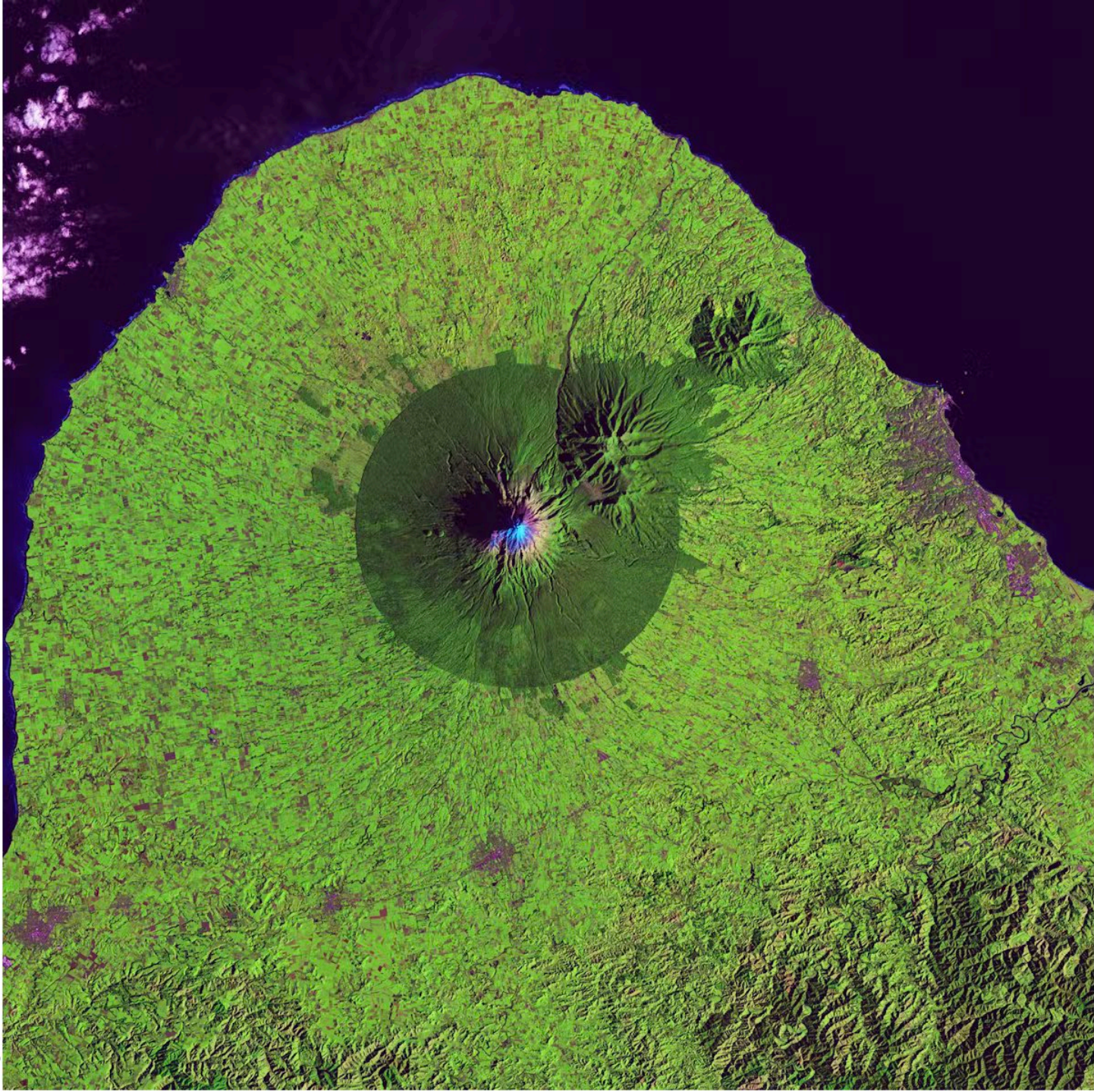
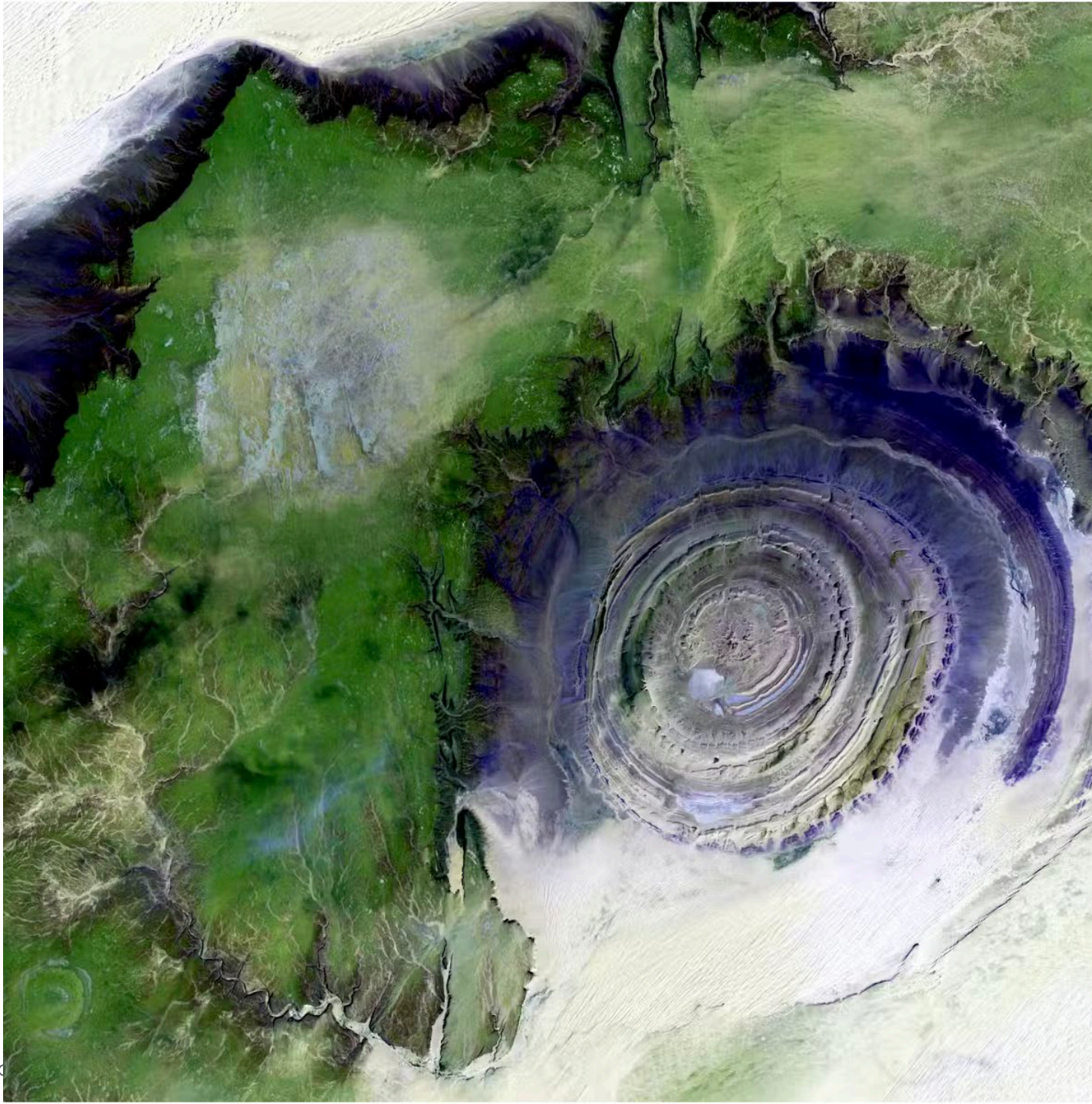


Energizer: Where in the World



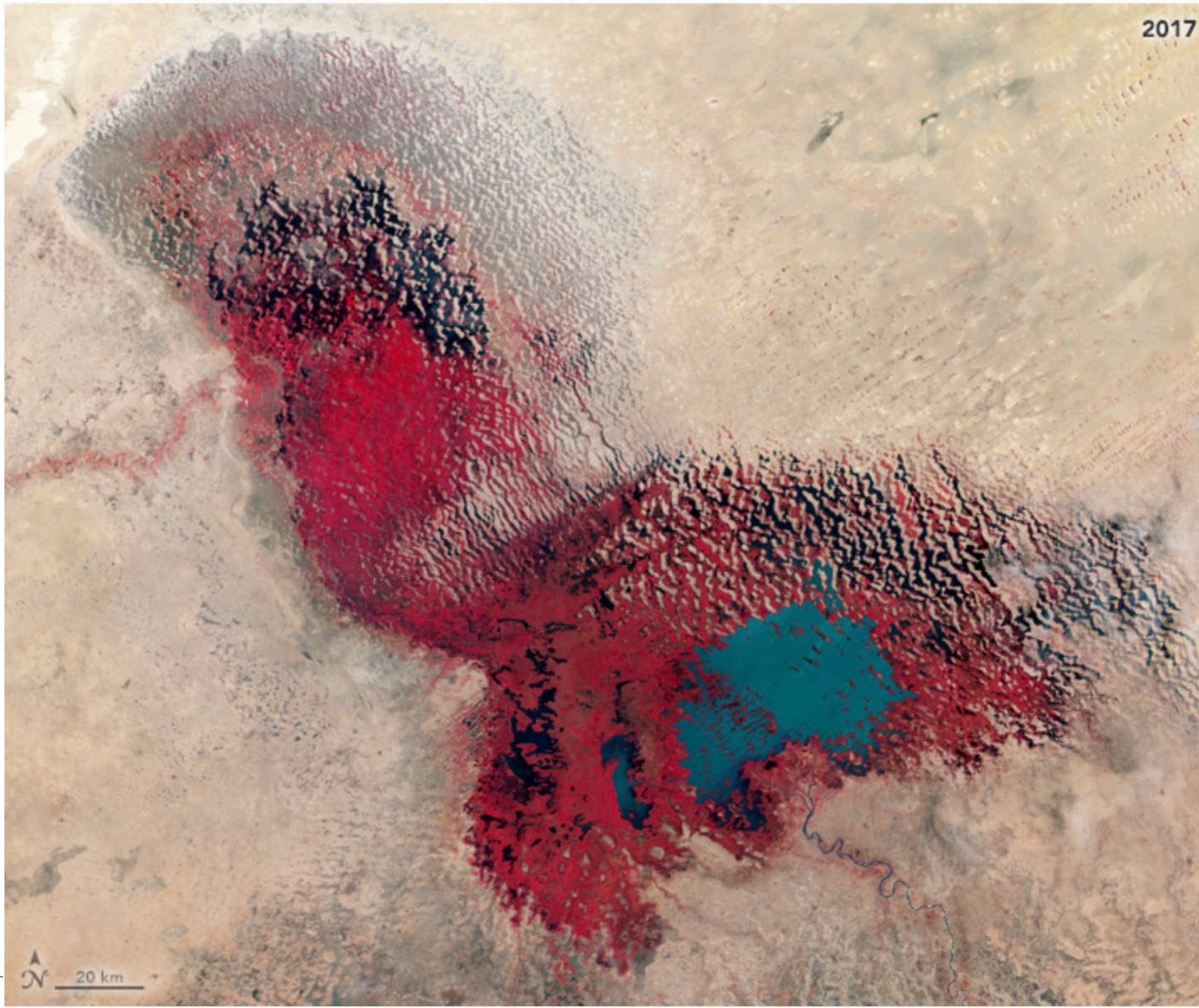








2017



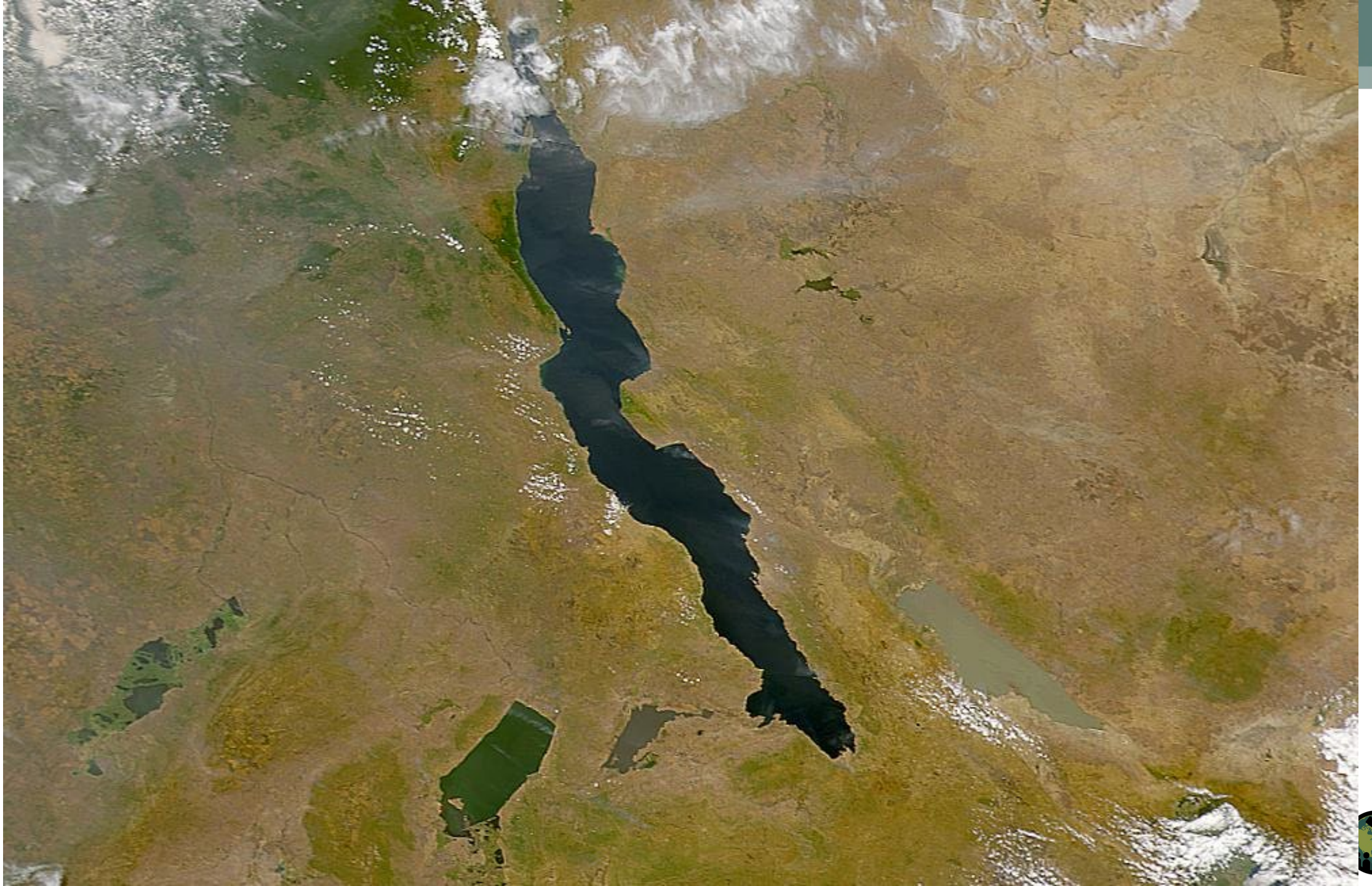
20 km

NASA ARSET -

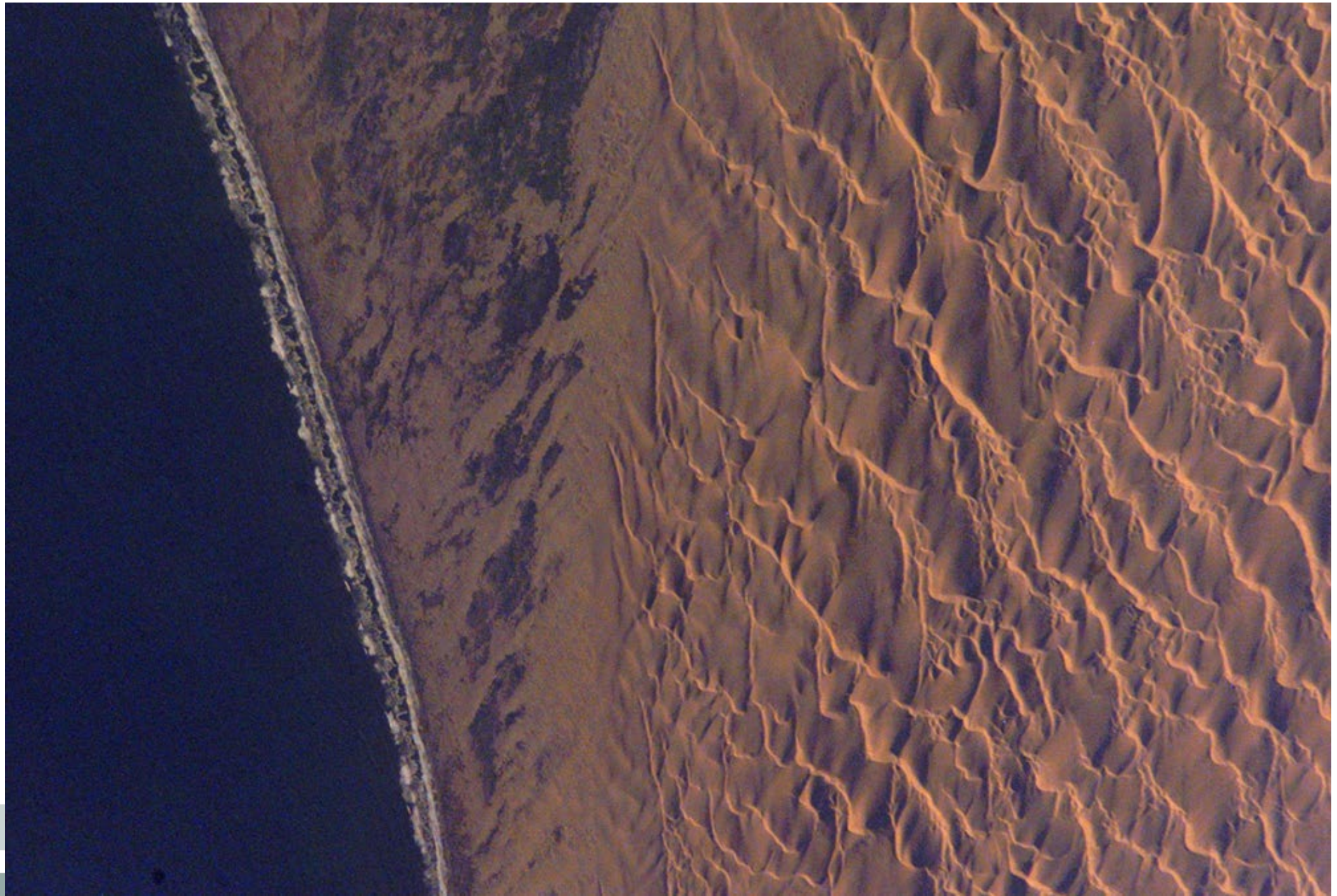








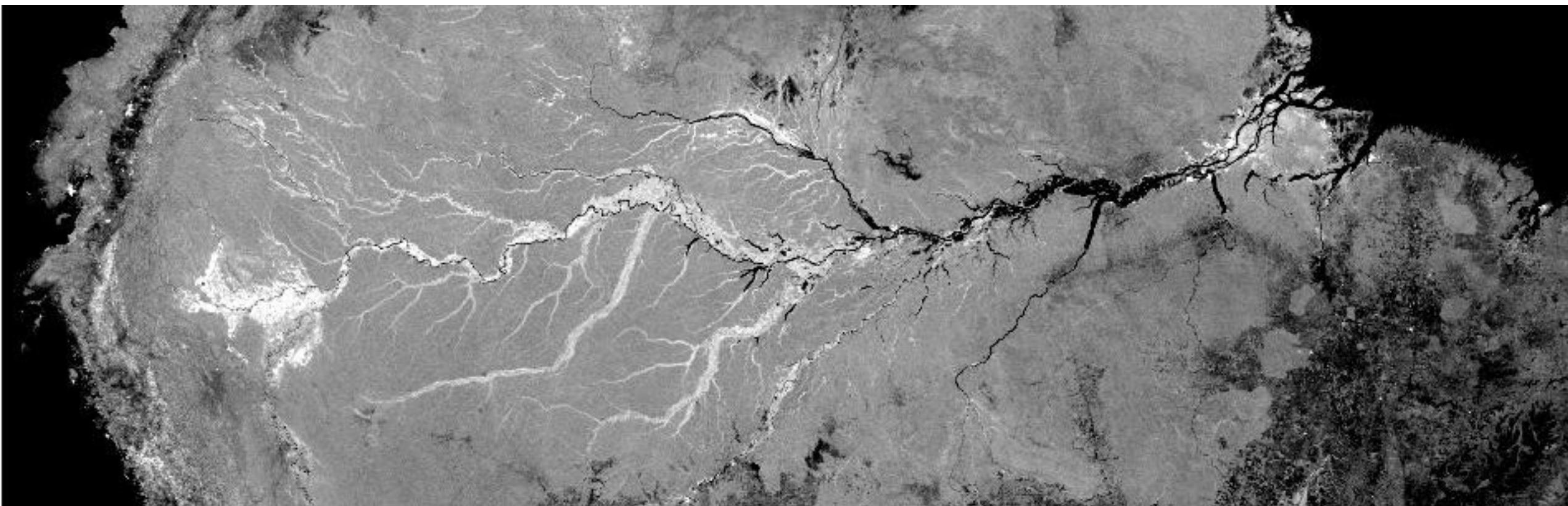


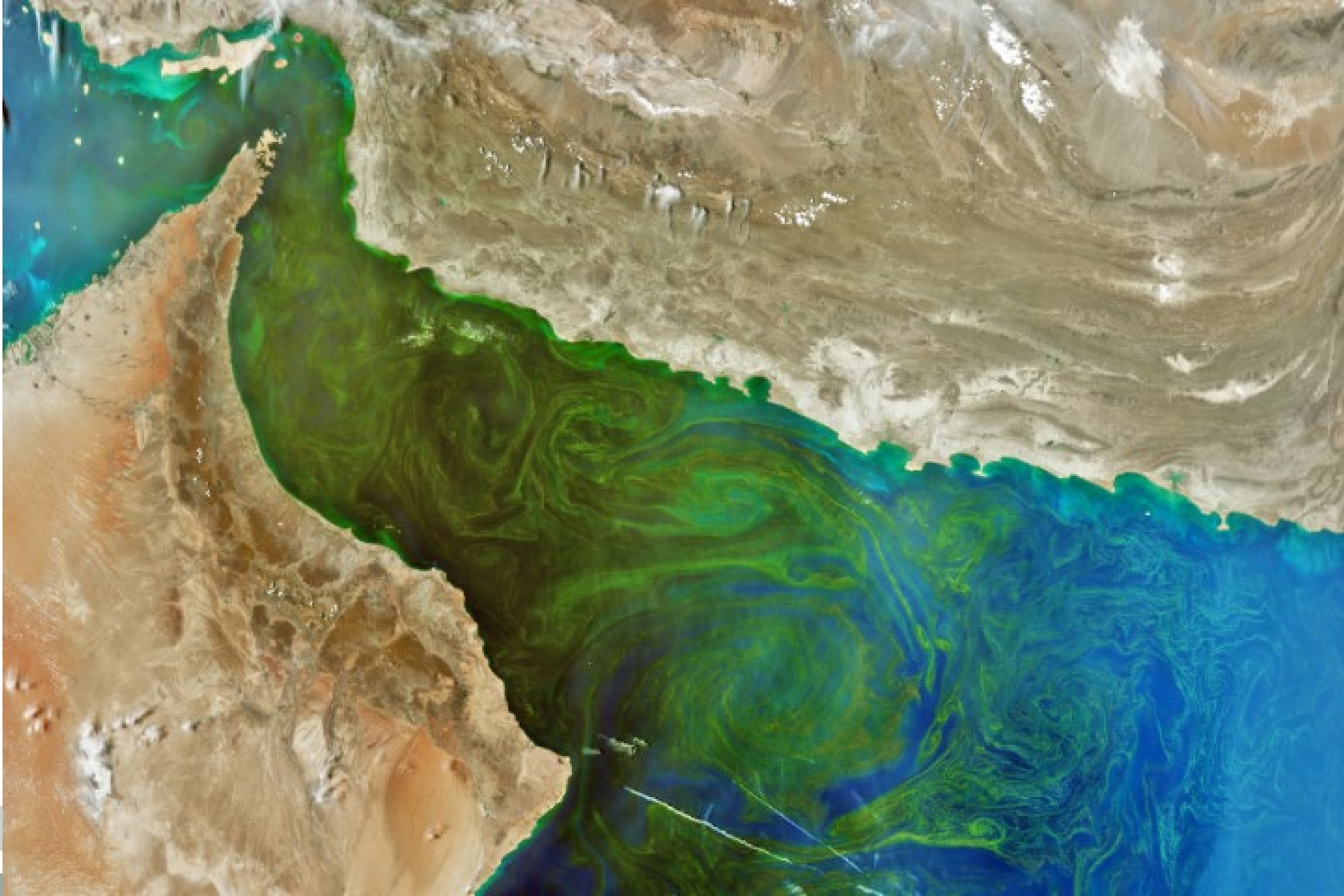






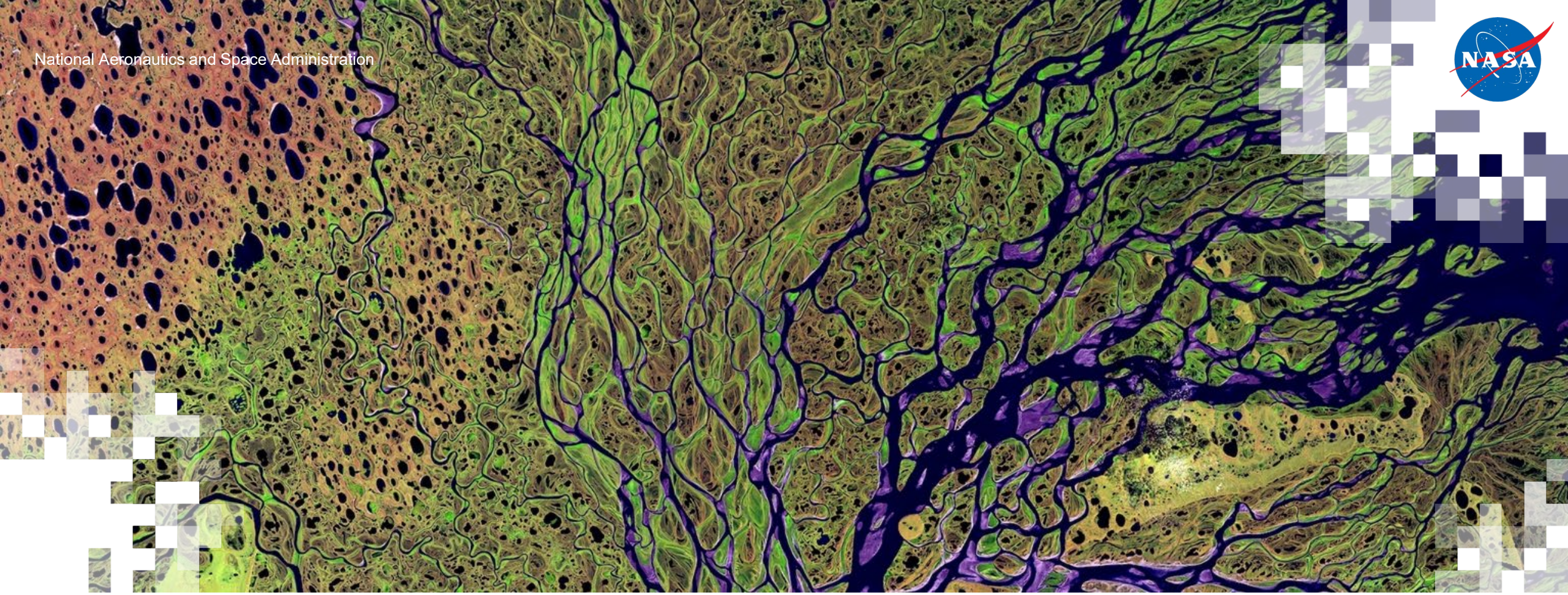












Monitoring Fires using Earth Observations

Amita Mehta (ARSET)

October 28, 2024

Objectives

- By the end of this section, attendees will be able to identify Earth observations and access webtools to:
 - Observe historical and near real time fires (location and burned area).
 - Assess pre-fire weather conditions conducive for fires.
 - Examine pre- and post-fire vegetation cover.



Outline

- A brief overview of fires: detection and risk assessment
- Demonstrations – monitoring near-real time and historical fires using:
 - [NASA Worldview](#)
 - [Fire Information for Resource Management System \(FIRMS\)](#)

Monitor pre- and post-fire environmental conditions and vegetation using

- [Climate Engine](#)
- Exercises: NASA Worldview – Monitor fires and smoke
Climate Engine – Examine pre-fire weather conditions, pre- and post-fire vegetation cover



Quick Fire Facts

- Most natural fires occur in dry and warm conditions.
- Both weather and climate conditions impact fire risk.
- Vegetation: cover and type (trees, shrubs, grasses, dead leaves), density, and height provide fuel for fires.

Data Relevant for Fire Risk Assessment

- Precipitation
- Surface Temperatures
- Soil Moisture
- Vegetation Fuel
- Topography
- Humidity
- Winds



Types of Fires

Forest Fires



Agricultural Fires

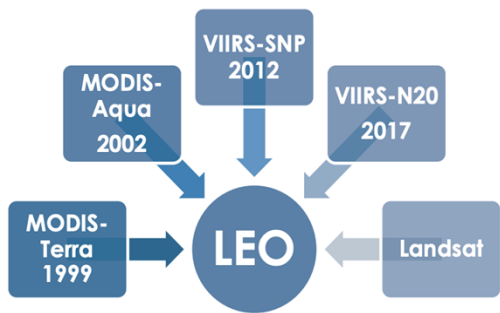


Waste Burning Fires

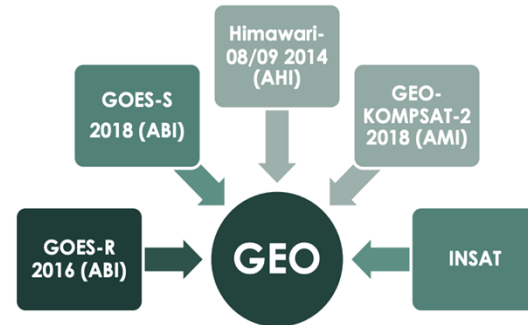


Fire Detection from Satellites

Satellites and Sensors



Global Coverage, typically twice per 24 hours



Regional Coverage, minutes to hours

LEO – Low Earth Orbit
GEO – Geostationary
ABI – Advanced Baseline Imager

Fire Detection Algorithms

- Examine thermal anomalies from satellite images to detect active fires.
- Use Brightness Temperature (Reflectance) threshold values to identify potential pixels with fires.
- Smoke and light (night) detection help locate fires.



True Color Image (or RGB) for Visible Smoke

A MODIS “true color image” uses visible wavelength bands 1, 4, & 3.

R = 0.66 μm

G = 0.55 μm

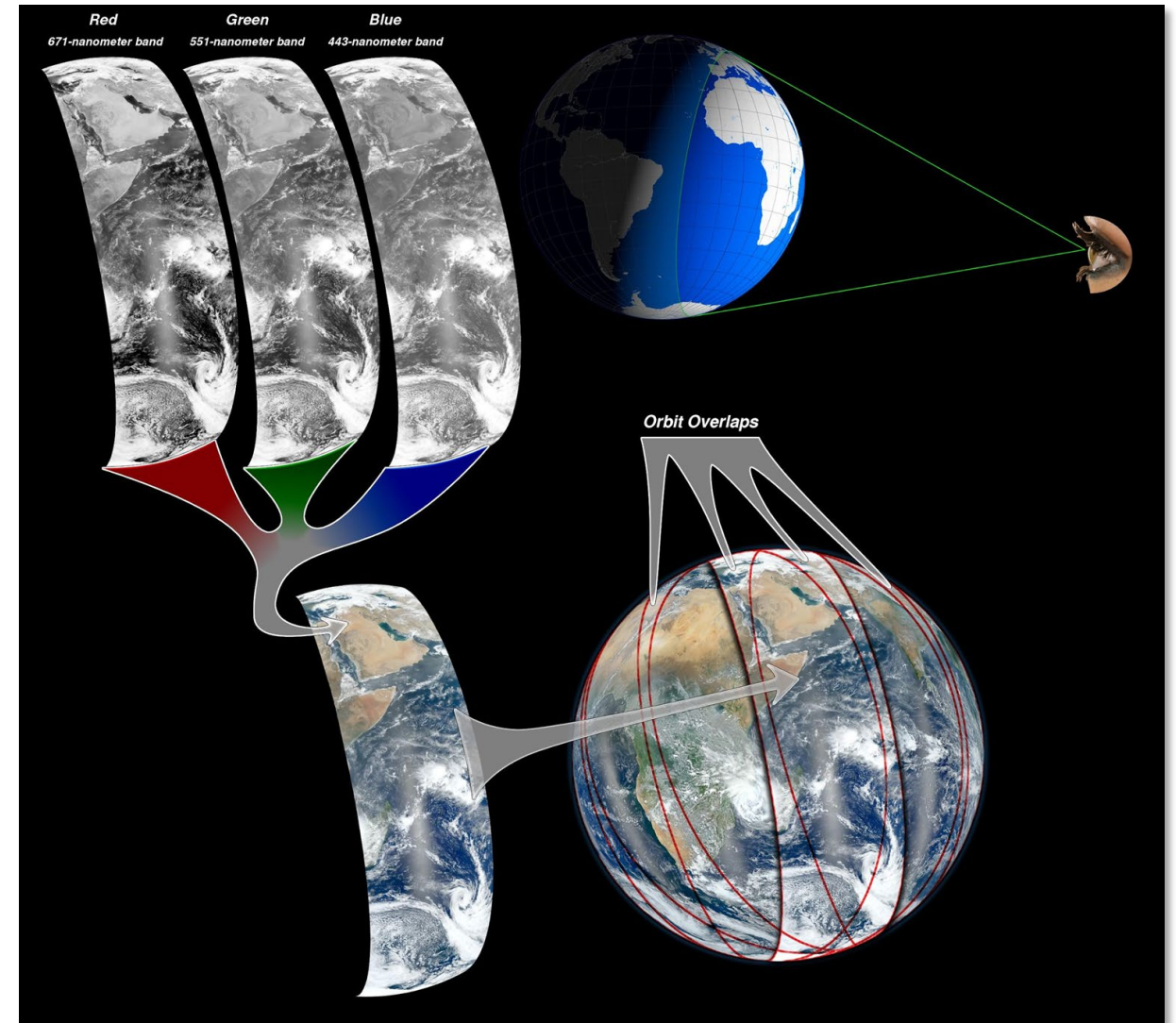
B = 0.47 μm

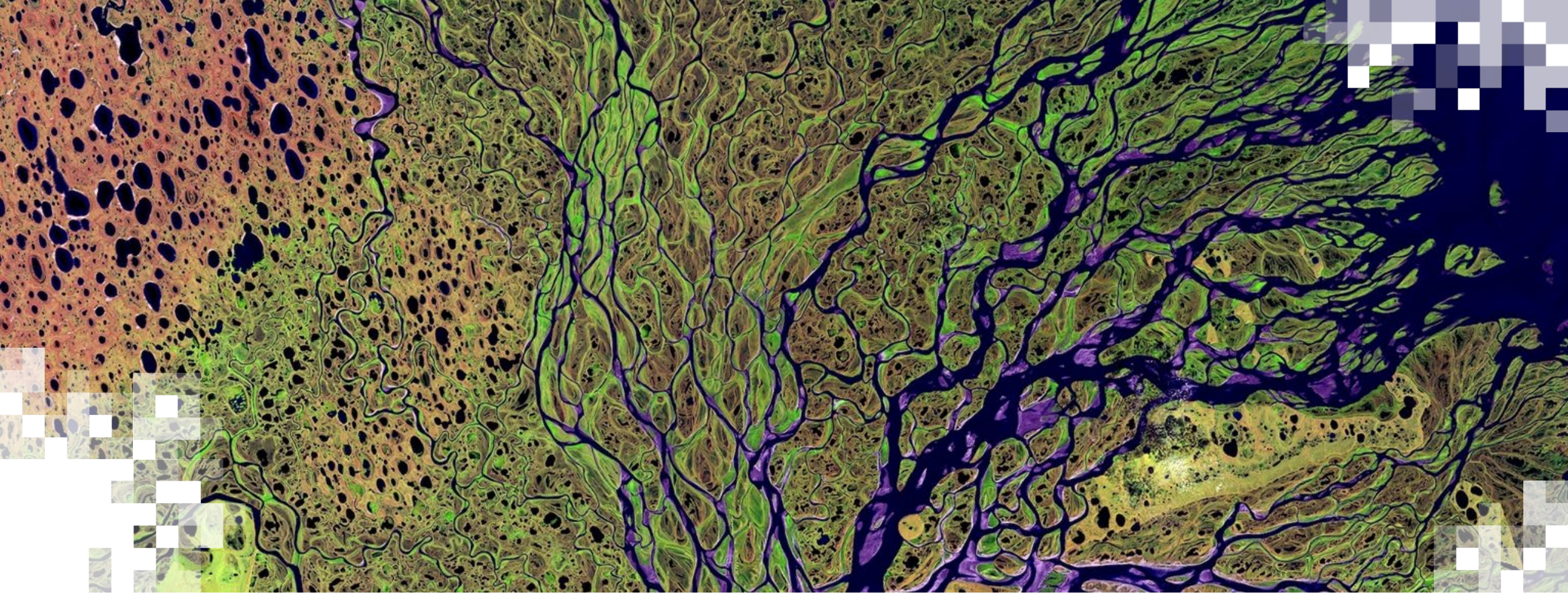
A VIIRS “true color image” uses visible wavelength bands I1, M4, & M3.

R = 0.640 μm

G = 0.555 μm

B = 0.488 μm





Demonstration and Exercises

Fire Cases

- California Bridge Fire → September 2024
- Democratic Republic of Congo → August – September 2024

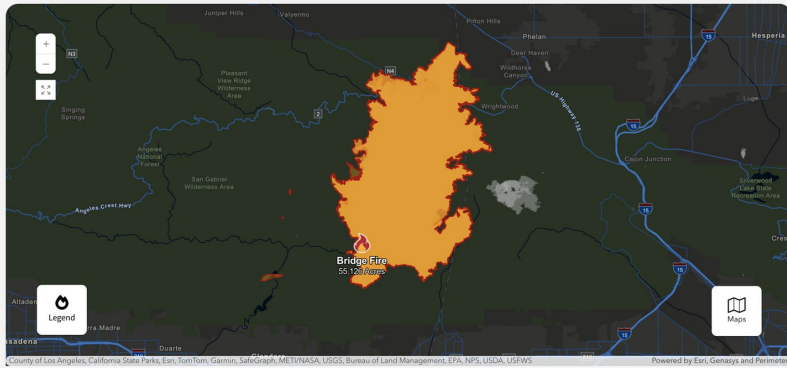


California Bridge Fire

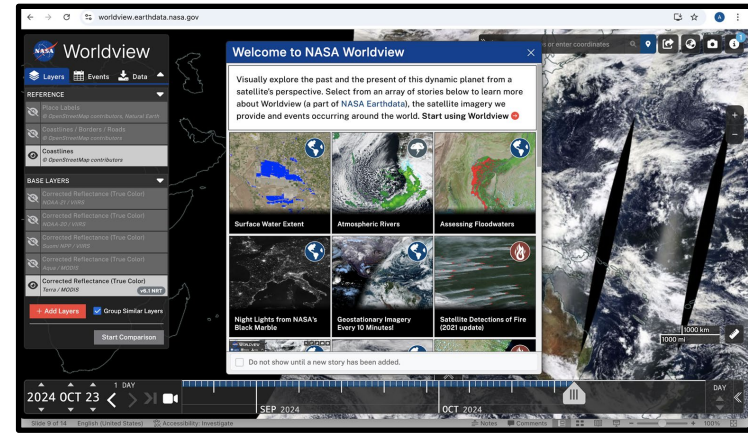
Bridge Fire Information

99% Contained 55,126 Acres 2 Counties: Los Angeles, San Bernardino

Not a CAL FIRE Incident. Updates will be made as they become available.

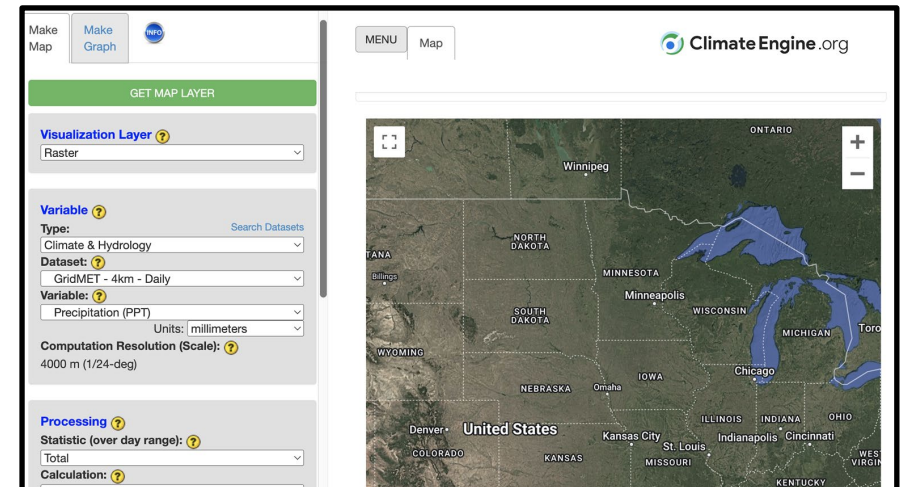


NASA Worldview



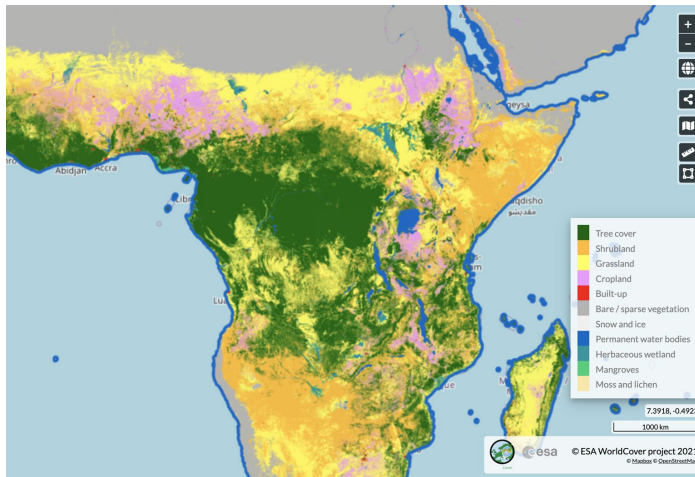
Climate Engine

Date Started 09/08/2024 2:12 PM	Last Updated 10/21/2024 10:15 AM	Cause Under Investigation
Incident Maps 3D Map	Admin Unit Angeles National Forest	Incident Management Team No team assigned
Location Camp Bonita Road, East of Camp Williams [34.2396,-117.7625]	Reports Status reports	

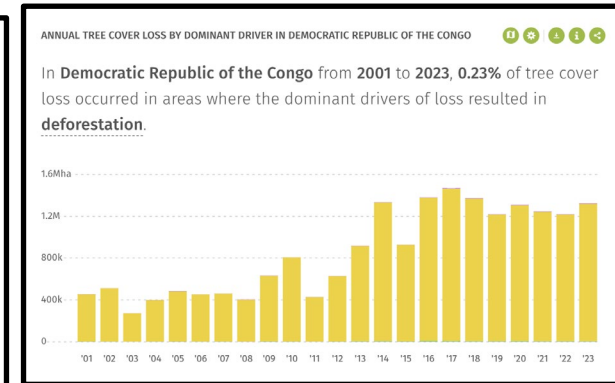
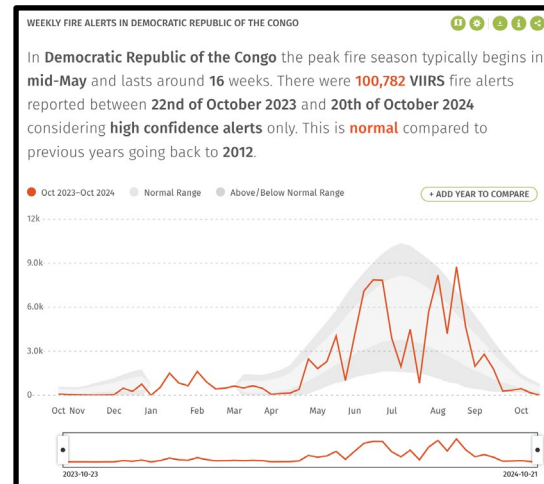


Fires in Democratic Republic of Congo (DRC)

ESA World Cover

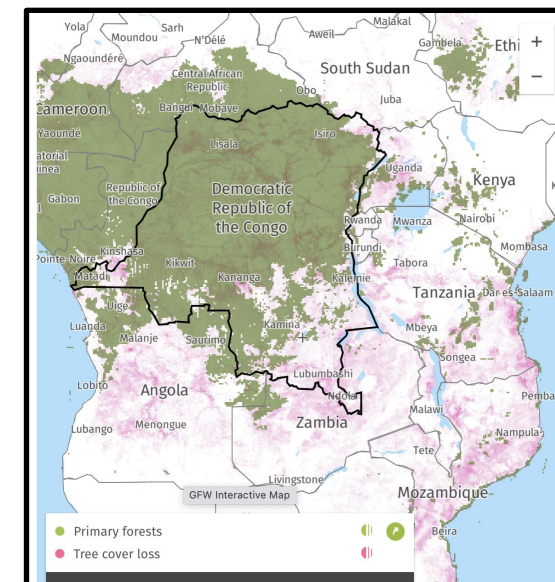


Global Forest Watch



NASA Earth Observatory

“More than half of the gross domestic product (the value of all the goods and services produced by a country) of [Democratic Republic of Congo](#) comes from the agriculture sector, and fire is a pivotal part of agriculture across most of Africa. People burn crop residue to clear fields after harvest, and they burn forest and other natural vegetation to clear new land for farming. Fire is also used to drive game and grazing animals to new locations and to stimulate new growth in pastures.”



Exercise: Monitor Fires in DRC

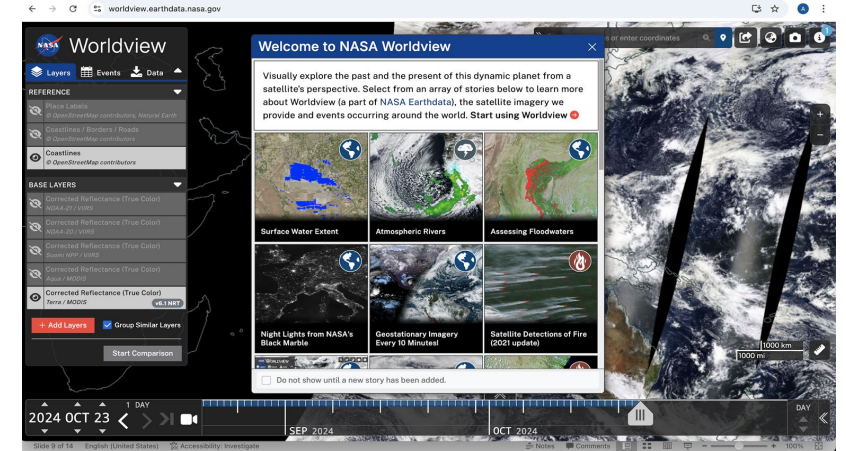
1. Go To [NASA Worldview](https://worldview.earthdata.nasa.gov) and click on **Add Layer**.
2. Type **Fires** in the Search Window.
3. Select the following from the data product list:

Fires and Thermal Anomalies
(Day and Night 375 m)
NOAA-21 VIIRS

Fires and Thermal Anomalies
(Day and Night 375 m)
NOAA-20 VIIRS

Fires and Thermal Anomalies
(Day and Night 375 m)
Suomi NPP VIIRS

Fires and Thermal Anomalies
(Day and Night 375 m)
Terra and Aqua/MODIS

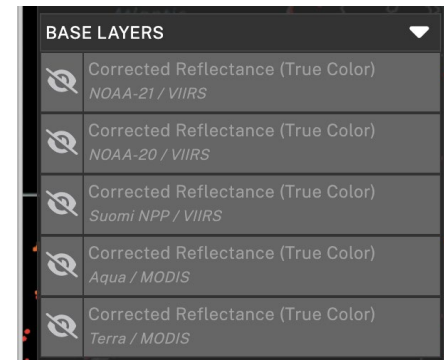
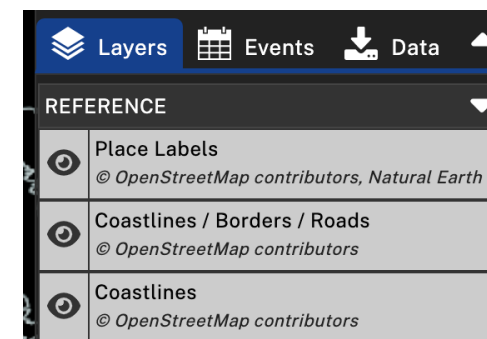
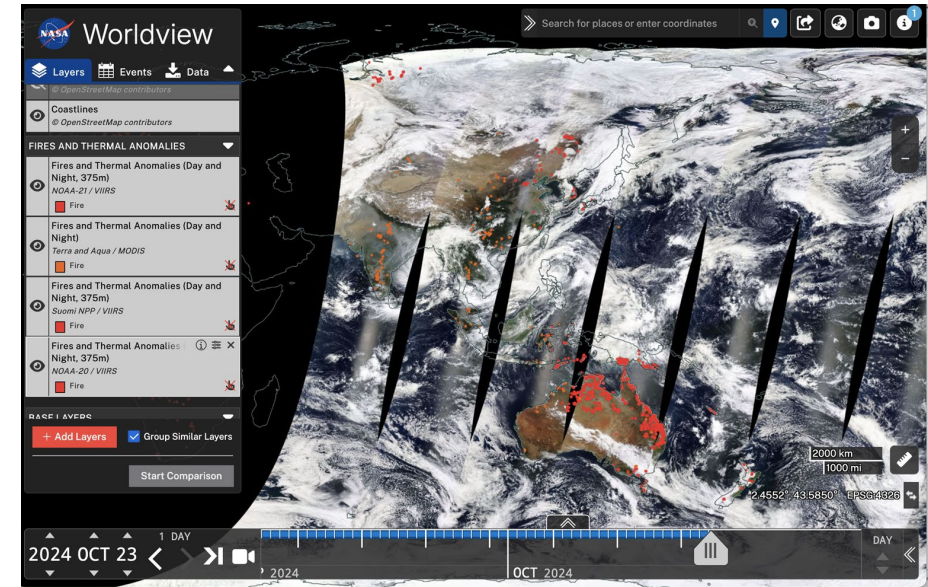


Fires	
Showing 18 out of 1145	
<input type="checkbox"/>	Fires and Thermal Anomalies (Day and Night, 375m) NOAA-21 / VIIRS
<input type="checkbox"/>	Fires and Thermal Anomalies (Day, 375m) NOAA-21 / VIIRS
<input type="checkbox"/>	Fires and Thermal Anomalies (Night, 375m) NOAA-21 / VIIRS
<input type="checkbox"/>	Fires and Thermal Anomalies (Day and Night, 375m) NOAA-20 / VIIRS
<input type="checkbox"/>	Fires and Thermal Anomalies (Day, 375m) NOAA-20 / VIIRS
<input type="checkbox"/>	Fires and Thermal Anomalies (Night, 375m) NOAA-20 / VIIRS
<input type="checkbox"/>	Fires and Thermal Anomalies (Day and Night, 375m) Suomi NPP / VIIRS
<input type="checkbox"/>	Fires and Thermal Anomalies (Day, 375m) Suomi NPP / VIIRS
<input type="checkbox"/>	Fires and Thermal Anomalies (Night, 375m) Suomi NPP / VIIRS



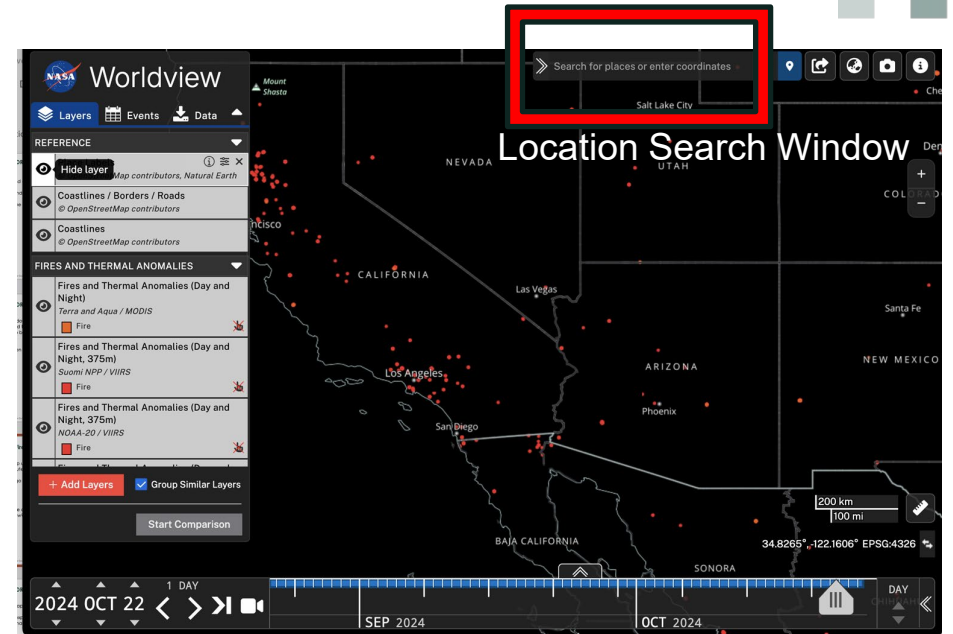
Exercise: Monitor Fires in DRC

4. Close the Layer Selection window.
 - You will see the layers added to the Layer Panel.
 - Zoom in and out of the map by using your computer mouse.
5. Turn all the **REFERENCE** layers on and **BASE LAYERS** off.



Exercise: Monitor Bridge Fire

6. Zoom to California on the map using +/- sign on the top right and using the computer mouse.
7. In the search window on the top right type 'Wrightwood, CA, USA'.
8. Using the time selection bar, specify 8 September to 15 September 2024.
9. Now zoom in further to the region around Wrightwood.

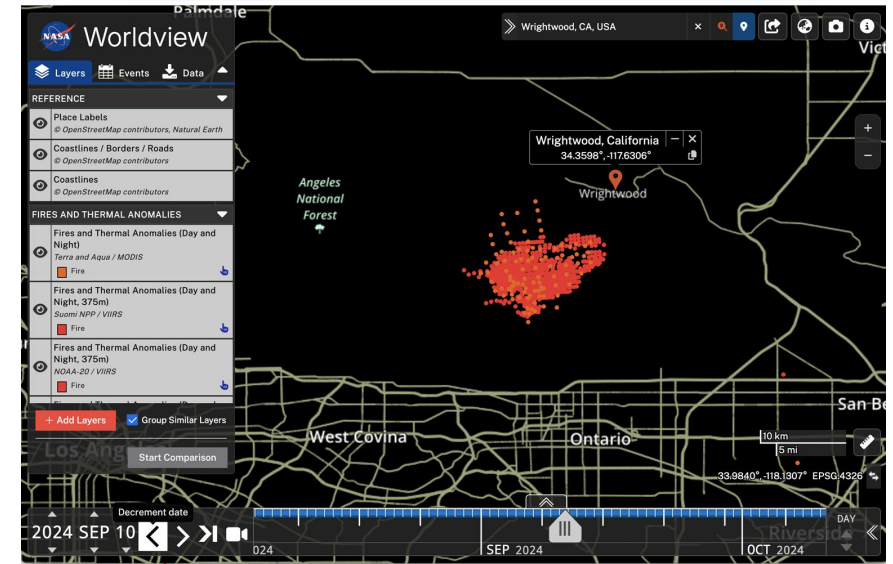


↑
Drag to move
along the timeline



Exercise: Monitor Bridge Fire

- Using the '1 Day' arrows move from 8 to 15 September 1 day at a time.
- Which day do you see the maximum spread of fires?
- Click on any fire spot (red dot) to see the details about the fire at that location.
- Now examine smoke by turning the true color images on from the **BASE LAYERS** – for example start with **Suomi NPP VIIRS** image on. Explore how smoke spreads between 8 to 15 September.

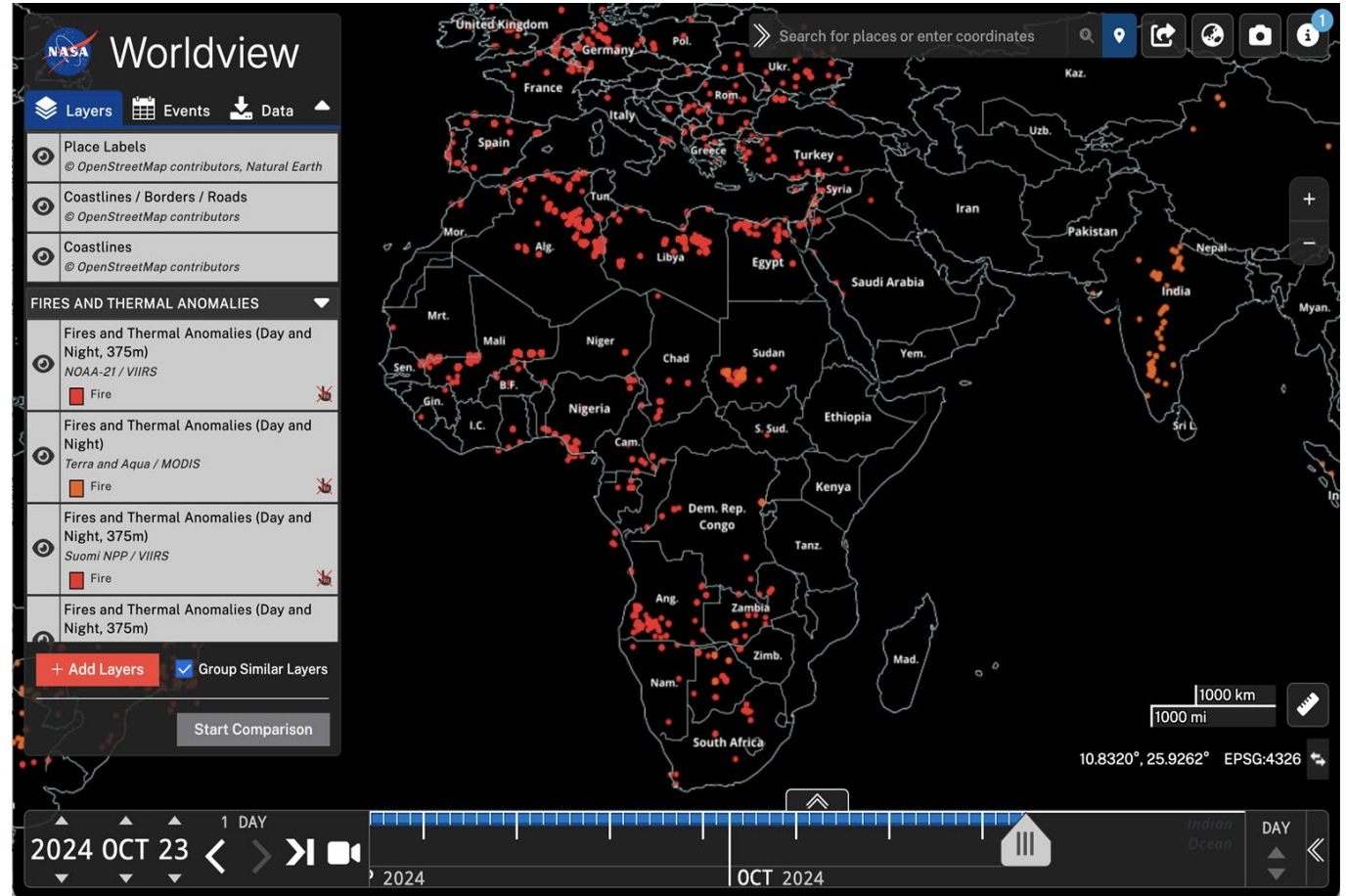


Fires and Thermal An... [1]	
21:10	
Latitude	34.29286 °
Longitude	-117.69413 °
Brightness Temperature (Channel I-4)	354.79 Kelvin
Brightness Temperature (Channel I-5)	286.33 Kelvin
Fire Radiative Power	322.59 MW
Detection Confidence	Nominal Confidence
Day/Night Flag	Daytime Fire
Along-Scan Pixel Size	0.49 km
Along-Track Pixel Size	0.4 km
Acquisition Date	2024-09-10
Acquisition Time	21:10
Satellite	NOAA-21 / Joint Polar Satellite System-2 (JPSS-2)
Collection And Source	Collection 2 Near Real-Time processing
Unique Identifier	116175



Exercise: Monitor Fires in DRC

Repeat Steps 5–13 in Worldview but now zoom in on Africa / Democratic Republic of Congo and use the dates 20–31 August 2024.



↑
Drag to move
along the timeline



Demonstration: FIRMS

- [Fire Information for Resource Management System \(FIRMS\)](#)

FIRMS
Fire Information for Resource Management System

Quick Search Announcements Feedback

Wildfire smoke Feb 2015

Constitución Talca Maule Linares Cauquenes Parral Chillan

FIRE MAP ACTIVE FIRE DATA FIRE ALERTS ARCHIVE DOWNLOAD WEB SERVICES

Fire Information for Resource Management System

Providing Active Fire Data for Near-Real Time Monitoring and Applications

The Fire Information for Resource Management System (FIRMS) distributes Near Real-Time (NRT) active fire data from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard the Aqua and Terra satellites, and the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard S-NPP, NOAA 20 and NOAA 21 (formally known as JPSS-1 and JPSS-2). Globally these data are available within 3 hours of satellite observation, but for the US and Canada active fire detections are available in real-time.

The active fire / hotspot data can be viewed in [FIRMS FIRE MAP](#) or in [NASA'S WORLDVIEW](#), delivered as email alerts or downloaded in the following formats: [SHP](#), [KML](#), [TXT](#), [WMS](#)

FIRMS is part of NASA's Land, Atmosphere Near real-time Capability for EO ([LANCE](#)).


[FIRE DATA ACADEMY](#) features examples of analyzing and visualizing fire data using Google Colaboratory (Colab), Jupyter Notebooks, and Python.





Assess Pre- and Post-Fire Conditions using Climate Engine

- [Climate Engine](https://climateengine.org)

← → ↻ 🌐 climateengine.org ☆ A ⋮

 **Climate Engine**.org

About API Reports Support Partnerships News Team   [Launch App](#)

On-Demand Insights from Climate and Earth Observations Data

[Launch App](#) [See What's New!](#)

ClimateEngine.org empowers users of all technical proficiencies to harness the power of cloud computing to analyze decades of Earth Observations

Started through the White House Climate Data Initiative and a Google Faculty Research award, ClimateEngine.org now plays an essential role in Earth science.



Examine Pre- and Post-Fire Normalized Difference Vegetation Index (NDVI)



Data Selection

Make Map Make Graph INFO

GET MAP LAYER

Visualization Layer ?

Raster

Variable ?

Type: Remote Sensing [Search Datasets](#)

Dataset: ?

Landsat 9 - 30m - 16day

Variable: ?

NDVI (Vegetation Index)

Processing and Temporal Selection

Processing ?

Statistic (over day range): ?

Mean

Calculation: ?

Values

Time Period ?

Period of Record: 2021-11-07 to 2024-10-24

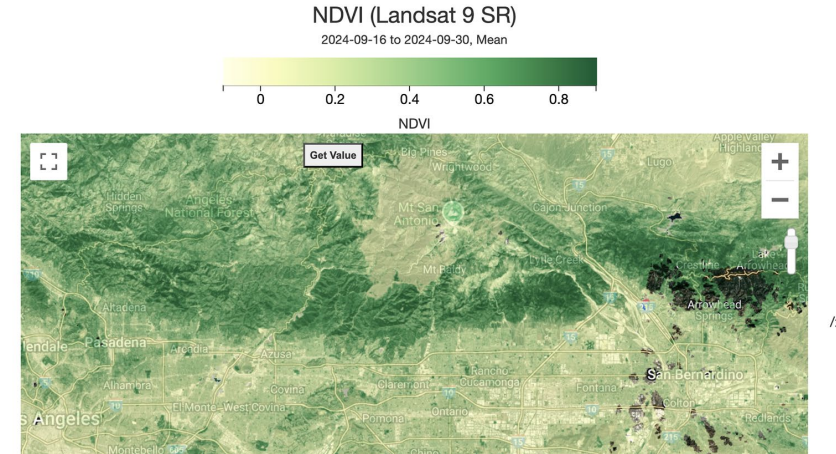
Custom Date Range

Start Date: 2024-09-16

End Date: 2024-09-30

GET MAP LAYER

Result



Examine Pre- and Post-Fire Normalized Difference Vegetation Index (NDVI)

Time Series

Make Map Make Graph INFO

GET TIME SERIES

Time Series Calculation: ?

Native Time Series

One Variable Analysis

Region: ?

Polygon

+ Add another region

Temporal Selection

Variable 1

Variable 1 ?

Type: Remote Sensing

Dataset: Landsat 9 - 30m - 16day

Variable: NDVI (Vegetation Index)

Computation Resolution (Scale): 30 m

Time Period ?

Period of Record: 2021-11-07 to 2024-10-24

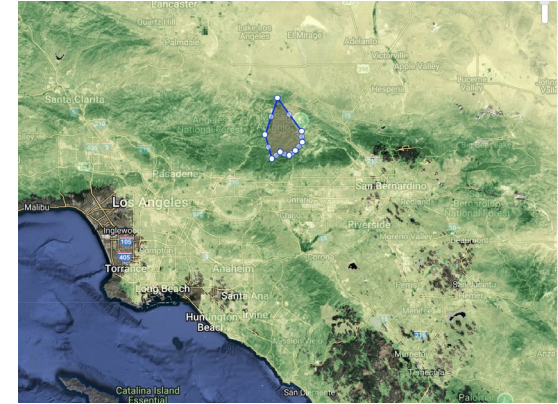
Custom Date Range

Start Date: 2024-08-01

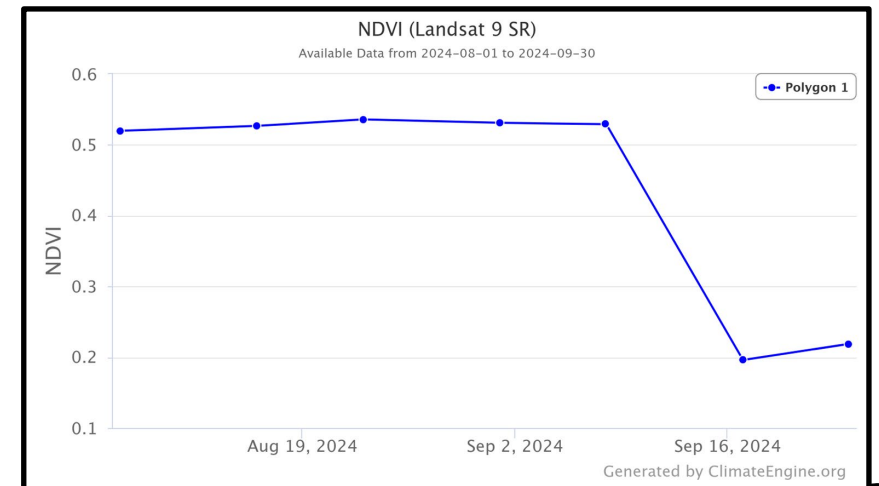
End Date: 2024-09-30

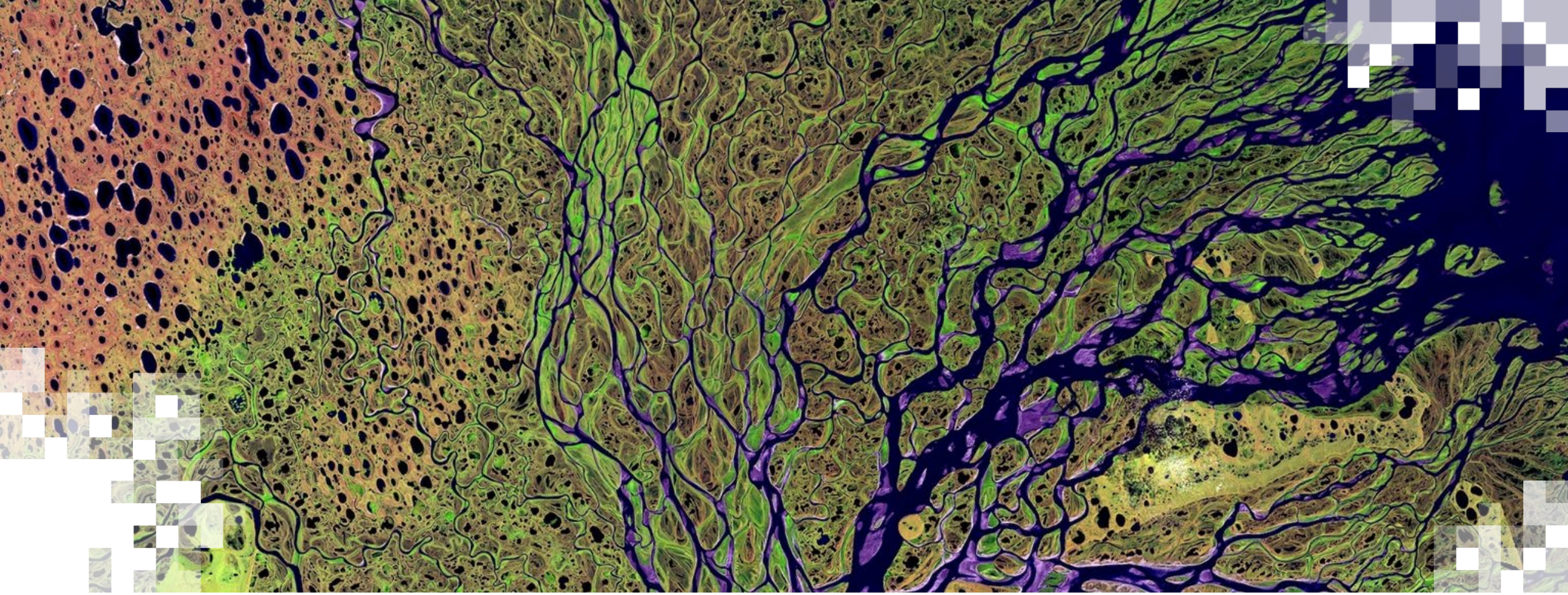
GET TIME SERIES

Spatial Selection



NDVI Time Series





Summary

Resources : ARSET Fire-related Trainings

- [Satellite Observations and Tools for Fire Risk, Detection, and Analysis](#)
- [Using Earth Observations for Pre- and Post- Fire Monitoring](#)
- [Assessing the Impact of Fires on Watershed Health](#)

- NASA Earth observations and webtools enable monitoring:
 - Near real-time fire detection.
 - Pre- and post-fire conditions.





Thank You!

