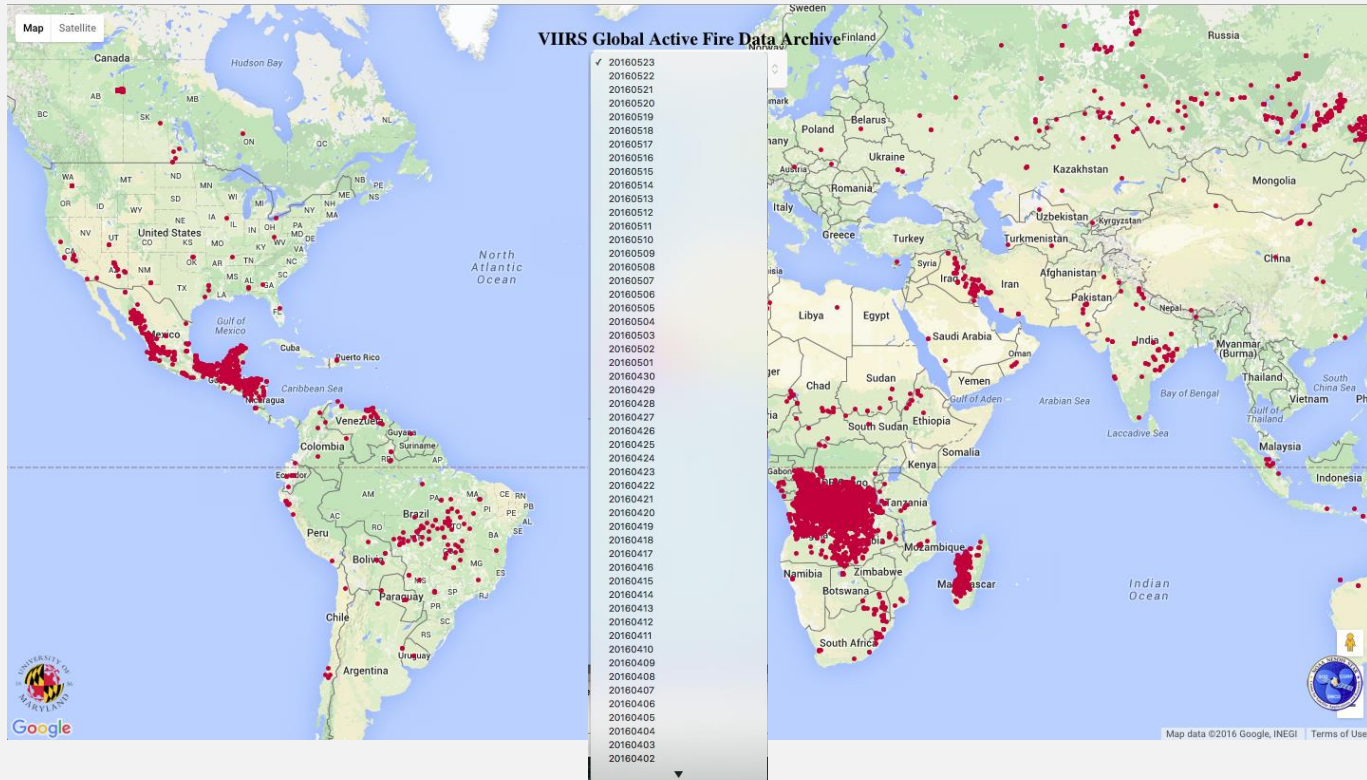
VIIRS Active Fire Map

Global



VIIRS Active Fire Map

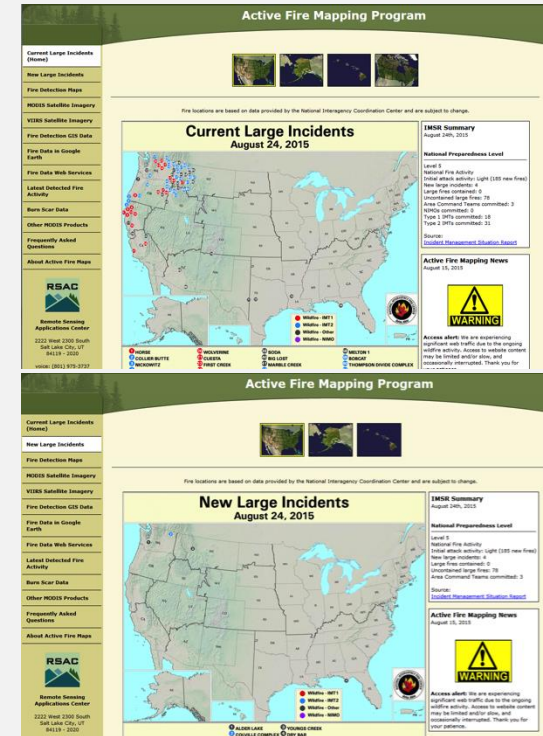
Global



U.S. Forest Service Active Fire Mapping Program

<http://activefiremaps.fs.fed.us>

- Satellite detection and monitoring of wildfire activity in CONUS, Alaska, Hawaii, and Canada
- Leverages NASA and NOAA assets:
 - GOES, AVHRR, MODIS, VIIRS
- Provision of comprehensive, NRT data are essential
- Facilitates decision support for strategic planning and response for U.S. and Canadian fire agencies



U.S. Forest Service Active Fire Mapping Program

<http://activefiremaps.fs.fed.us/googleearth.php>

Fire Data in Google Earth



MODIS VIIRS LANDSAT AVHRR GOES

Continental United States



KML
Fire Detections (MODIS): [Current](#) | [Animation](#) | [Historical](#)
Fire Radiative Power (MODIS): [Current](#) | [Animation](#) | [Historical](#)
Large Incidents: [Current](#) | [Historical](#)
Fire Weather: [Current](#)
AFM KML Bundle: [Current](#)

U.S. Forest Service Active Fire Mapping Program

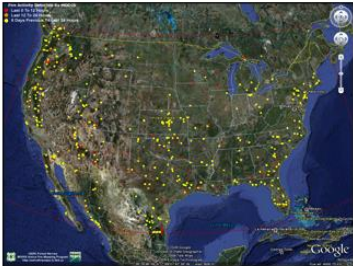
<http://activefiremaps.fs.fed.us/googleearth.php>

Fire Data in Google Earth



MODIS **VIIRS** LANDSAT AVHRR GOES

Continental United States



KML
Fire Detections (MODIS): [Current](#) | [Animation](#) | [Historical](#)
Fire Radiative Power (MODIS): [Current](#) | [Animation](#) | [Historical](#)
Large Incidents: [Current](#) | [Historical](#)
Fire Weather: [Current](#)
AFM KML Bundle: [Current](#)

U.S. Forest Service Active Fire Mapping Program

<http://activefiremaps.fs.fed.us/googleearth.php>

Fire Data in Google Earth



MODIS VIIRS LANDSAT AVHRR GOES

Continental United States

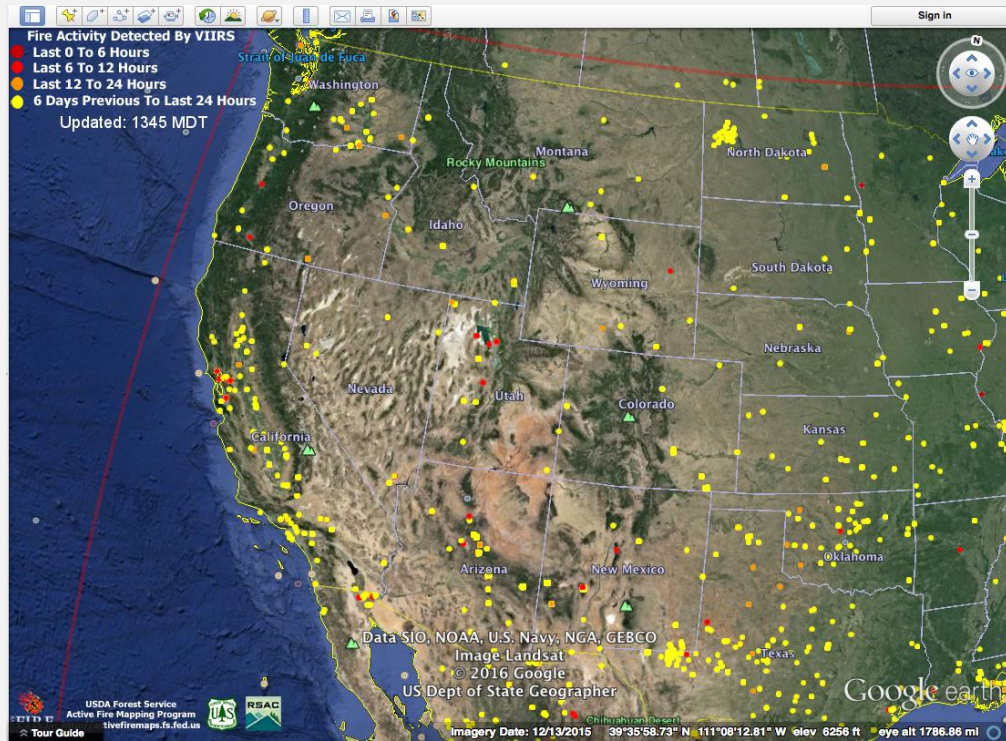


KML
Fire Detections (VIIRS 750m): [Current](#) | [Animation](#) | [Historical](#)
Fire Detections (VIIRS 375m): [Current](#) | [Animation](#) | [Historical](#)
Fire Radiative Power (VIIRS 750m): [Current](#) | [Animation](#) | [Historical](#)
Large Incidents: [Current](#) | [Historical](#)
Fire Weather: [Current](#)
AFM KML Bundle: [Current](#)



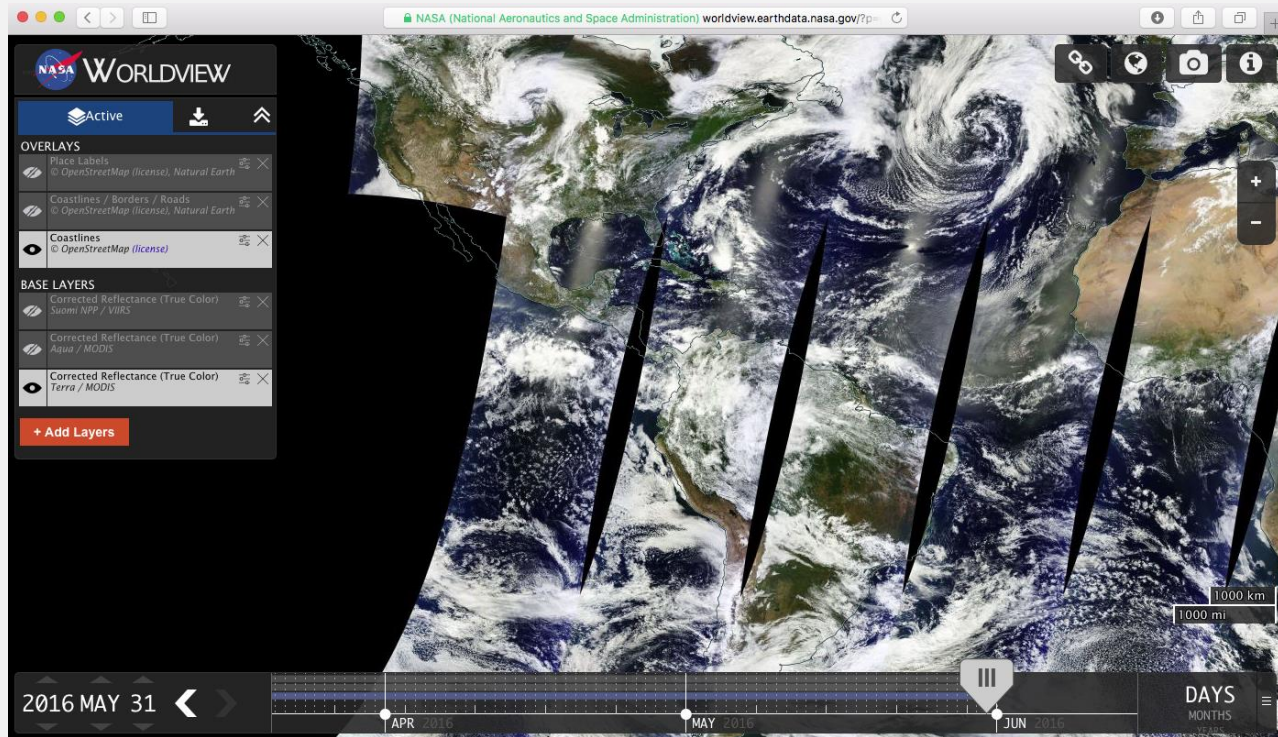
U.S. Forest Service Active Fire Mapping Program

Visualizing VIIRS current fire activity in Google Earth



NASA Worldview

<https://earthdata.nasa.gov/labs/worldview>



Active 📄 ⬆️ ⬆️

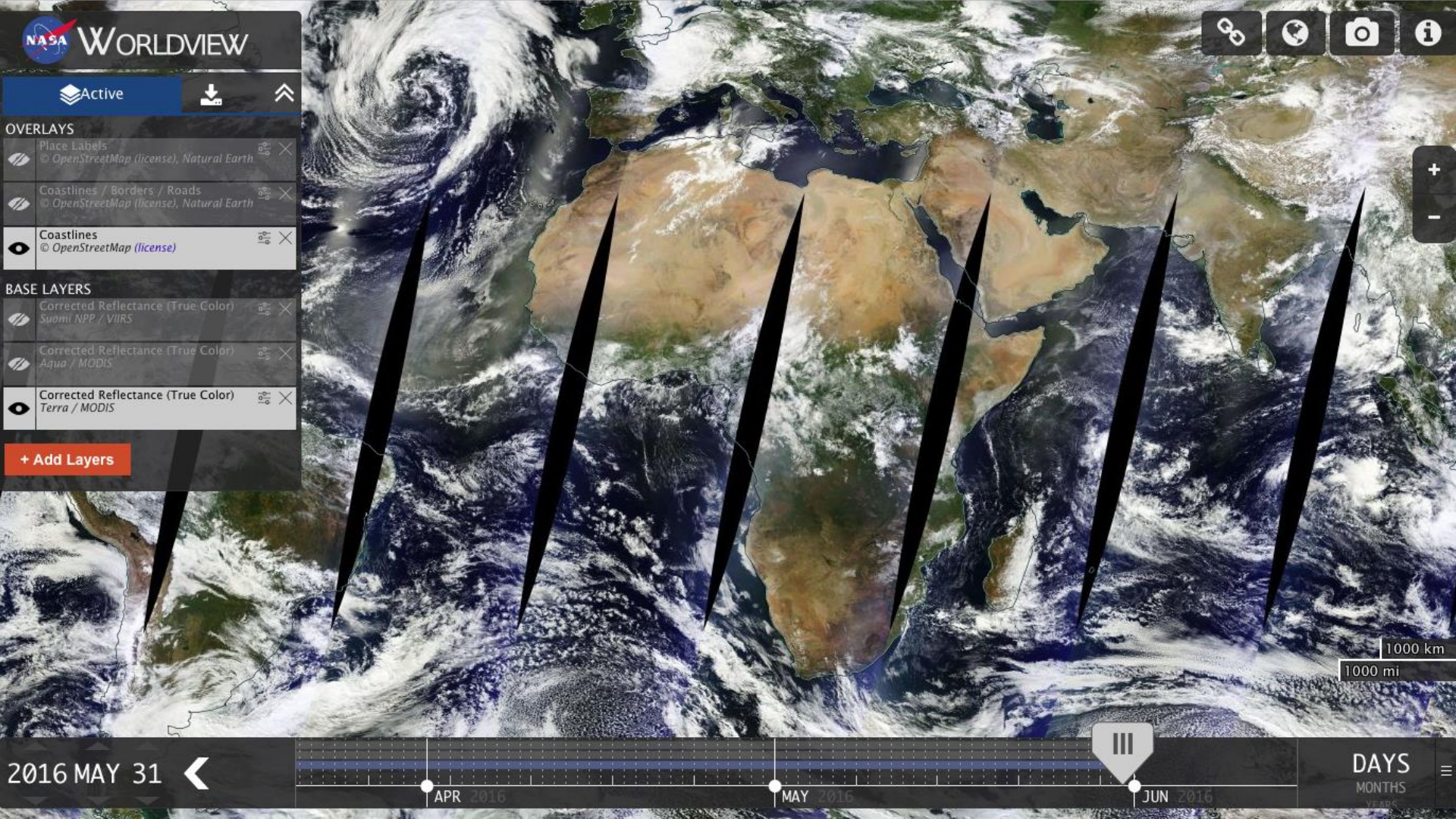
OVERLAYS

- Place Labels
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- Coastlines
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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







2016 MAY 31 ⬅️









DAYS
MONTHS
YEARS

Active  

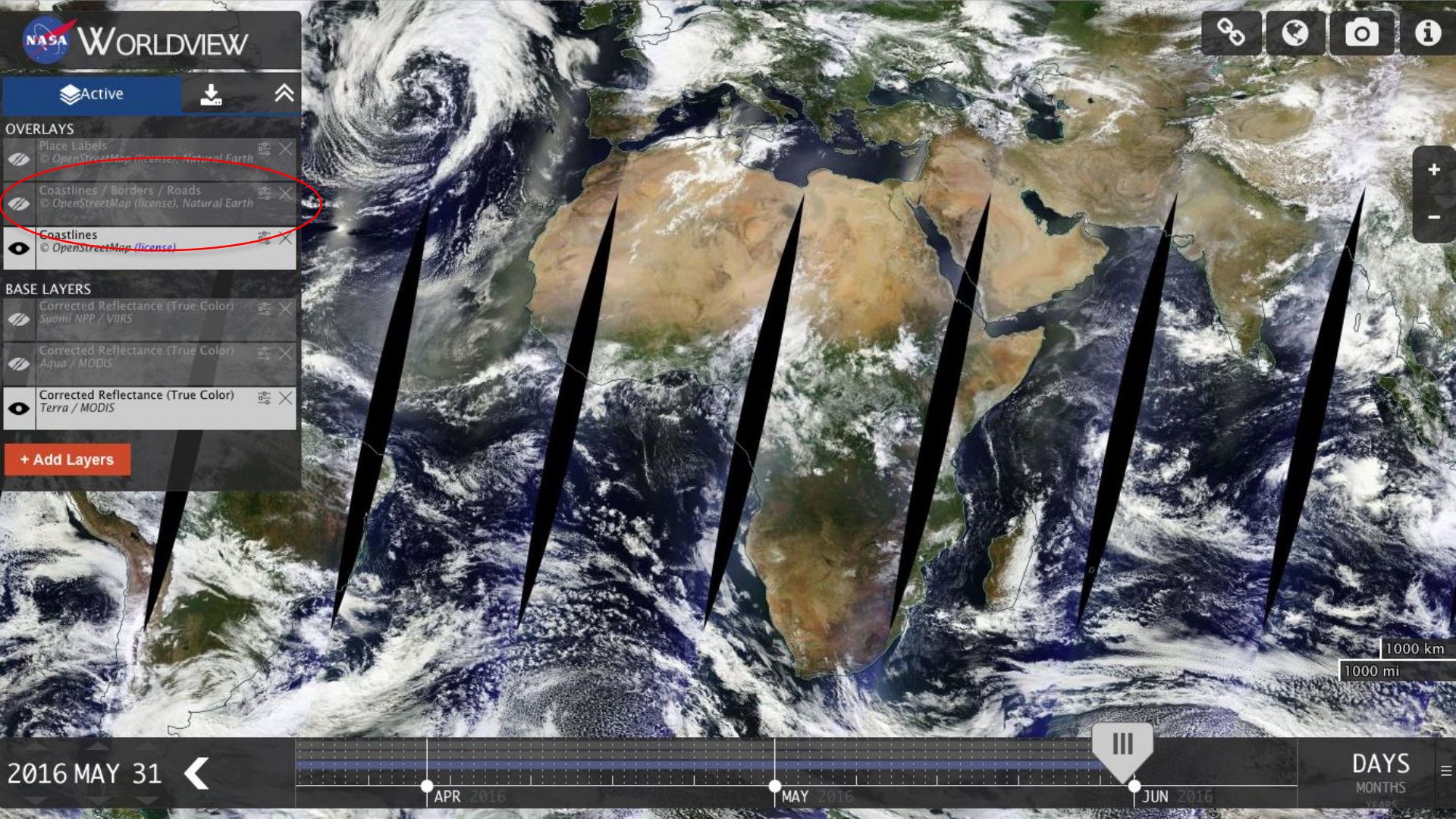
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-  **Coastlines**
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BASE LAYERS

-  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

2016 MAY 31 









DAYS
MONTHS
YEARS

Active  

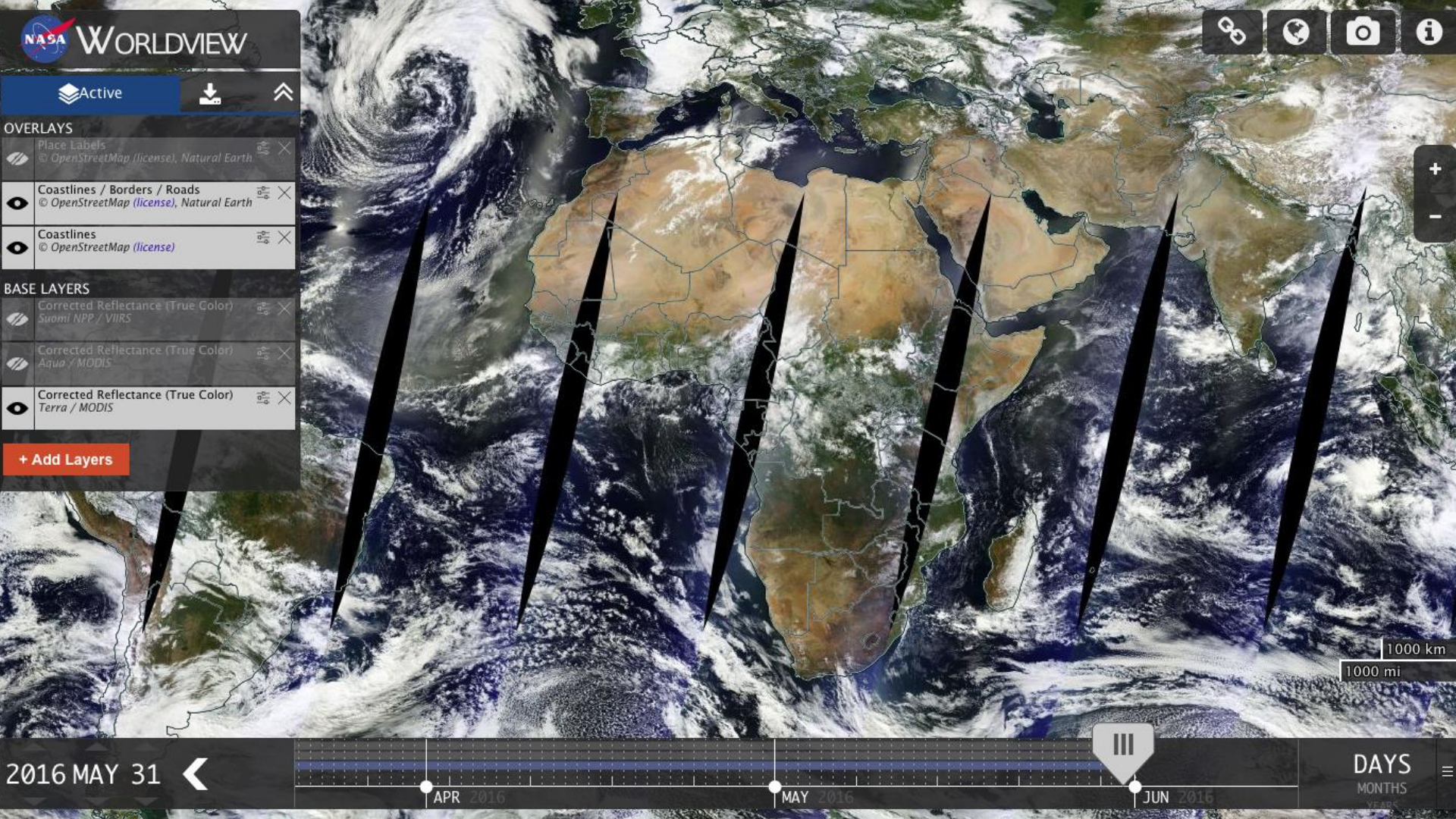
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© OpenStreetMap (license), Natural Earth 
-  Coastlines
© OpenStreetMap (license) 

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

2016 MAY 31 









DAYS
MONTHS
YEARS


Active  

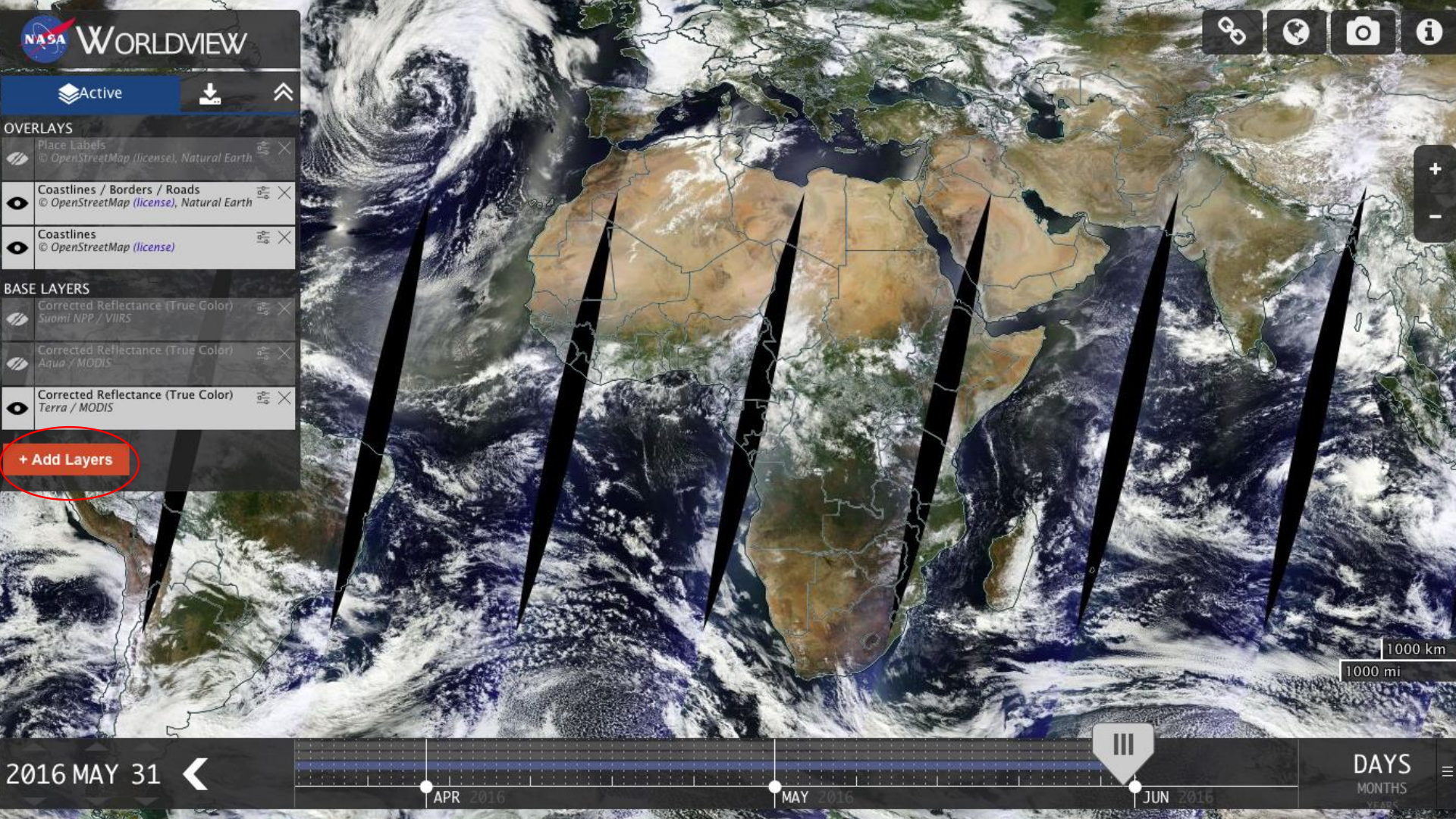
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-  Coastlines / Borders / Roads
© OpenStreetMap (license), Natural Earth 
-  Coastlines
© OpenStreetMap (license) 

BASE LAYERS

-  Corrected Reflectance (True Color)
Suomi NPP / VIIRS 
-  Corrected Reflectance (True Color)
Aqua / MODIS 
-  Corrected Reflectance (True Color)
Terra / MODIS 





1000 km
1000 mi

2016 MAY 31 



DAYS
MONTHS
YEARS

Active

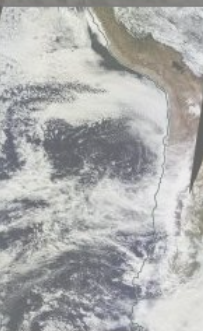
OVERLAYS

- Place Labels © OpenStreetMap (lic)
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- Coastlines © OpenStreetMap (lic)

BASE LAYERS

- Corrected Reflectance Suomi NPP / VIIRS
- Corrected Reflectance Aqua / MODIS
- Corrected Reflectance Terra / MODIS

+ Add Layers



2016 MAY 31

Hazards And Disasters Science Disciplines

- All
- Aerosol Optical Depth
- Areas of No Data (mask)
- Blue Marble
- Brightness Temperature
- Carbon Monoxide
- Chlorophyll a
- ...

Drought

- Corrected Reflectance
- Dams
- Drought Hazard
- Land Surface Reflectance
- Precipitation Estimate
- Reservoirs
- ...

Floods

- Corrected Reflectance
- Land Surface Reflectance
- Precipitation Estimate

Air Quality

- Aerosol Optical Depth
- Carbon Monoxide
- Corrected Reflectance
- Fires and Thermal Anomalies
- Sulfur Dioxide

Dust Storms

- Aerosol Optical Depth
- Corrected Reflectance
- Dust Score

Severe Storms

- Cloud Pressure
- Cloud Top Temperature
- Corrected Reflectance

Ash Plumes

- Corrected Reflectance
- Land Surface Reflectance
- Aerosol Optical Depth
- Sulfur Dioxide
- Fires and Thermal Anomalies
- Volcano Hazard

Fires

- Fires and Thermal Anomalies
- Aerosol Optical Depth
- Carbon Monoxide
- Corrected Reflectance
- Land Surface Reflectance
- Land Surface Temperature
- ...

Shipping

- Brightness Temperature
- Corrected Reflectance
- Land Surface Reflectance

1000 km
1000 mi

DAYS MONTHS YEARS

Active

OVERLAYS

- Place Labels © OpenStreetMap (lic)
- Coastlines / Borders © OpenStreetMap (lic)
- Coastlines © OpenStreetMap (lic)

BASE LAYERS

- Corrected Reflectance Suomi NPP / VIIRS
- Corrected Reflectance Aqua / MODIS
- Corrected Reflectance Terra / MODIS

+ Add Layers



2016 MAY 31

Hazards And Disasters

- All
- Aerosol Optical Depth
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Drought

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- Land Surface Reflectance
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- Reservoirs
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- Corrected Reflectance
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Science Disciplines

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Dust Storms

- Aerosol Optical Depth
- Corrected Reflectance
- Dust Score

Severe Storms

- Cloud Pressure
- Cloud Top Temperature
- Corrected Reflectance

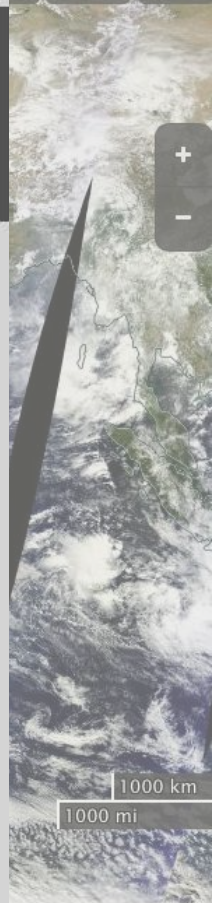
- Ash Plumes
- Corrected Reflectance
- Land Surface Reflectance
- Aerosol Optical Depth
- Sulfur Dioxide
- Fires and Thermal Anomalies
- Volcano Hazard

Fires

- Fires and Thermal Anomalies
- Aerosol Optical Depth
- Carbon Monoxide
- Corrected Reflectance
- Land Surface Reflectance
- Land Surface Temperature
- ...

Shipping

- Brightness Temperature
- Corrected Reflectance
- Land Surface Reflectance



DAYS MONTHS YEARS



Categories / Fires

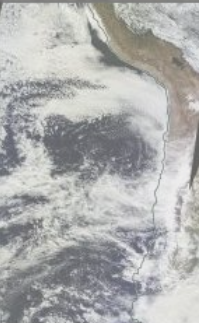
OVERLAYS

Place Labels
© OpenStreetMap (licCoastlines / Borders
© OpenStreetMap (licCoastlines
© OpenStreetMap (lic

BASE LAYERS

Corrected Reflectance
Suomi NPP / VIIRSCorrected Reflectance
Aqua / MODISCorrected Reflectance
Terra / MODIS

+ Add Layers



2016 MAY 31

Fires and Thermal Anomalies

Aqua / MODIS, Terra / MODIS, Aqua and Terra / MODIS, Suomi NPP / VIIRS

Terra / MODIS



Fires and Thermal Anomalies (Day and Night)

Aqua and Terra / MODIS

Suomi NPP / VIIRS

Aqua / MODIS

MODIS (Terra/Aqua, Terra & Aqua) Fire and Thermal Anomalies

The MODIS Fire and Thermal Anomalies layer shows active fire detections and thermal anomalies, such as volcanoes, and gas flares. Fires can be set naturally, such as by lightning, or by humans, whether intentionally or accidentally. Fire is often thought of as a menace and detriment to life, but in some ecosystems it is necessary to maintain the equilibrium, for example, some plants only release seeds under high temperatures that can only be achieved by fire, fires can also clear undergrowth and brush to help restore forests to good health, humans use fire in slash and burn agriculture, to clear away last year's crop stubble and provide nutrients for the soil and to clear areas for pasture. The fire layer is useful for studying



Aerosol Optical Depth

Aura/OMI, Aqua/MODIS, Terra/MODIS

Carbon Monoxide

Aqua/AIRS, Aura/MLS

Corrected Reflectance

Aqua / MODIS, Terra / MODIS, Suomi NPP / VIIRS

Land Surface Reflectance

Aqua / MODIS, Terra / MODIS

Land Surface Temperature

Aqua / MODIS, Terra / MODIS

Sulfur Dioxide

Aqua / AIRS, Aura / MLS, Aura / OMI

1000 km
1000 miDAYS
MONTHS
YEARS



OVERLAYS

Place Labels
 OpenStreetMap (licCoastlines / Borders
 OpenStreetMap (licCoastlines
 OpenStreetMap (lic

BASE LAYERS

Corrected Reflectan
Suomi NPP / VIIRSCorrected Reflectan
Aqua / MODISCorrected Reflectan
Terra / MODIS

+ Add Layers

Categories / Fires

Fires and Thermal Anomalies

Aqua / MODIS, Terra / MODIS, Aqua and Terra / MODIS, Suomi NPP / VIIRS

Terra / MODIS

 Fires and Thermal Anomalies (Day and Night)

Aqua and Terra / MODIS

Suomi NPP / VIIRS

Aqua / MODIS

MODIS (Terra/Aqua, Terra & Aqua) Fire and Thermal Anomalies

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Aerosol Optical Depth

Aura/OMI, Aqua/MODIS, Terra/MODIS

Carbon Monoxide

Aqua/AIRS, Aura/MLS

Corrected Reflectance

Aqua / MODIS, Terra / MODIS, Suomi NPP / VIIRS

Land Surface Reflectance

Aqua / MODIS, Terra / MODIS

Land Surface Temperature

Aqua / MODIS, Terra / MODIS

Sulfur Dioxide

Aqua / AIRS, Aura / MLS, Aura / OMI

Active [Download Icon] [Up Arrow Icon]

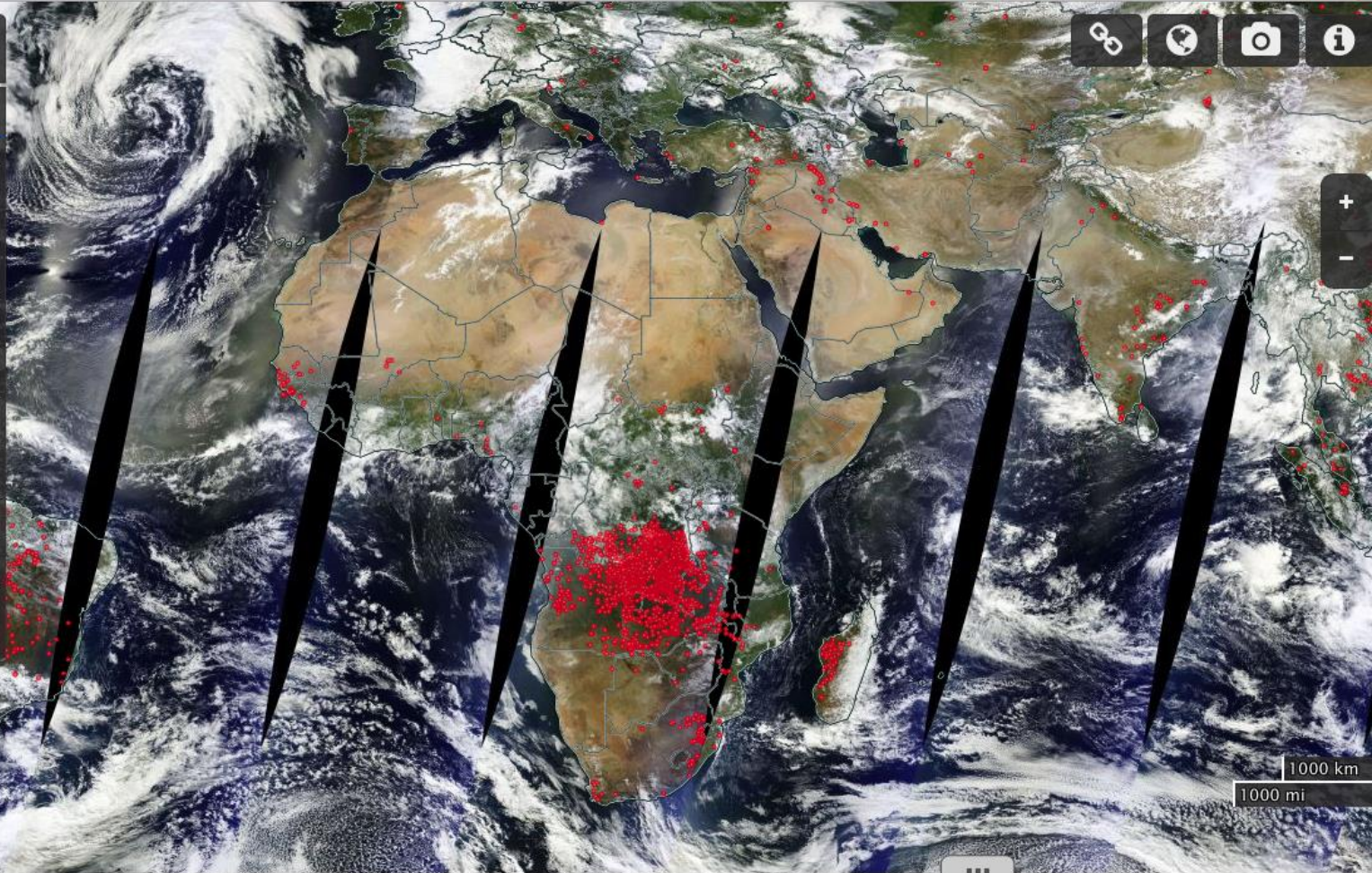
OVERLAYS

- Fires and Thermal Anomalies (Day and Night) Terra and Aqua / MODIS
- 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



2016 MAY 31



DAYS MONTHS YEARS

Active

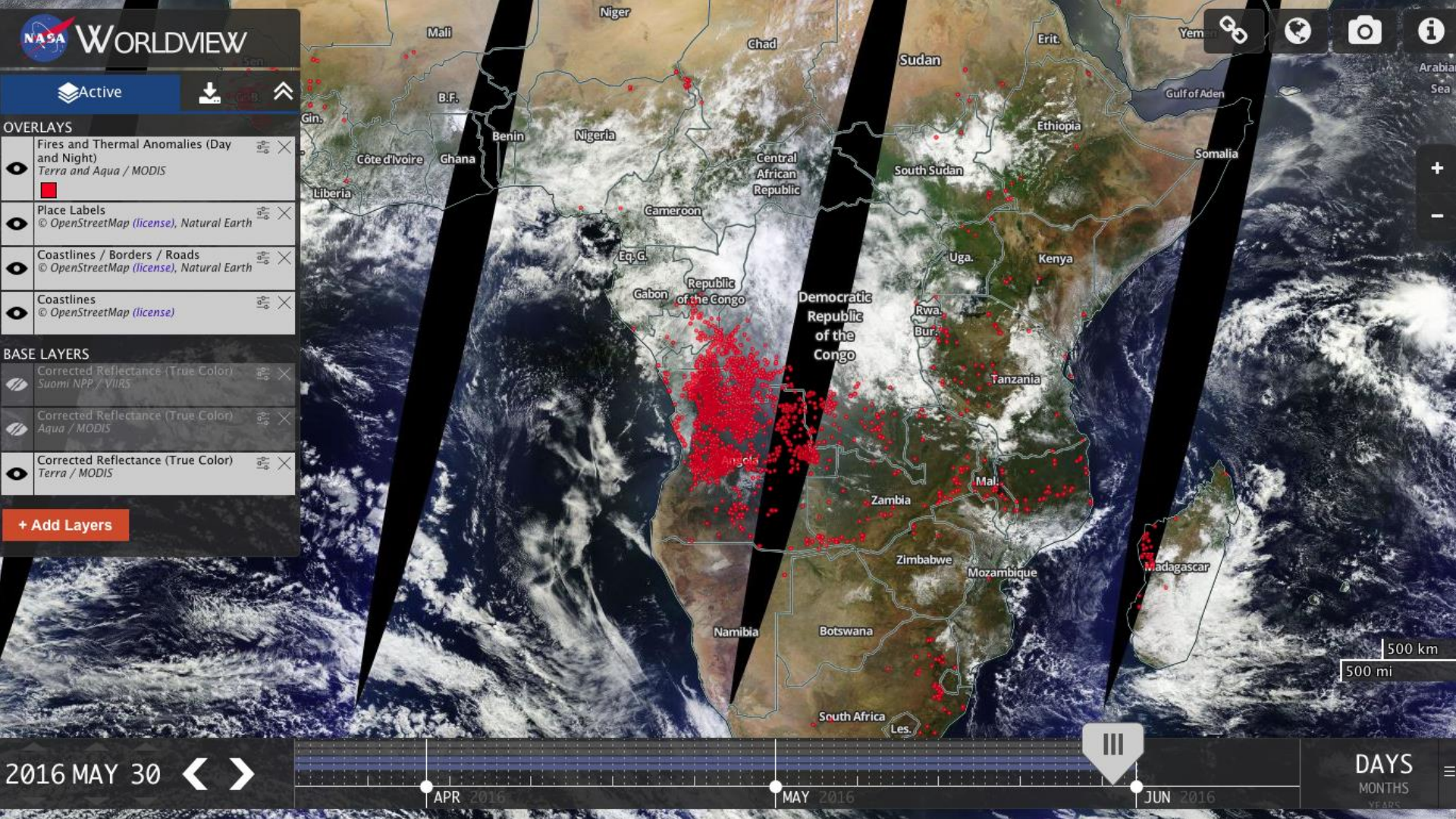
OVERLAYS

- Fires and Thermal Anomalies (Day and Night)
Terra and Aqua / MODIS
- 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



2016 MAY 30



APR 2016

MAY 2016

JUN 2016

DAYS MONTHS YEARS

500 km 500 mi

Active

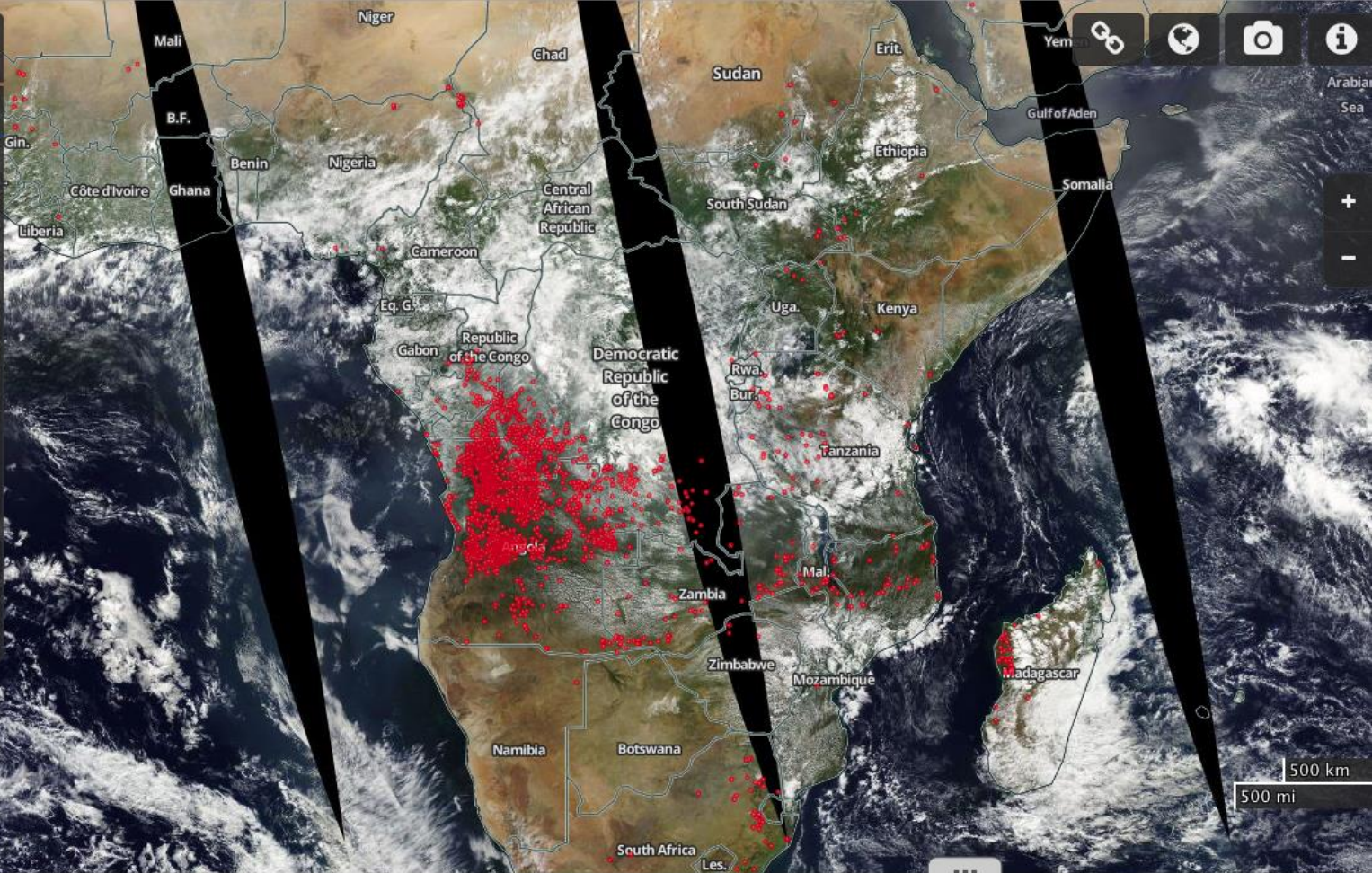
OVERLAYS

- Fires and Thermal Anomalies (Day and Night)
Terra and Aqua / MODIS
- 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



500 km
500 mi

Active [Download] [Refresh]

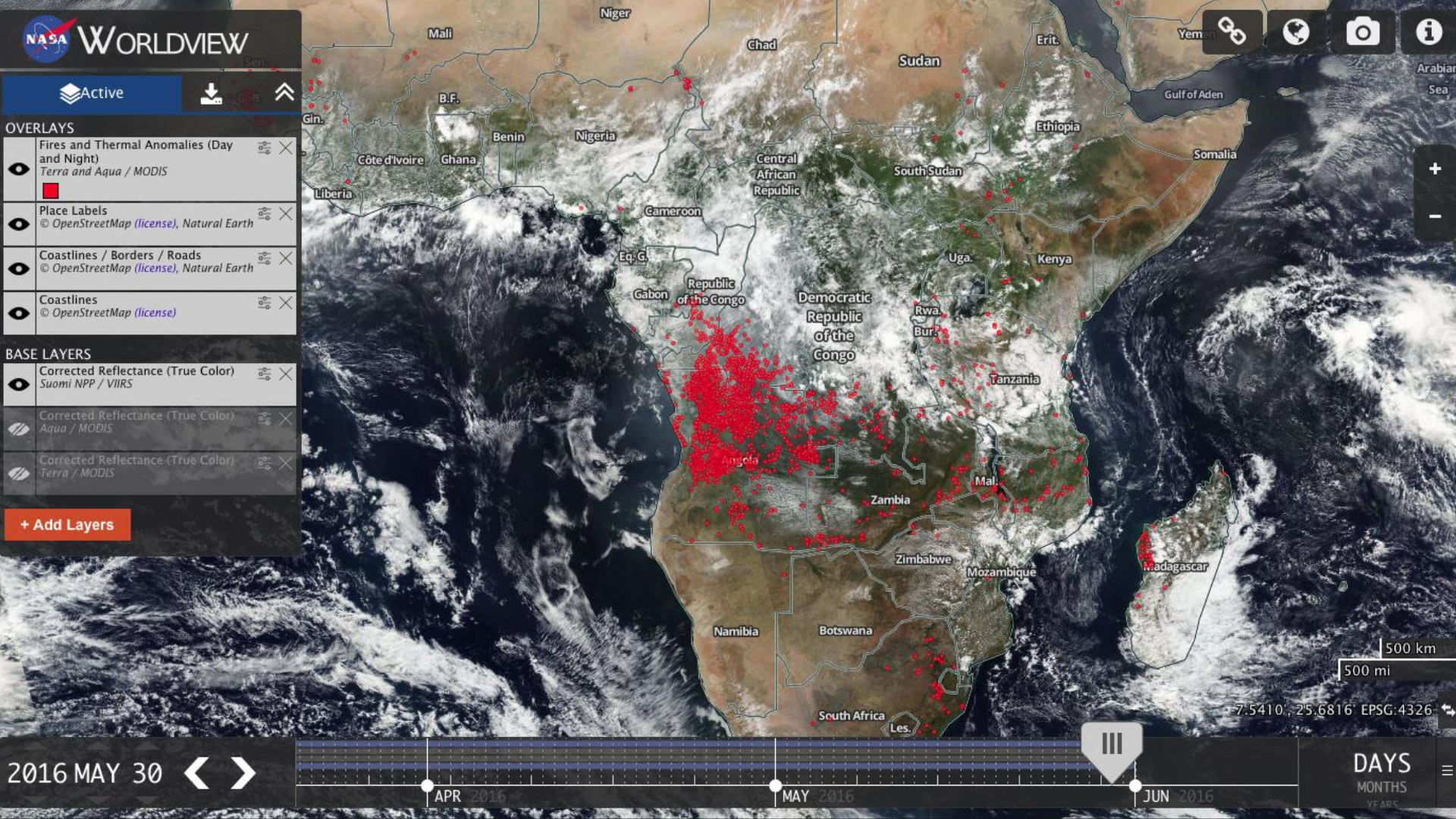
OVERLAYS

- Fires and Thermal Anomalies (Day and Night) Terra and Aqua / MODIS
- 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



2016 MAY 30 [Left Arrow] [Right Arrow]



DAYS MONTHS YEARS [Menu Icon]

Active [Download icon]

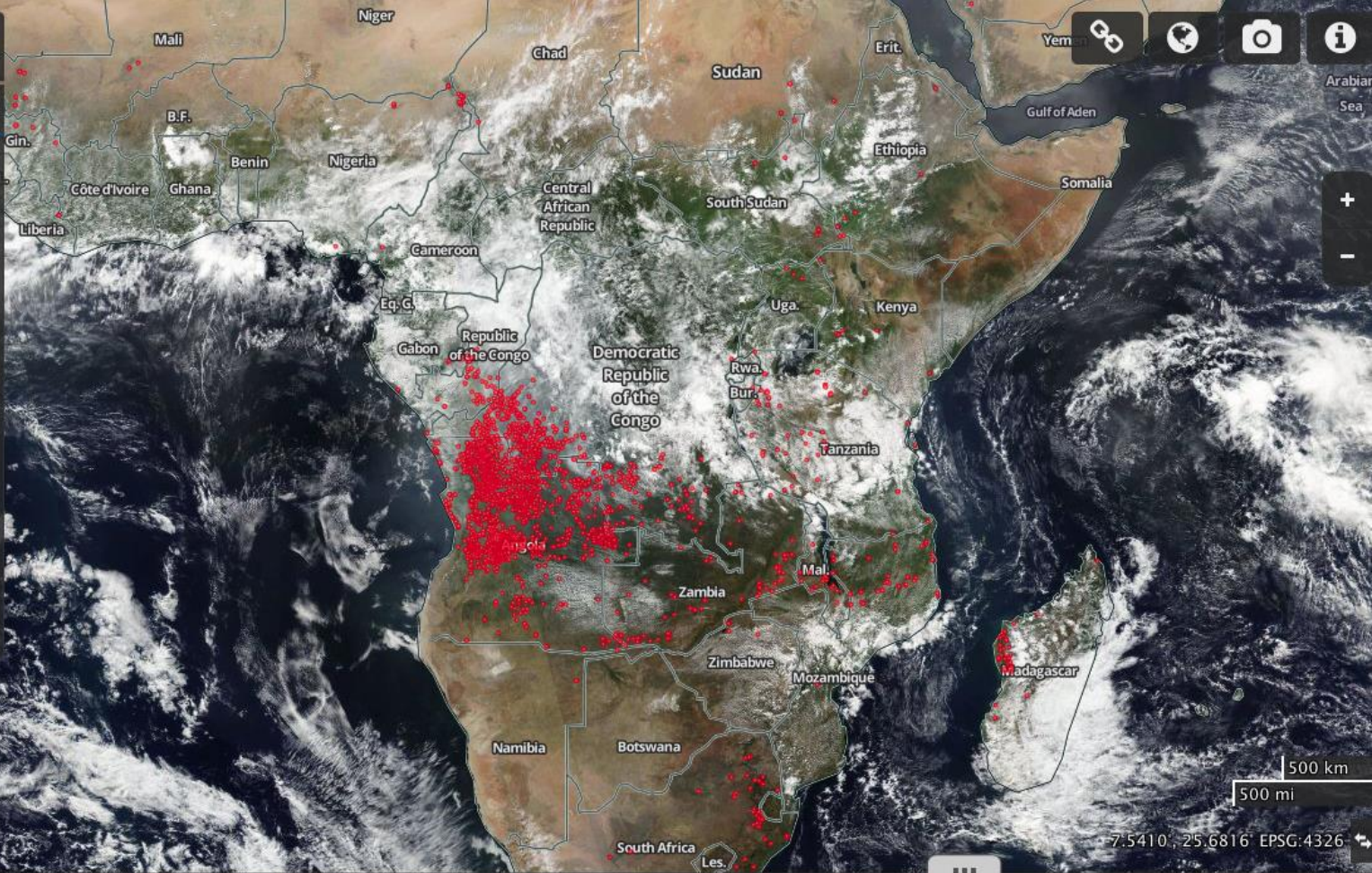
OVERLAYS

- Fires and Thermal Anomalies (Day and Night) Terra and Aqua / MODIS
- 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



500 km, 500 mi

-7.5410°, 25.6816° EPSG:4326

2016 MAY 30



DAYS MONTHS YEARS

Download Data

NOT AVAILABLE FOR DOWNLOAD (?)

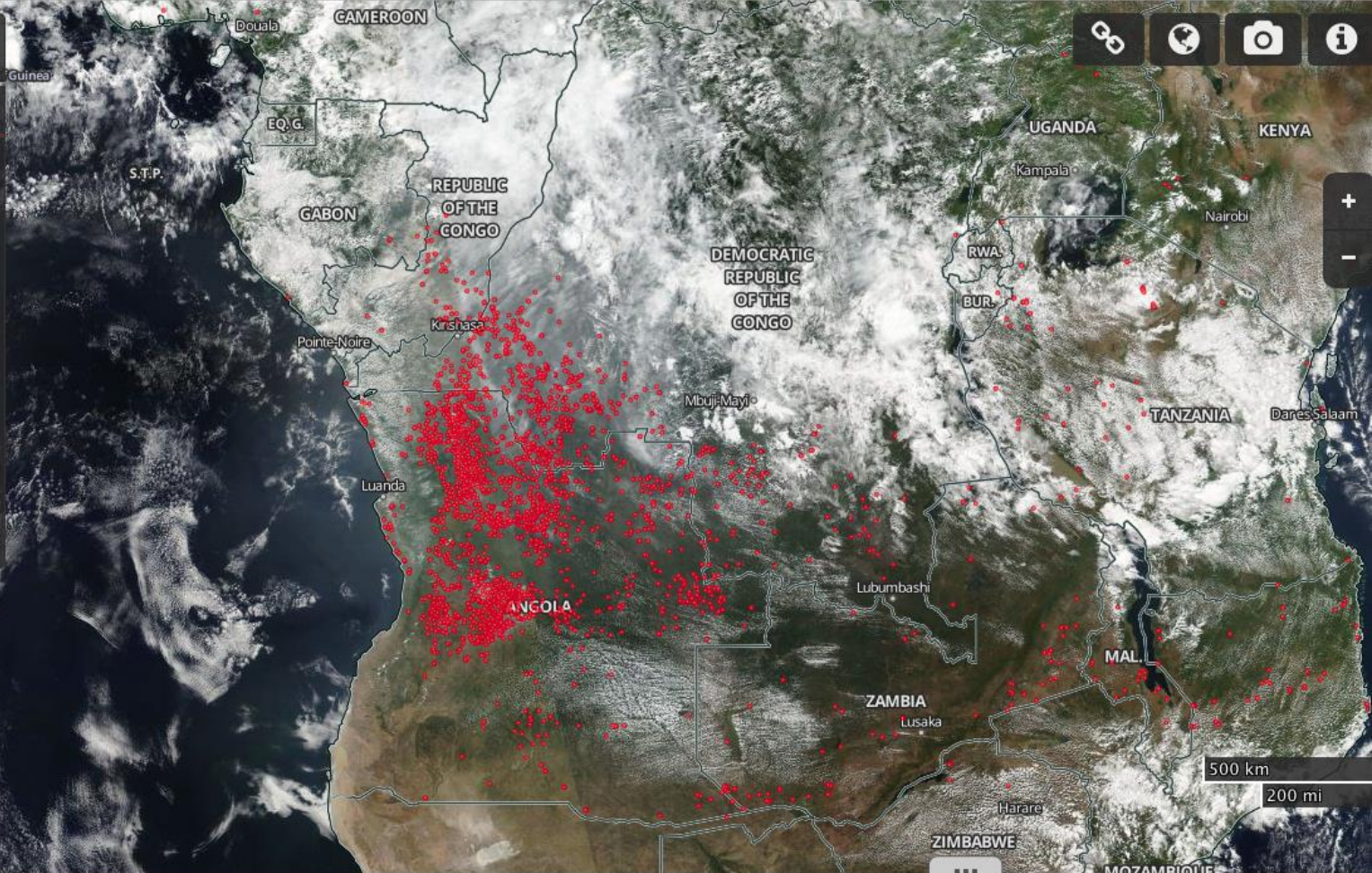
- Corrected Reflectance (True Color)
Suomi NPP / VIIRS
- Corrected Reflectance (True Color)
Aqua / MODIS
- Corrected Reflectance (True Color)
Terra / MODIS
- Fires and Thermal Anomalies (Day and Night)
Terra and Aqua / MODIS

Place Labels
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Coastlines / Borders / Roads
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Coastlines
© OpenStreetMap (license)

No Data Selected



2016 MAY 30









DAYS MONTHS YEARS


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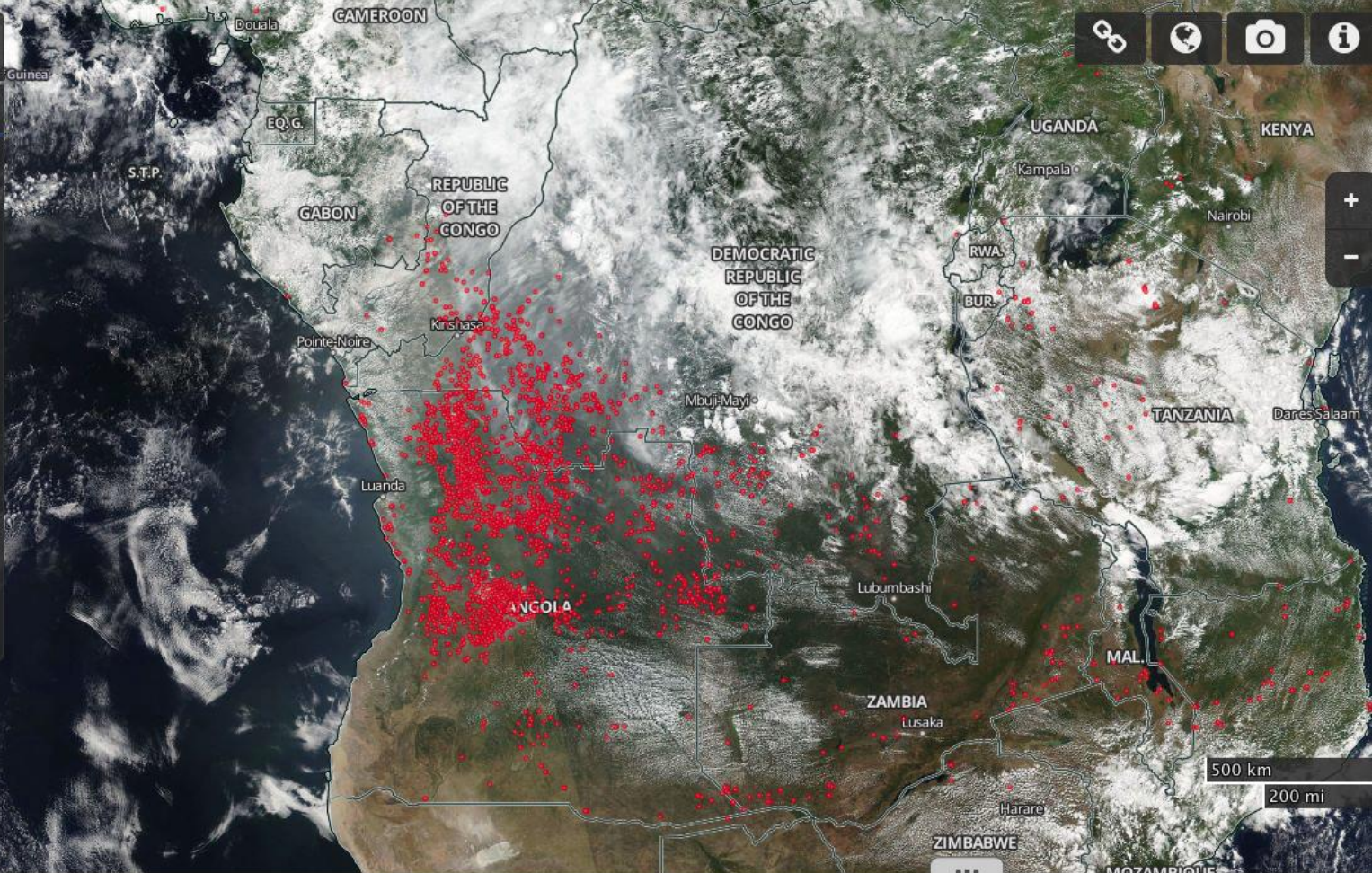
OVERLAYS

-  Fires and Thermal Anomalies (Day and Night)
Terra and Aqua / MODIS 
-  Place Labels
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-  Coastlines / Borders / Roads
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-  Coastlines
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BASE LAYERS

-  Corrected Reflectance (True Color)
Suomi NPP / VIIRS 
-  Corrected Reflectance (True Color)
Aqua / MODIS 
-  Corrected Reflectance (True Color)
Terra / MODIS 

 Add Layers



2016 MAY 30  



DAYS MONTHS YEARS

Search [X]

Hazards And Disasters

Science Disciplines

- All
- Aerosol Optical Depth
- Areas of No Data (mask)
- Blue Marble
- Brightness Temperature
- Carbon Monoxide
- Chlorophyll a
- ...

- Air Quality
- Aerosol Optical Depth
- Carbon Monoxide
- Corrected Reflectance
- Fires and Thermal Anomalies
- Sulfur Dioxide

- Ash Plumes
- Corrected Reflectance
- Land Surface Reflectance
- Aerosol Optical Depth
- Sulfur Dioxide
- Fires and Thermal Anomalies
- Volcano Hazard

- Drought
- Corrected Reflectance
- Dams
- Drought Hazard
- Land Surface Reflectance
- Precipitation Estimate
- Reservoirs
- ...

- Dust Storms
- Aerosol Optical Depth
- Corrected Reflectance
- Dust Score

- Fires
- Fires and Thermal Anomalies**
- Aerosol Optical Depth
- Carbon Monoxide
- Corrected Reflectance
- Land Surface Reflectance
- Land Surface Temperature
- ...

- Floods
- Corrected Reflectance
- Land Surface Reflectance
- Precipitation Estimate

- Severe Storms
- Cloud Pressure
- Cloud Top Temperature
- Corrected Reflectance

- Shipping
- Brightness Temperature
- Corrected Reflectance
- Land Surface Reflectance



Fires and Thermal Anomalies

Aqua / MODIS, Terra / MODIS, Aqua and Terra / MODIS, Suomi NPP / VIIRS

Terra / MODIS

Fires and Thermal Anomalies (Day and Night)

Aqua and Terra / MODIS

Orbital Tracks:

Suomi NPP / VIIRS

Ascending/Night

Aqua / MODIS

Descending/Day

MODIS (Terra/Aqua, Terra & Aqua) Fire and Thermal Anomalies

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Aerosol Optical Depth

Aura/OMI, Aqua/MODIS, Terra/MODIS

Carbon Monoxide

Aqua/AIRS, Aura/MLS

Corrected Reflectance

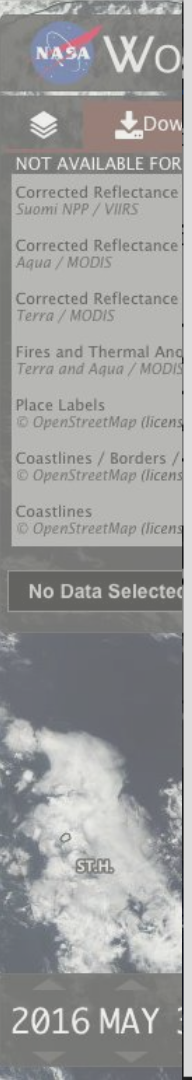
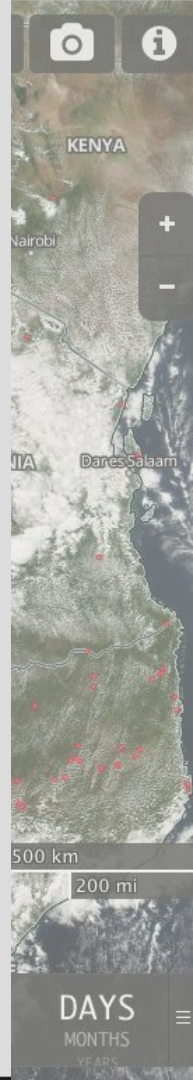
Aqua / MODIS, Terra / MODIS, Suomi NPP / VIIRS

Land Surface Reflectance

Aqua / MODIS, Terra / MODIS

Land Surface Temperature

Aqua / MODIS, Terra / MODIS



Fires and Thermal Anomalies

Aqua / MODIS, Terra / MODIS, Aqua and Terra / MODIS, Suomi NPP / VIIRS

Terra / MODIS

Fires and Thermal Anomalies (Day and Night)

Aqua and Terra / MODIS

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Aerosol Optical Depth

Aura/OMI, Aqua/MODIS, Terra/MODIS

Carbon Monoxide

Aqua/AIRS, Aura/MLS

Corrected Reflectance

Aqua / MODIS, Terra / MODIS, Suomi NPP / VIIRS

Land Surface Reflectance

Aqua / MODIS, Terra / MODIS

Land Surface Temperature

Aqua / MODIS, Terra / MODIS



NASA WorldView-2 interface elements: Download icon, 'NOT AVAILABLE FOR' status, various layer options (Corrected Reflectance, Fires and Thermal Anomalies, Place Labels, Coastlines), 'No Data Selected' message, and a satellite image of a cloud with 'STH' label.

Active  

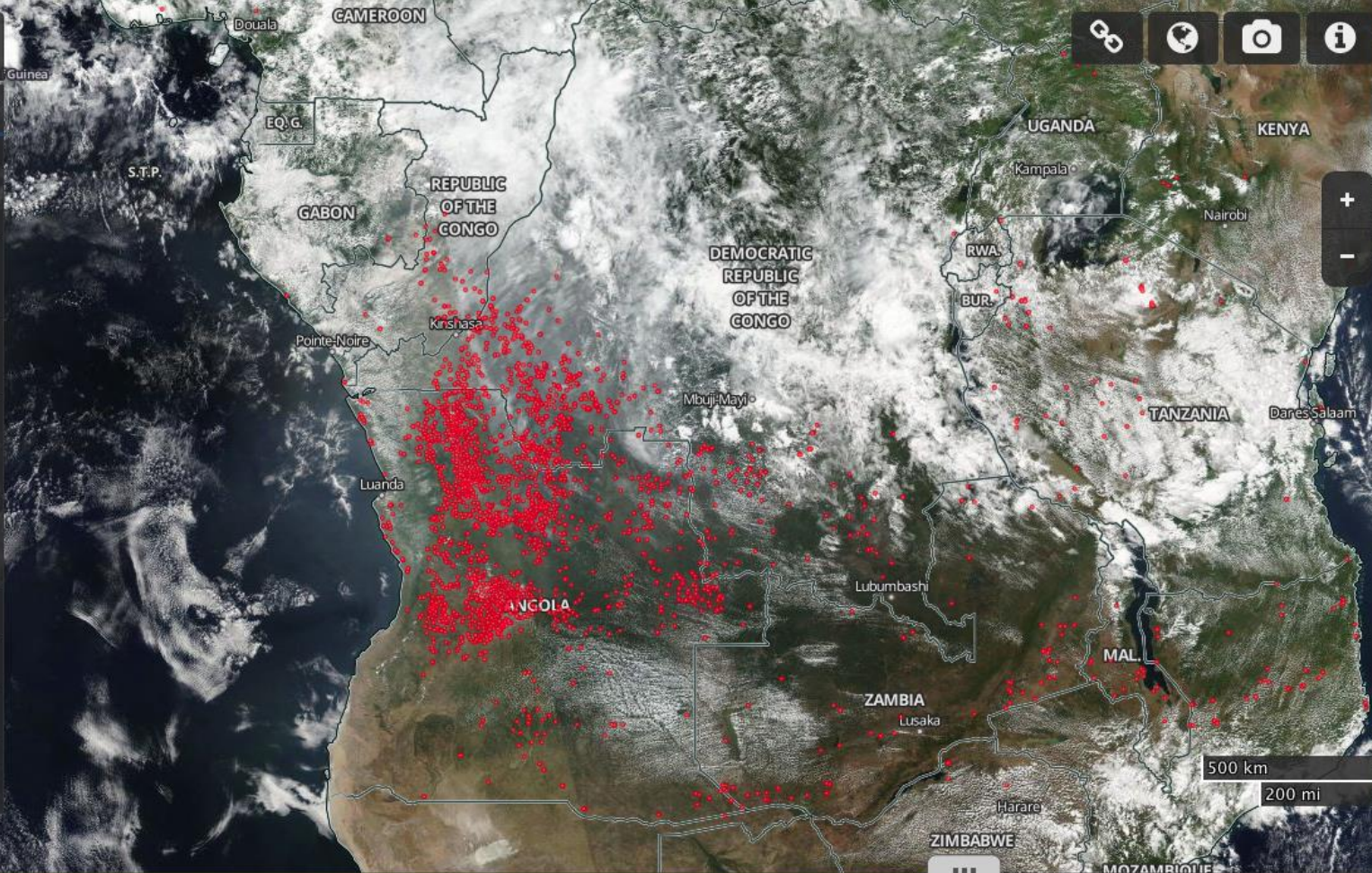
OVERLAYS

-  Fires and Thermal Anomalies (Day and Night) 
Aqua / MODIS 
-  Fires and Thermal Anomalies (Day and Night) 
Terra / MODIS 
-  Fires and Thermal Anomalies (Day and Night) 
Terra and Aqua / MODIS 
-  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



2016 MAY 30  



DAYS MONTHS YEARS

Active [Download Icon] [Up Arrow Icon]

OVERLAYS

- Fires and Thermal Anomalies (Day and Night) Aqua / MODIS [On] [Close]
- Fires and Thermal Anomalies (Day and Night) Terra / MODIS [On] [Close]
- Fires and Thermal Anomalies (Day and Night) Terra and Aqua / MODIS [On] [Close]
- Place Labels © OpenStreetMap (license), Natural Earth [On] [Close]
- Coastlines / Borders / Roads © OpenStreetMap (license), Natural Earth [On] [Close]
- Coastlines © OpenStreetMap (license) [On] [Close]

BASE LAYERS

- Corrected Reflectance (True Color) Suomi NPP / VIIRS [On] [Close]
- Corrected Reflectance (True Color) Aqua / MODIS [On] [Close]
- Corrected Reflectance (True Color) Terra / MODIS [On] [Close]

+ Add Layers



2016 MAY 30 [Left Arrow] [Right Arrow]



DAYS MONTHS YEARS [Menu Icon]

Active [Download Icon] [Refresh Icon]

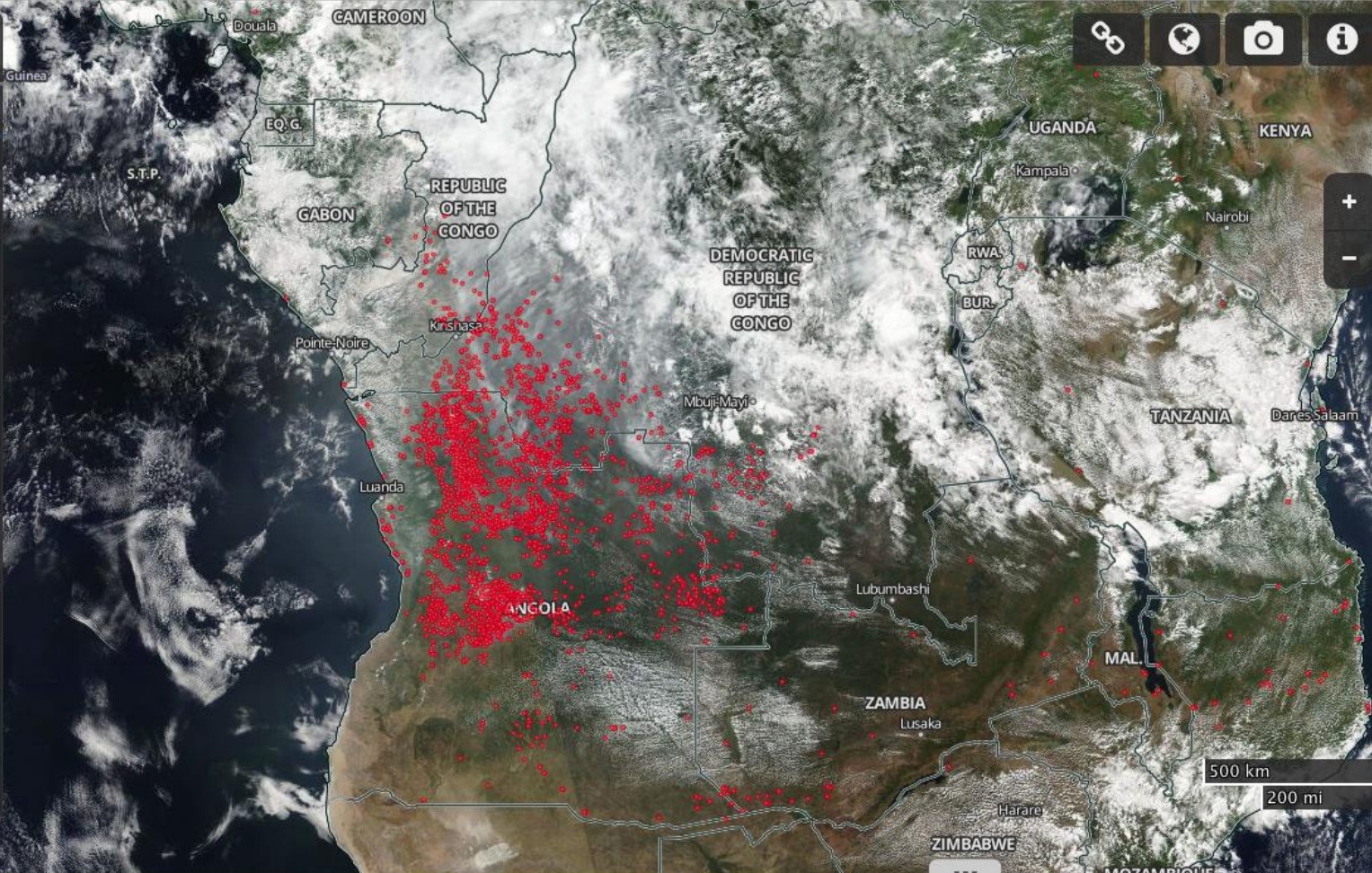
OVERLAYS

- Fires and Thermal Anomalies (Day and Night) Aqua / MODIS [On] [Close]
- Fires and Thermal Anomalies (Day and Night) Terra / MODIS [On] [Close]
- Fires and Thermal Anomalies (Day and Night) Terra and Aqua / MODIS [On] [Close]
- Place Labels © OpenStreetMap (license), Natural Earth [On] [Close]
- Coastlines / Borders / Roads © OpenStreetMap (license), Natural Earth [On] [Close]
- Coastlines © OpenStreetMap (license) [On] [Close]

BASE LAYERS

- Corrected Reflectance (True Color) Suomi NPP / VIIRS [On] [Close]
- Corrected Reflectance (True Color) Aqua / MODIS [On] [Close]
- Corrected Reflectance (True Color) Terra / MODIS [On] [Close]

+ Add Layers



2016 MAY 30 [Left Arrow] [Right Arrow]



DAYS MONTHS YEARS [Menu Icon]

Active



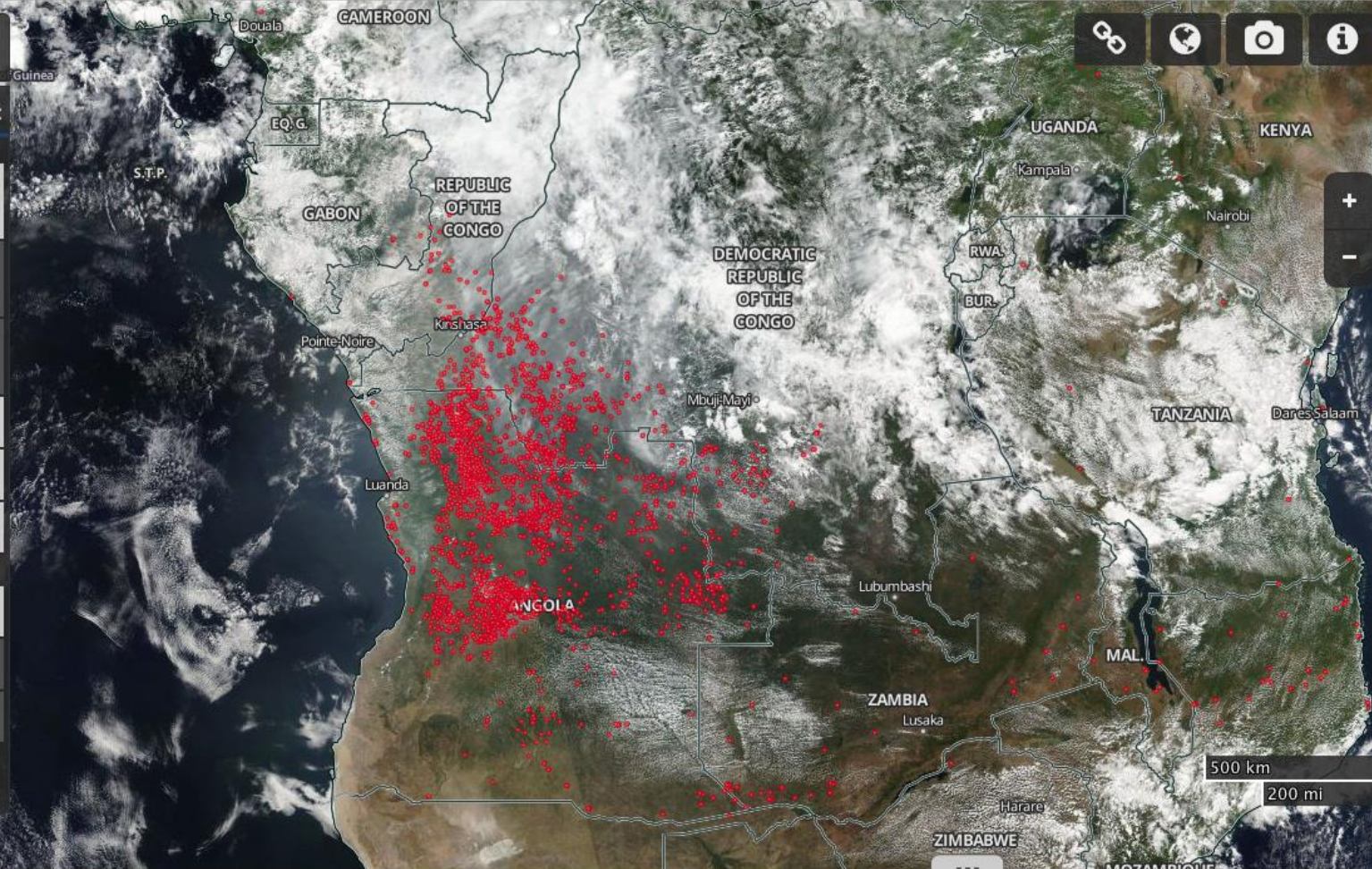
OVERLAYS

- Fires and Thermal Anomalies (Day and Night) Aqua / MODIS
- Fires and Thermal Anomalies (Day and Night) Terra / MODIS
- Fires and Thermal Anomalies (Day and Night) Terra and Aqua / MODIS
- 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



2016 MAY 30



APR 2016

MAY 2016

JUN 2016



DAYS MONTHS YEARS

Download Data

MODIS/AQUA THERMAL ANOMALIES/FIRE
5-MIN L2 SWATH 1KM 0 SELECTED

Fires and Thermal Anomalies (Day and Night)
Aqua / MODIS

NOT AVAILABLE FOR DOWNLOAD (?)

Corrected Reflectance (True Color)
Suomi NPP / VIIRS

Corrected Reflectance (True Color)
Aqua / MODIS

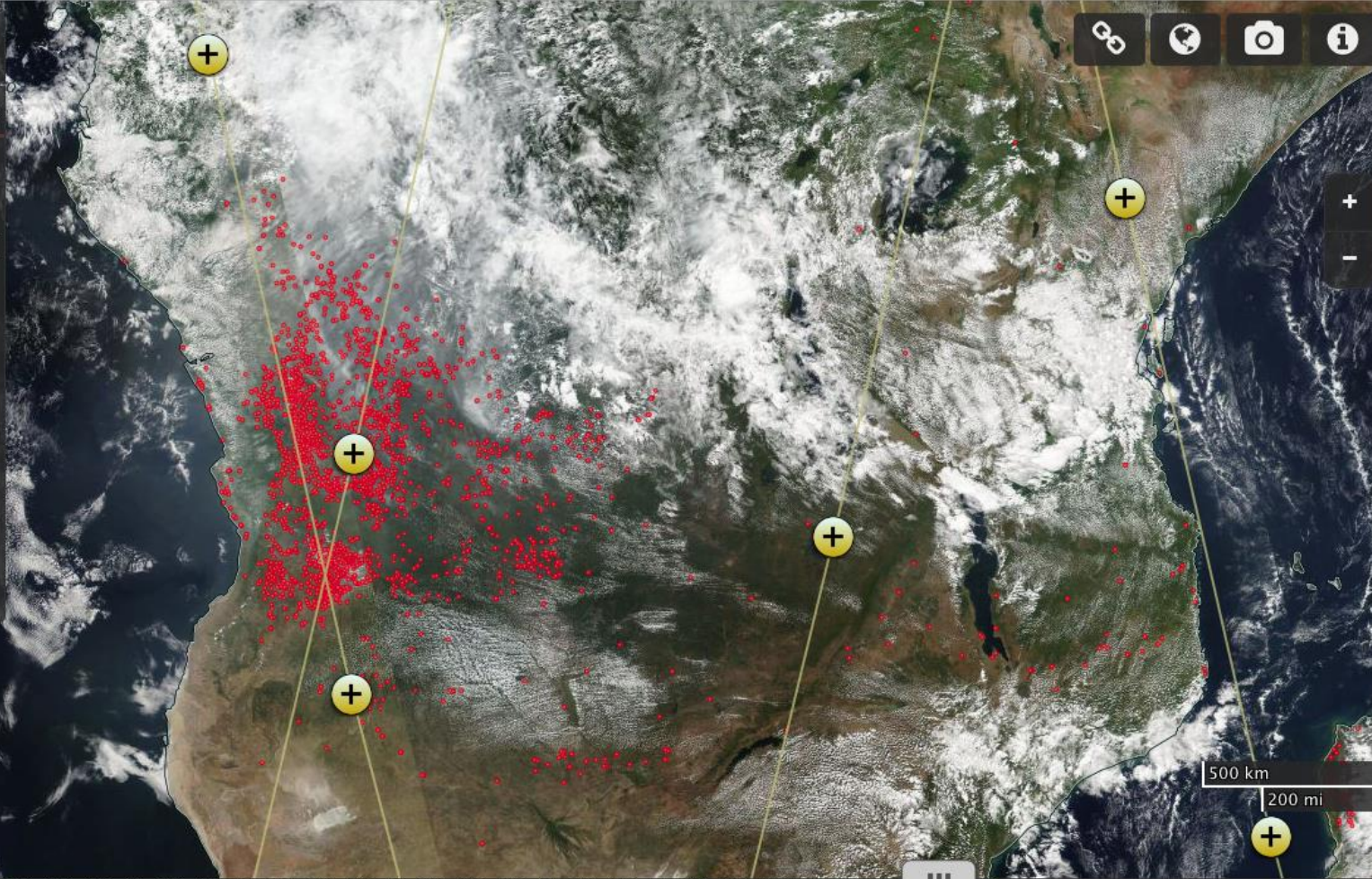
Corrected Reflectance (True Color)
Terra / MODIS

Place Labels
© OpenStreetMap (license), Natural Earth

Coastlines / Borders / Roads
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Coastlines
© OpenStreetMap (license)

No Data Selected



500 km
200 mi

2016 MAY 30



DAYS
MONTHS
YEARS

Download Data

MODIS/AQUA THERMAL ANOMALIES/FIRE
5-MIN L2 SWATH 1 KM **1 SELECTED**

Fires and Thermal Anomalies (Day and Night)
Aqua / MODIS

NOT AVAILABLE FOR DOWNLOAD (?)

Corrected Reflectance (True Color)
Suomi NPP / VIIRS

Corrected Reflectance (True Color)
Aqua / MODIS

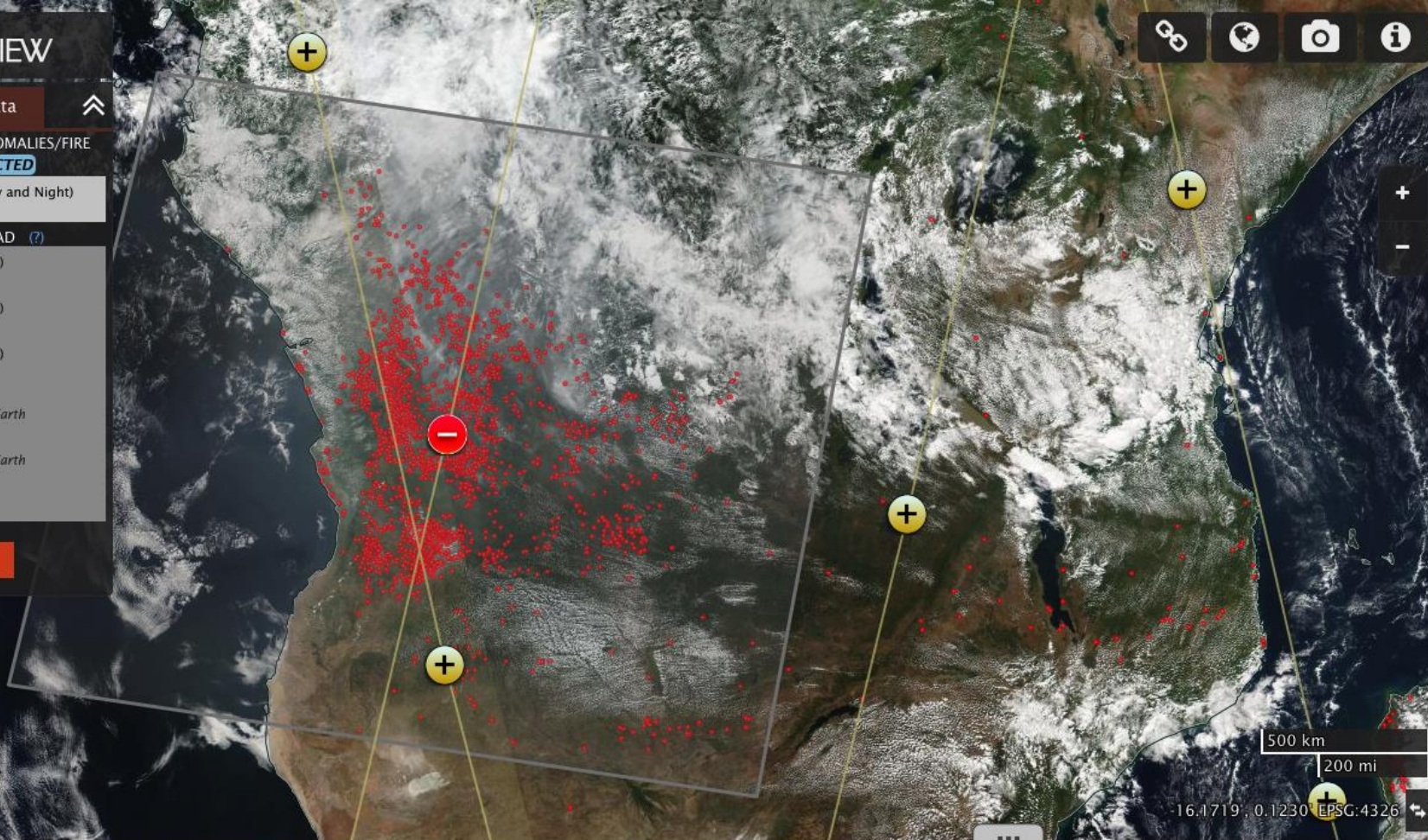
Corrected Reflectance (True Color)
Terra / MODIS

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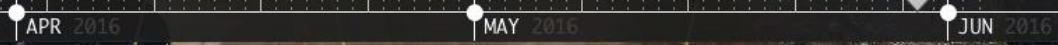
Download Data (0.22 MB)



500 km
200 mi

-16.1719, 0.1230 EPSG:4326

2016 MAY 30



DAYS
MONTHS
YEARS

Contacts

- ARSET Disaster
- ARSET Land Management and Wildfire Contacts
 - Cynthia Schmidt: Cynthia.L.Schmidt@nasa.gov
 - Amber McCullum: AmberJean.Mccullum@nasa.gov
- General ARSET Inquiries
 - Ana Prados: aprados@umbc.edu
- ARSET Website:
 - <http://arset.gsfc.nasa.gov/>



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Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

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Thank You!

**Next Week: Observing Oil Spills Using Remote Sensing
Measurements**