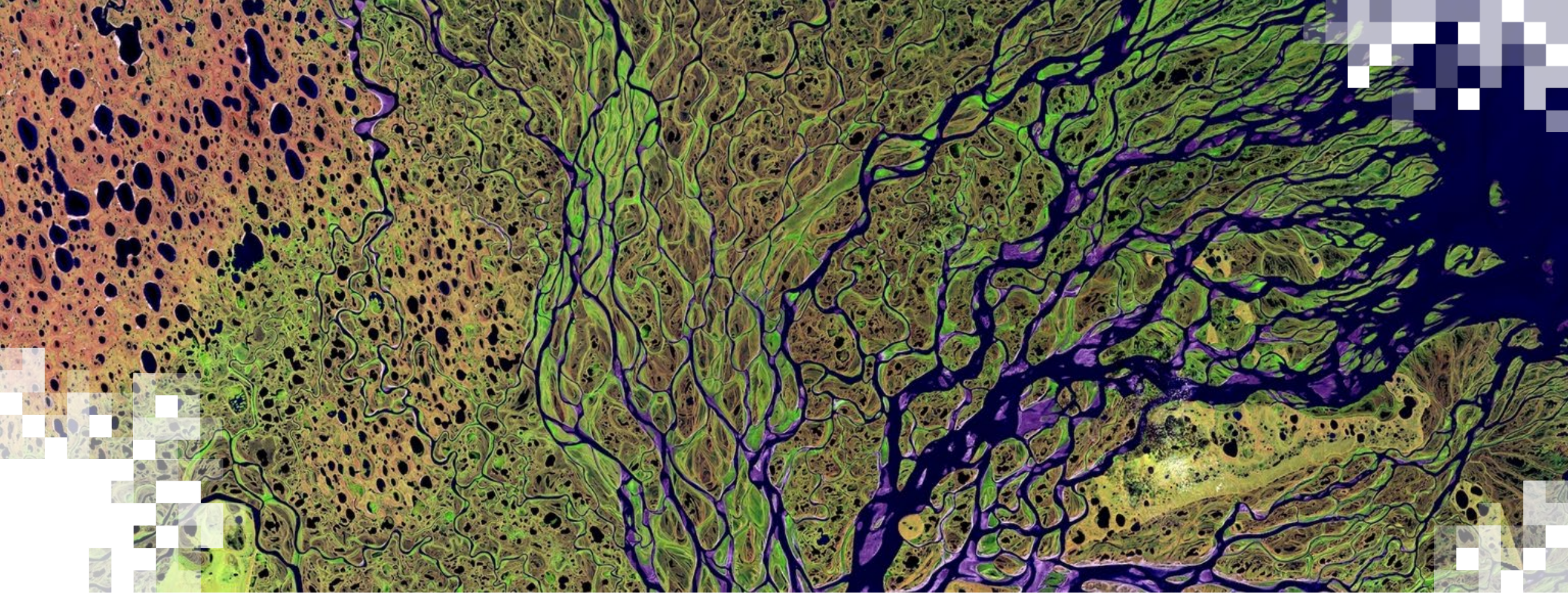
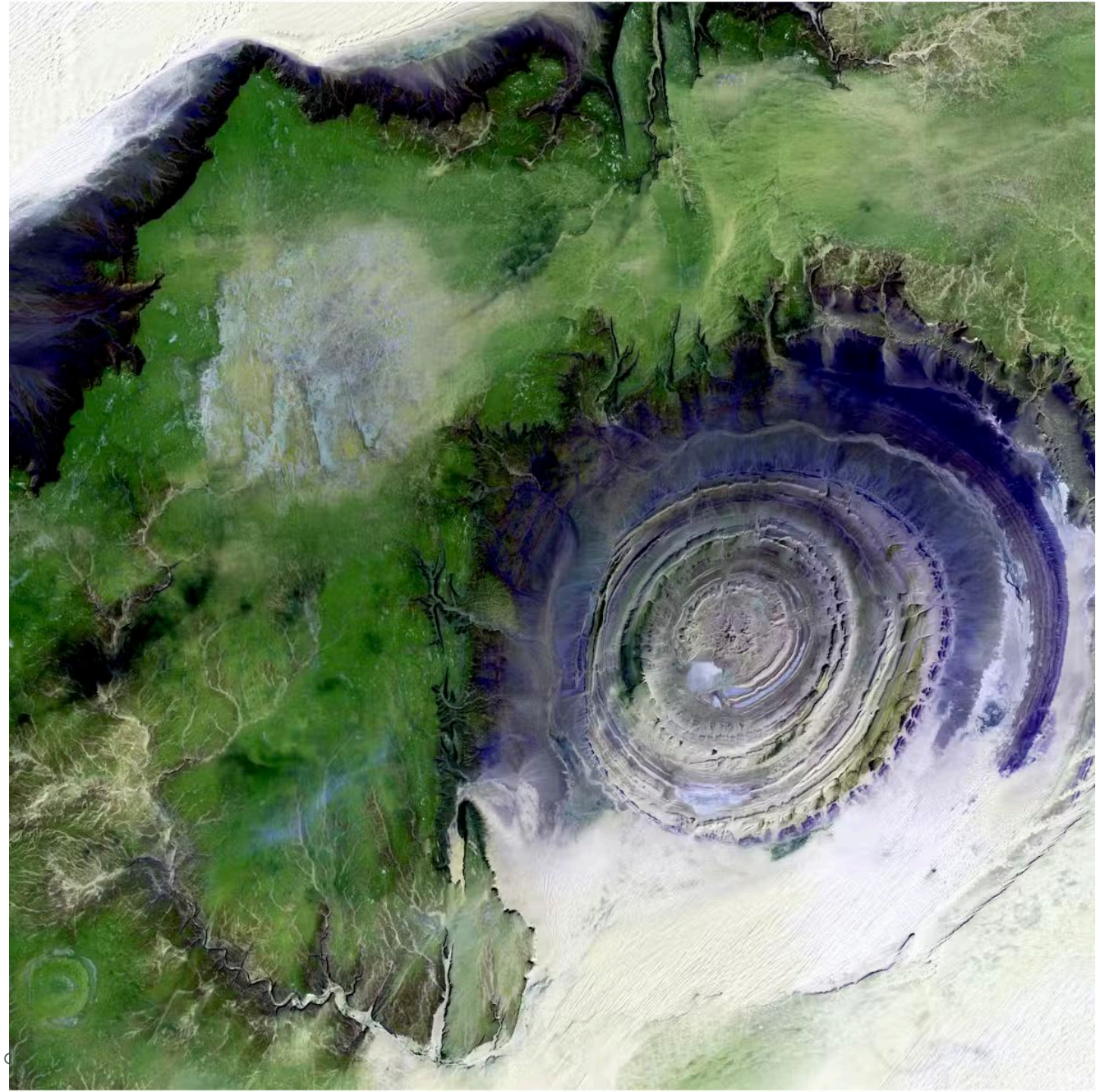
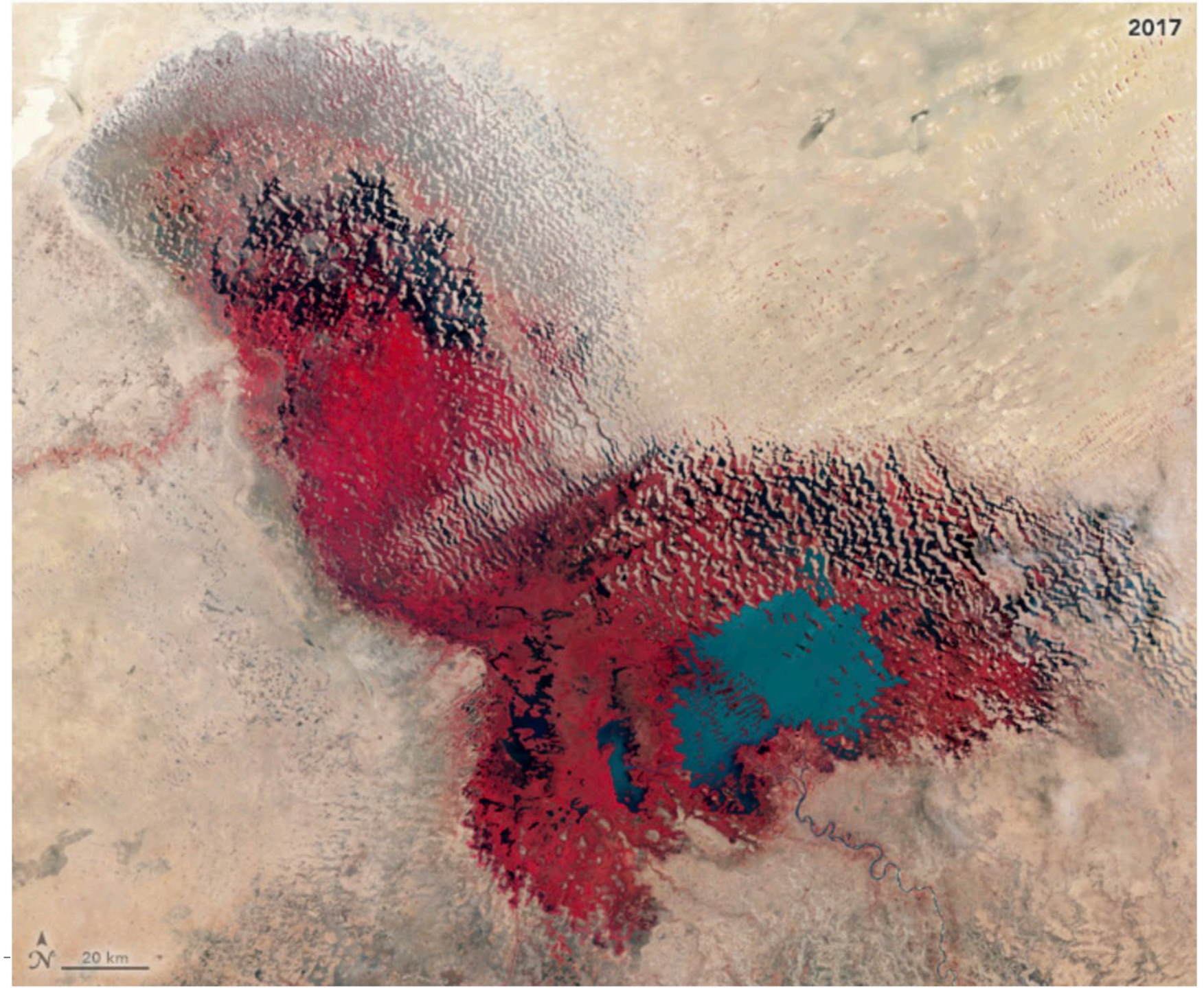
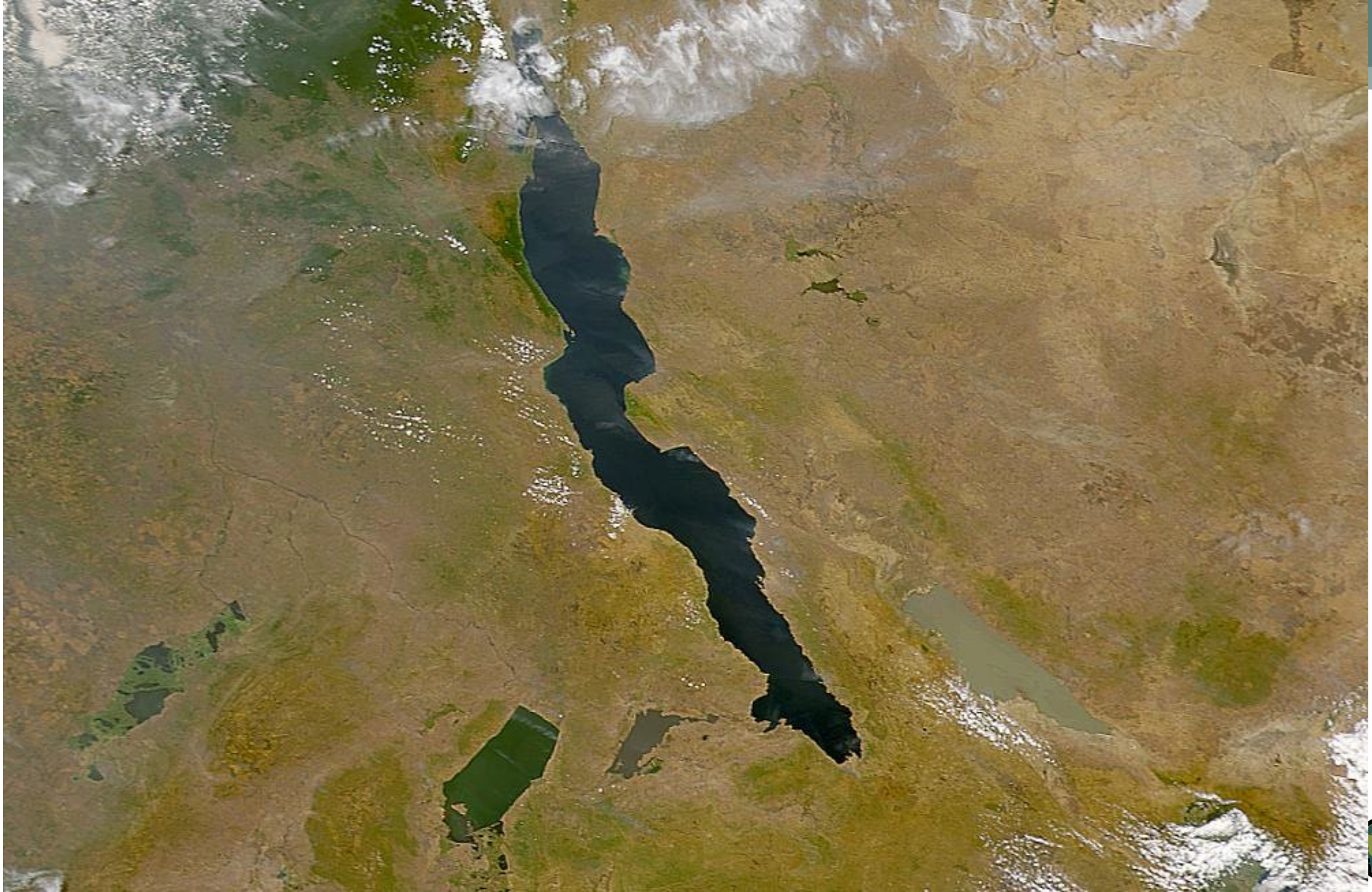
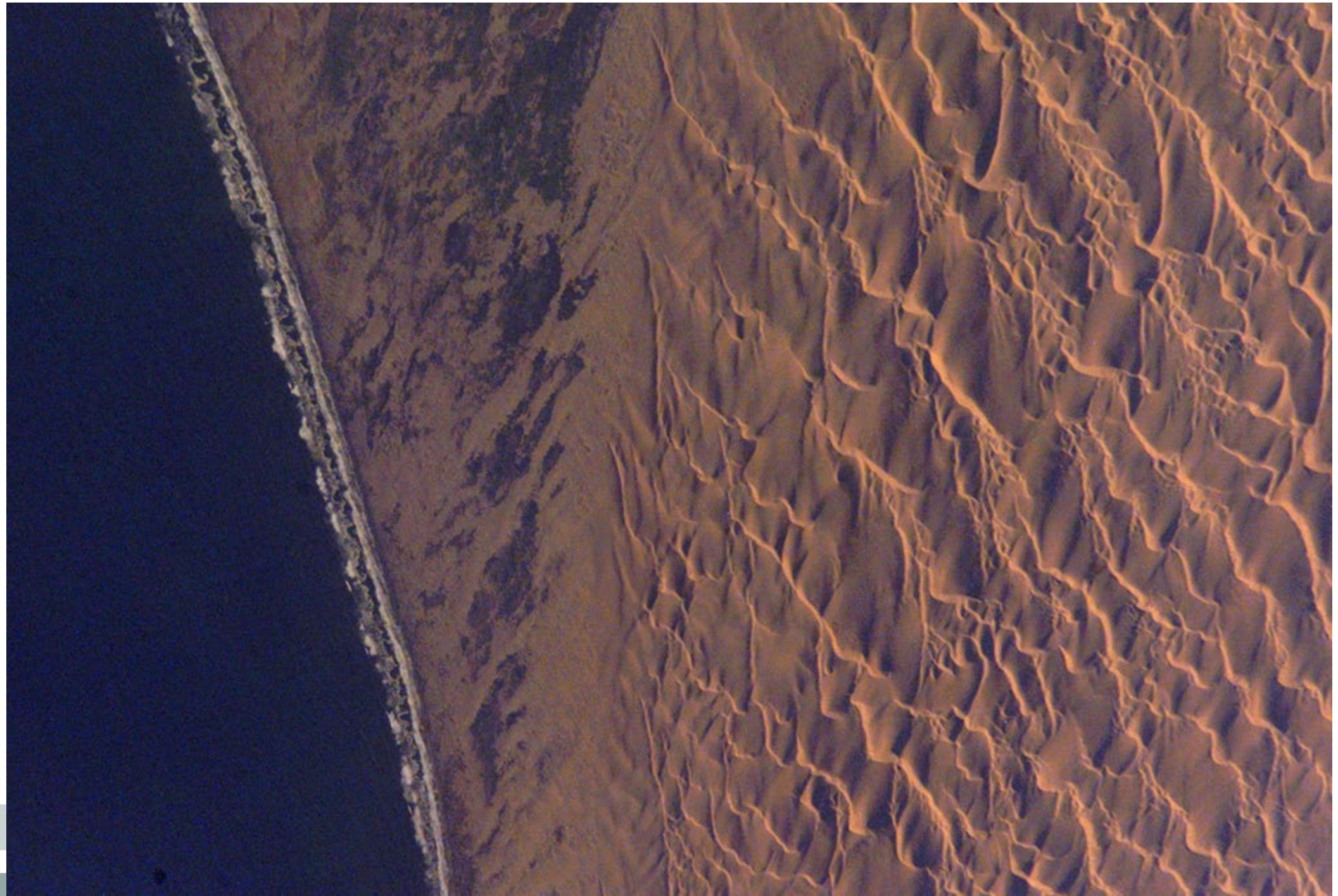


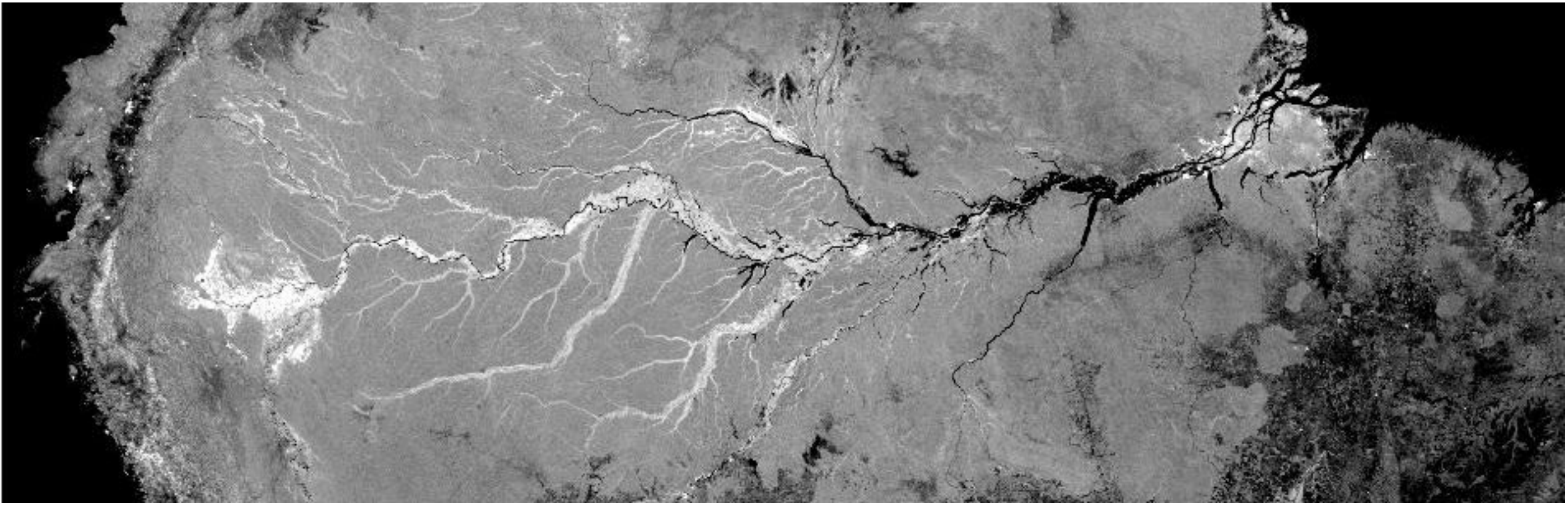
Energizer: Where in the World

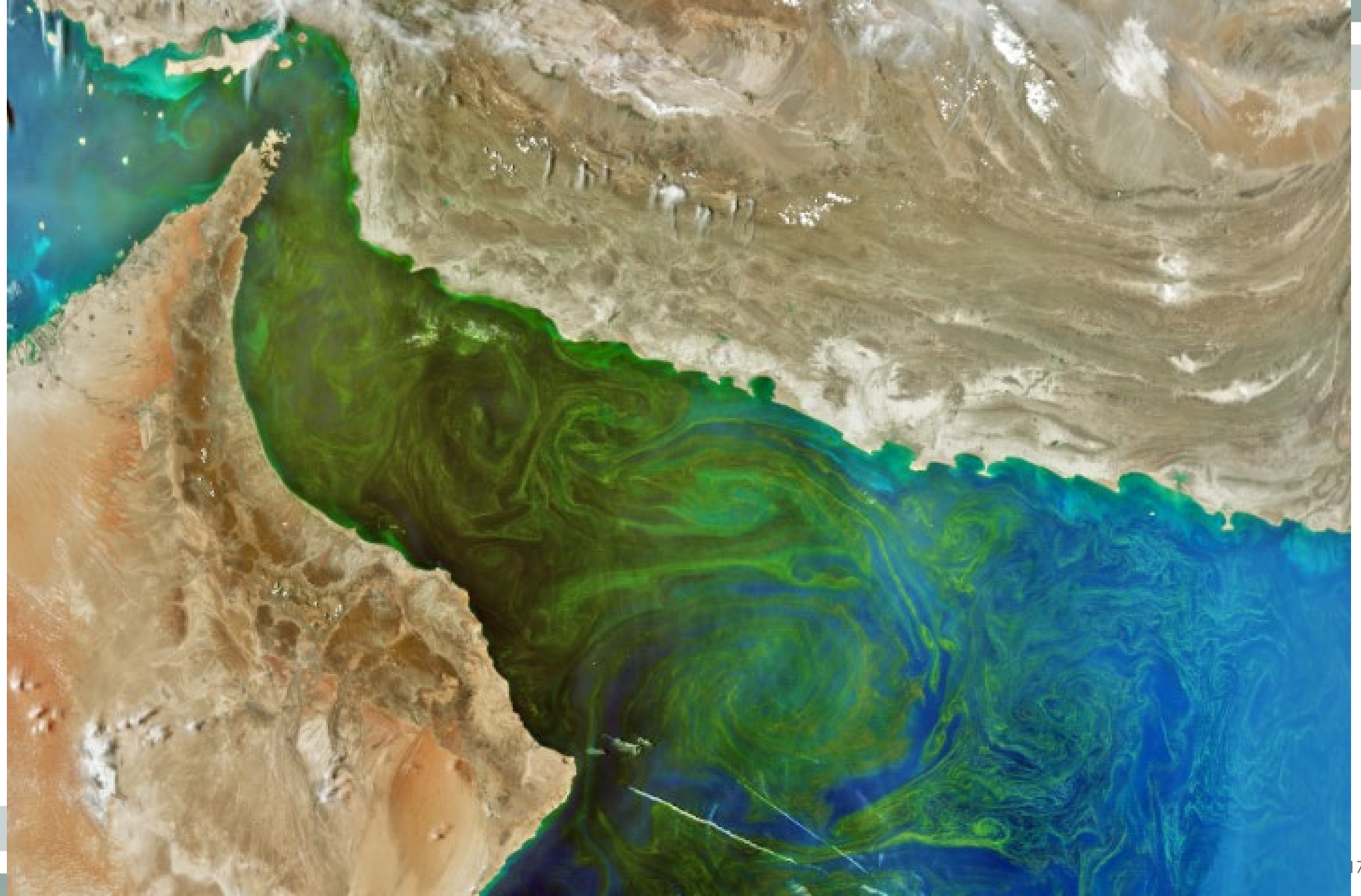


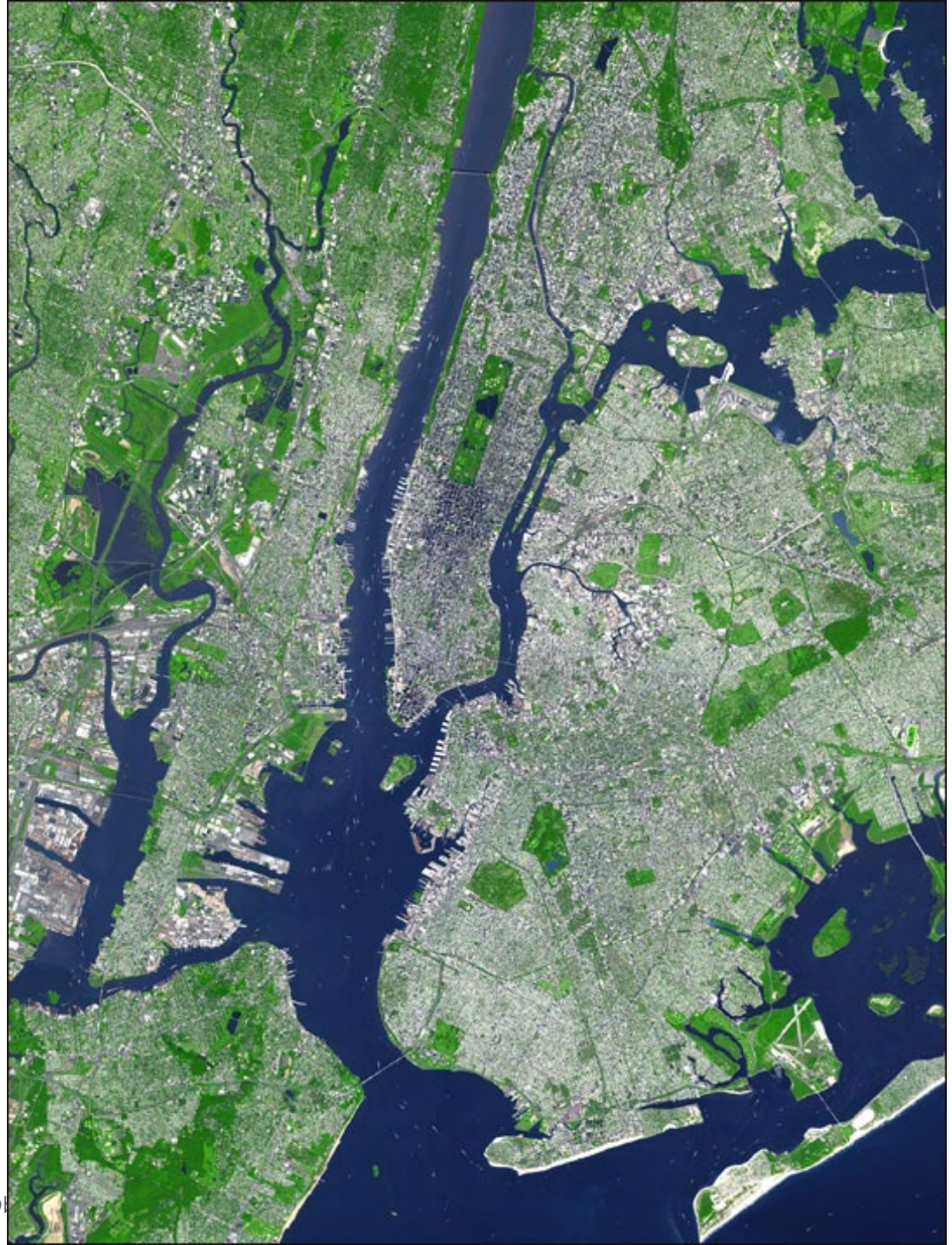

2017
20 km



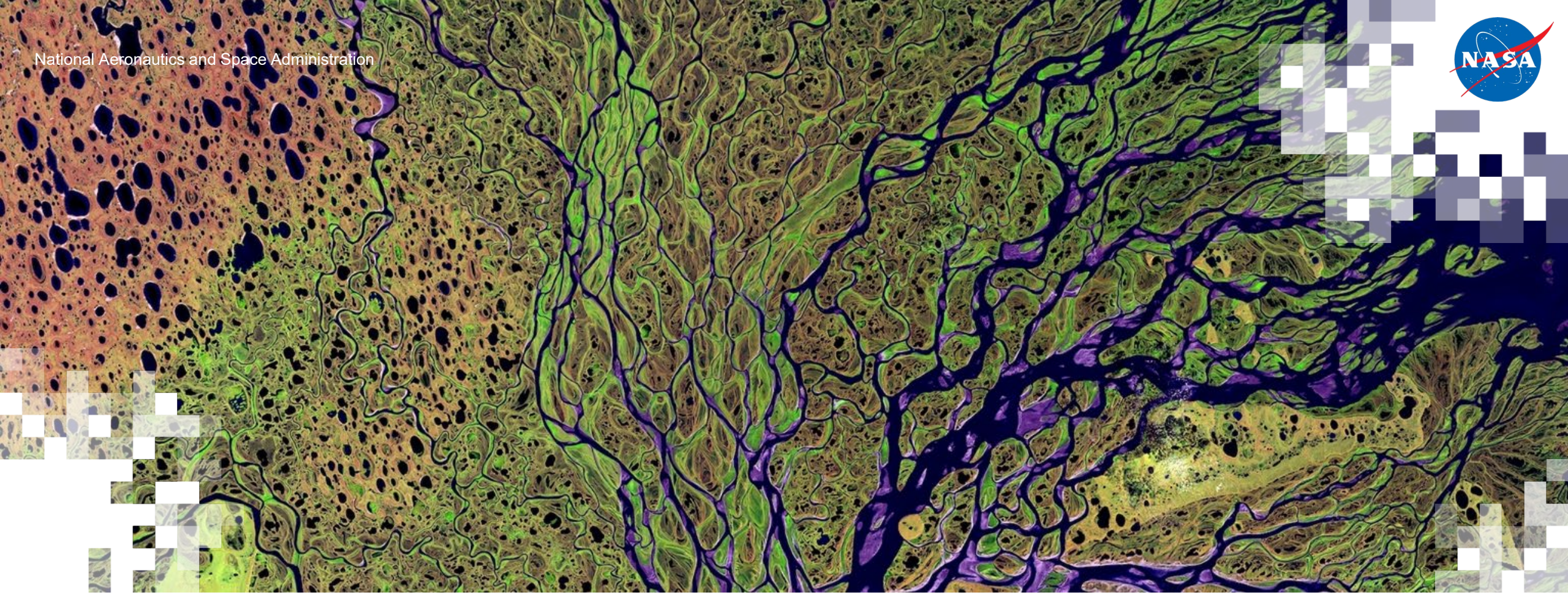








National Aeronautics and Space Administration



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

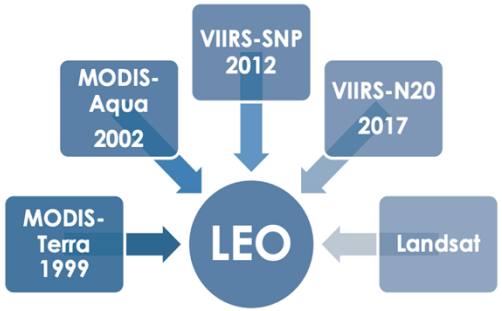
Forest Fires

Agricultural Fires

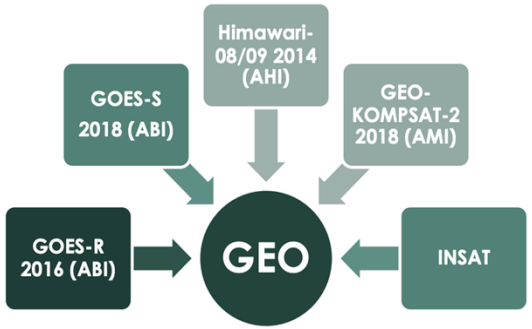
Waste Burning Fires

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

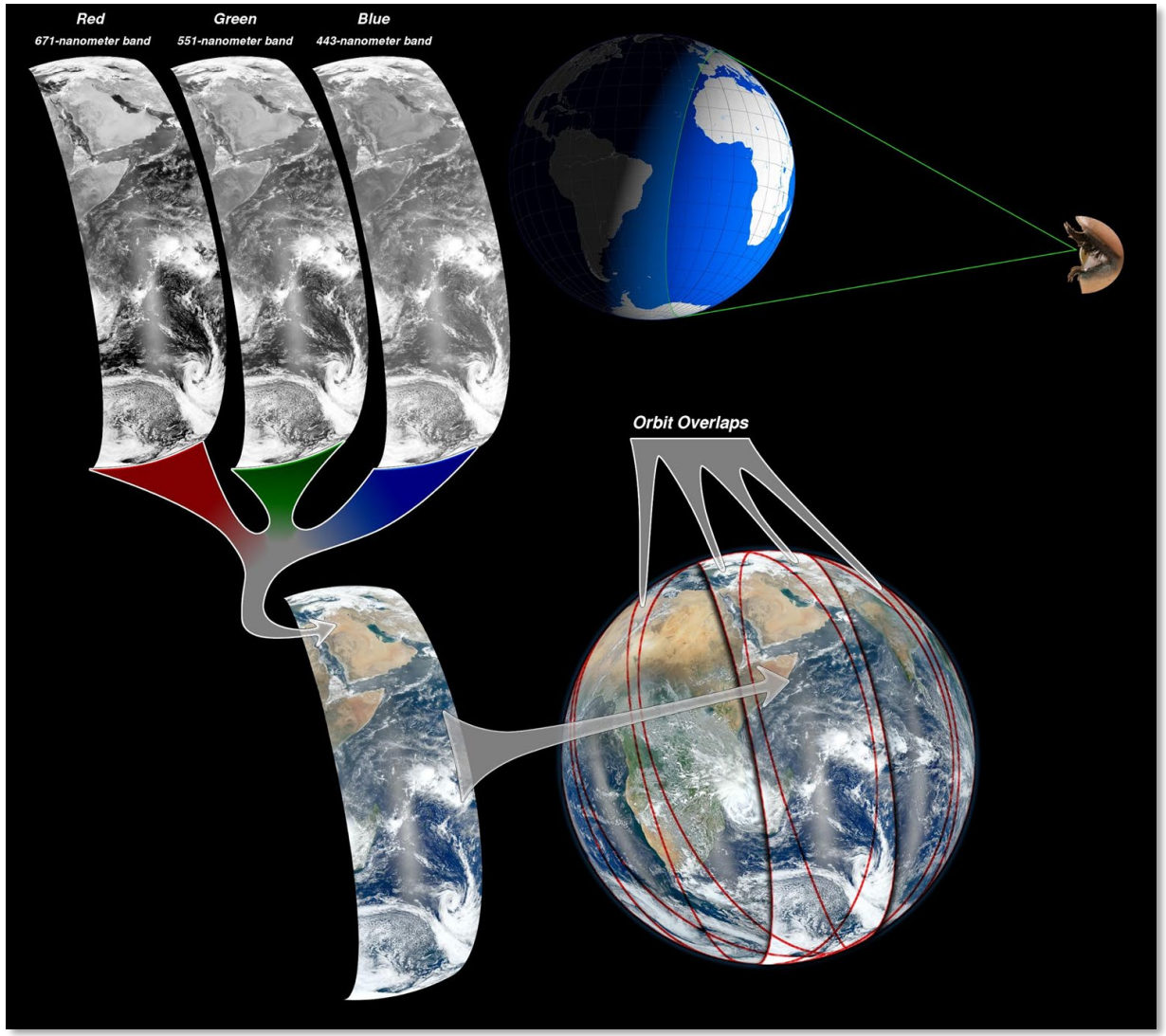
B = 0.47 µm

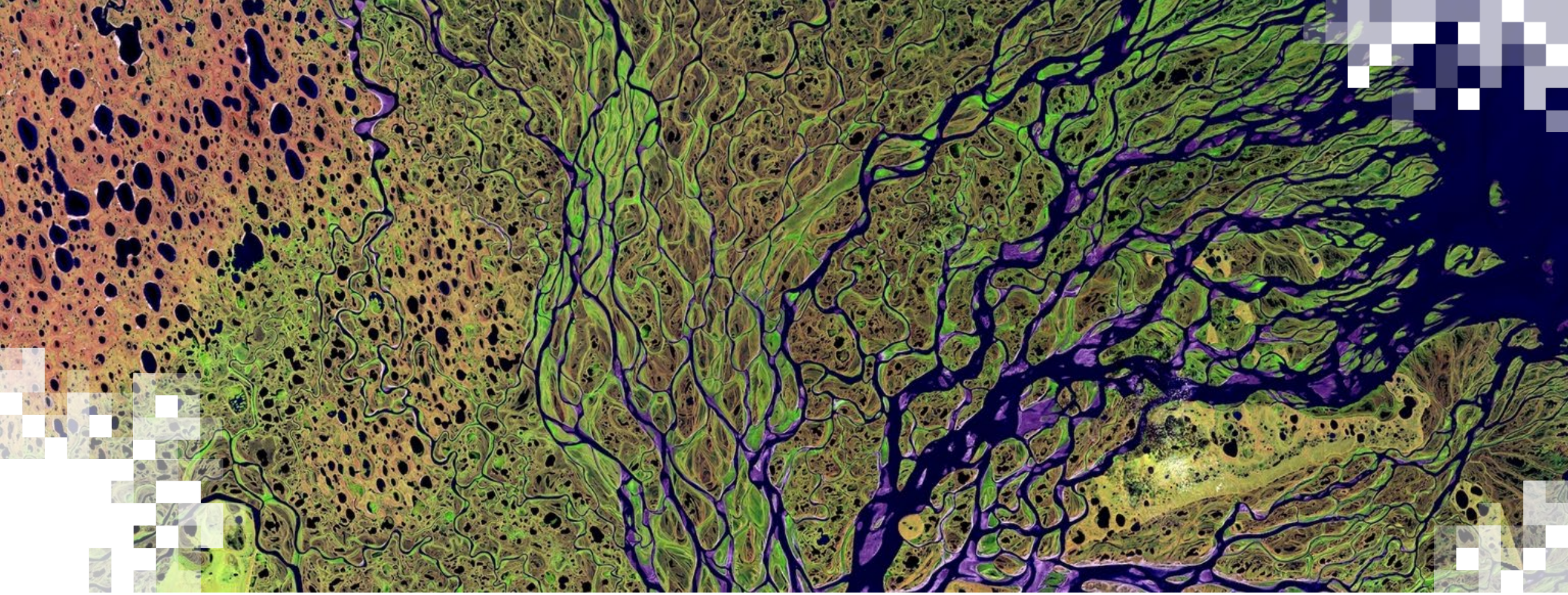
A VIIRS "true color image" uses visible wavelength bands I1, M4, & M3.

R = 0.640 µm

G = 0.555 µm

B = 0.488 µm





Demonstration and Exercises

Fire Cases

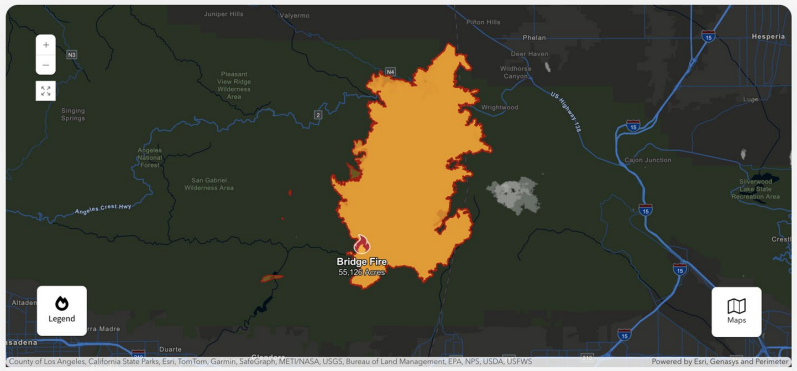
- California Bridge Fire ⟶ September 2024
- Democratic Republic of Congo ⟶ August – September 2024

California Bridge Fire

Bridge Fire Information

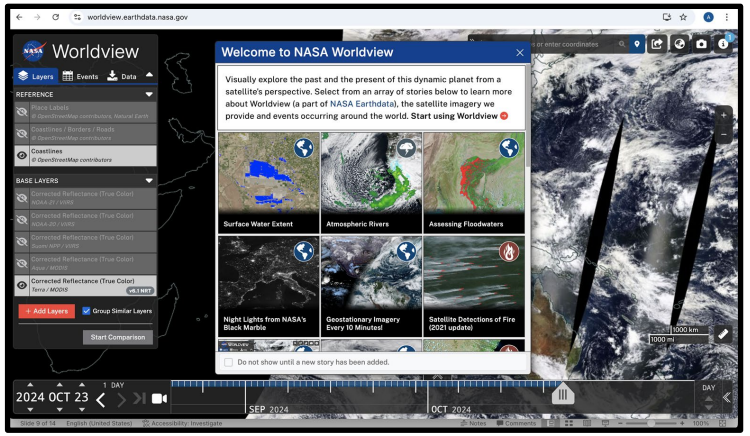
99% Contained 55,126 Acres 2 Counties: Los Angeles, San Bernardino

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

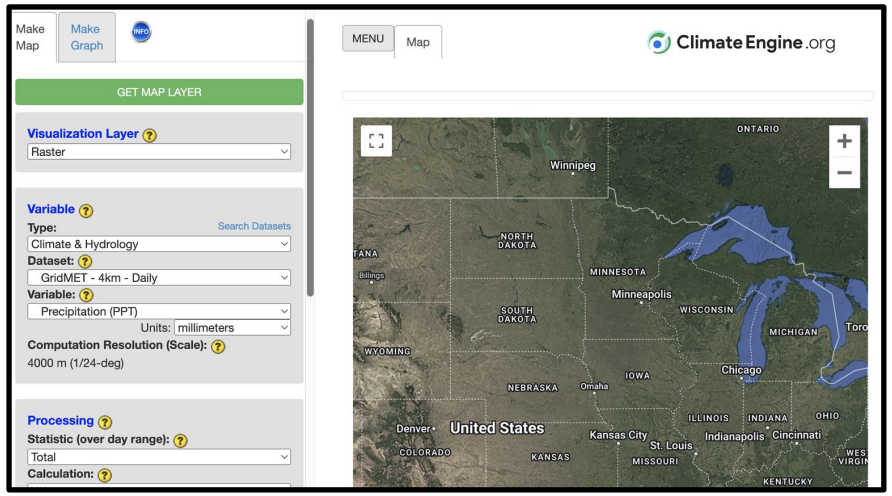


Date Started 09/08/2024 2:12 PM	**Last Updated** 10/21/2024 10:15 AM	**Cause** Under Investigation
Incident Maps 3D Map	**Admin Unit** Angeles National Forest	**Incident Management Team** No team assigned
Location Camp Bonita Road, East of Camp Williams [34.2396,-117.7625]	**Reports** Status reports	

NASA Worldview

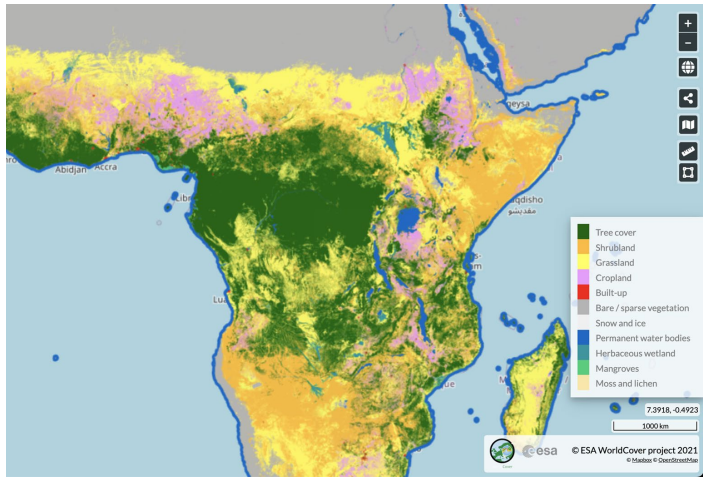


Climate Engine

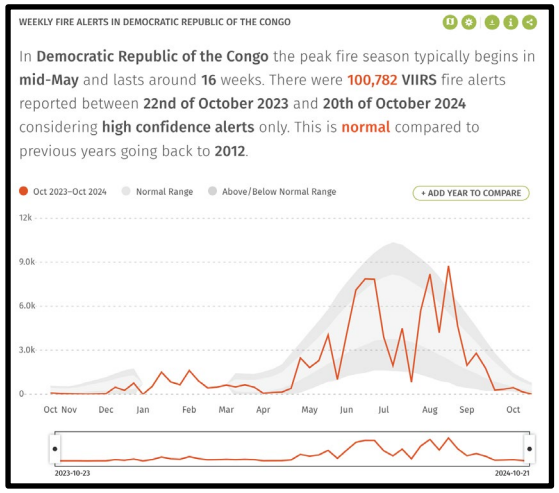


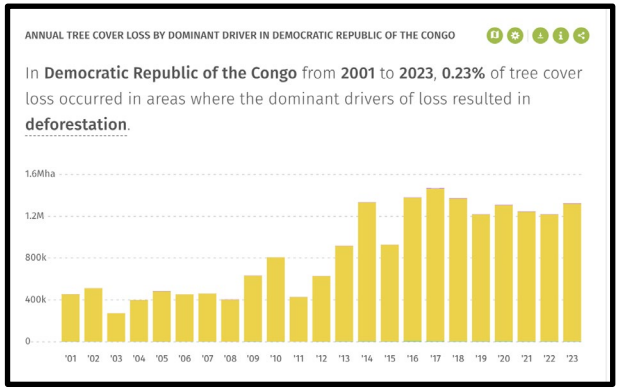
Fires in Democratic Republic of Congo (DRC)

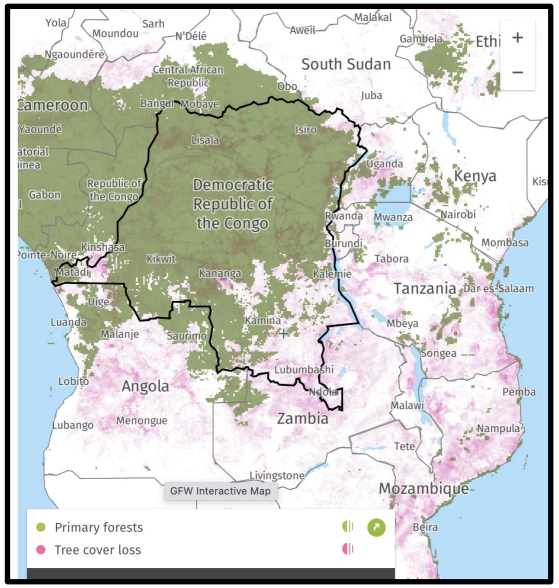
ESA World Cover



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

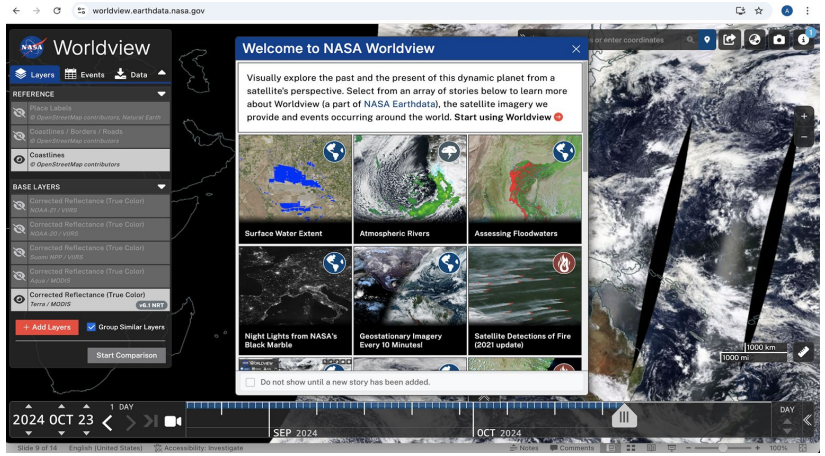
1. Go To NASA Worldview and click on **Add Layer.**
2. Type **Fires** in the Search Window.
3. Select the following from the data product list:

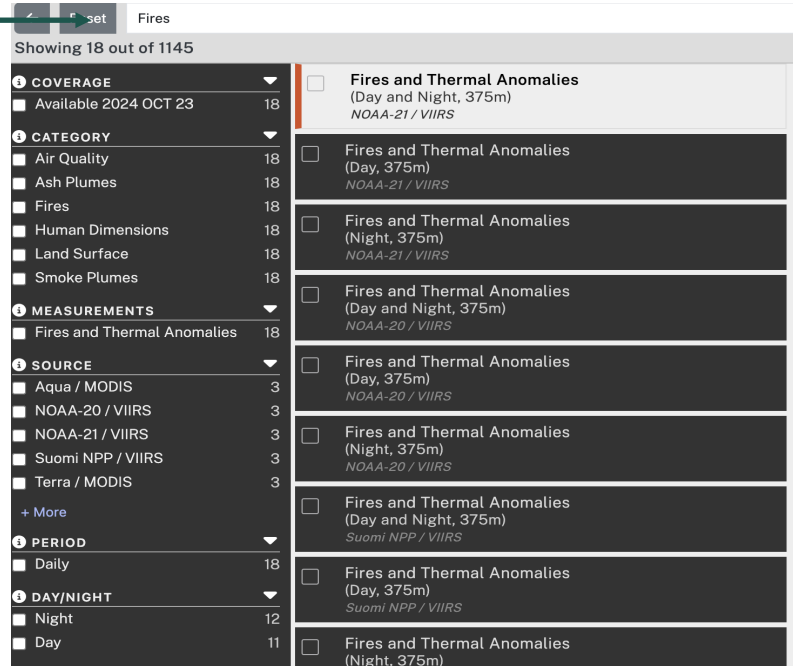
   Fires and Thermal Anomalies
   (Day and Night 375 m)
   NOAA-21 VIIRS

   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





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.

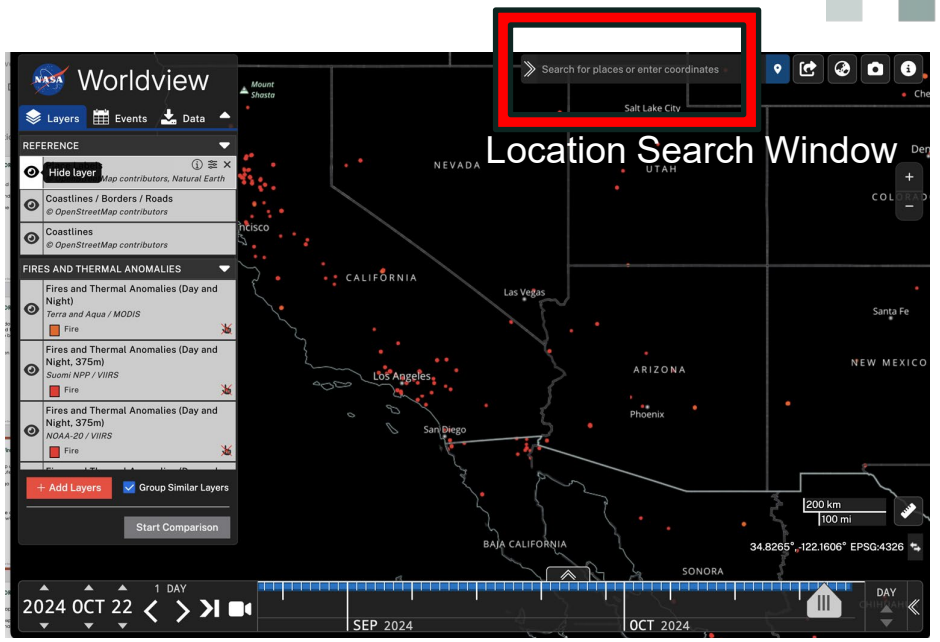
Exercise: Monitor Bridge Fire

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

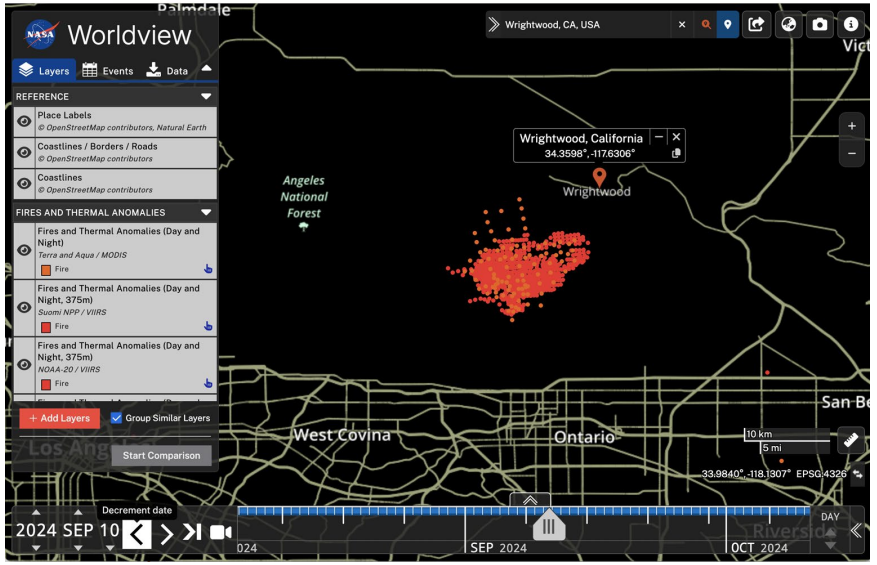
Exercise: Monitor Bridge Fire

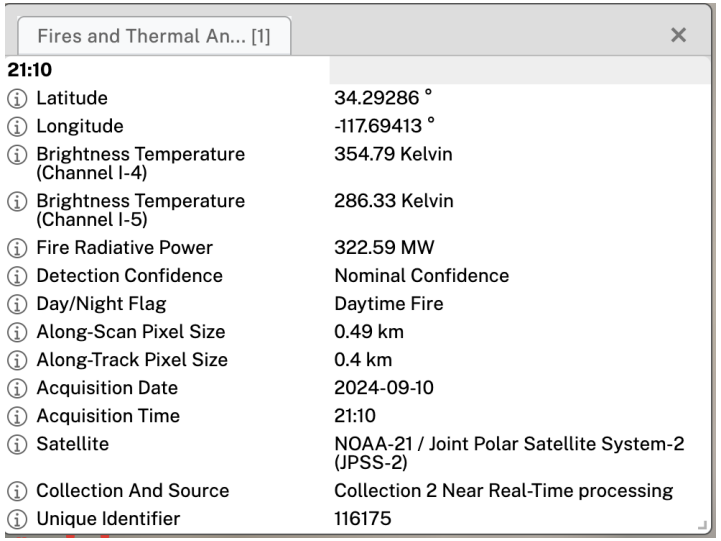
10. Using the ‘1 Day’ arrows move from 8 to 15 September 1 day at a time.

11. Which day do you see the maximum spread of fires?

12. Click on any fire spot (red dot) to see the details about the fire at that location.

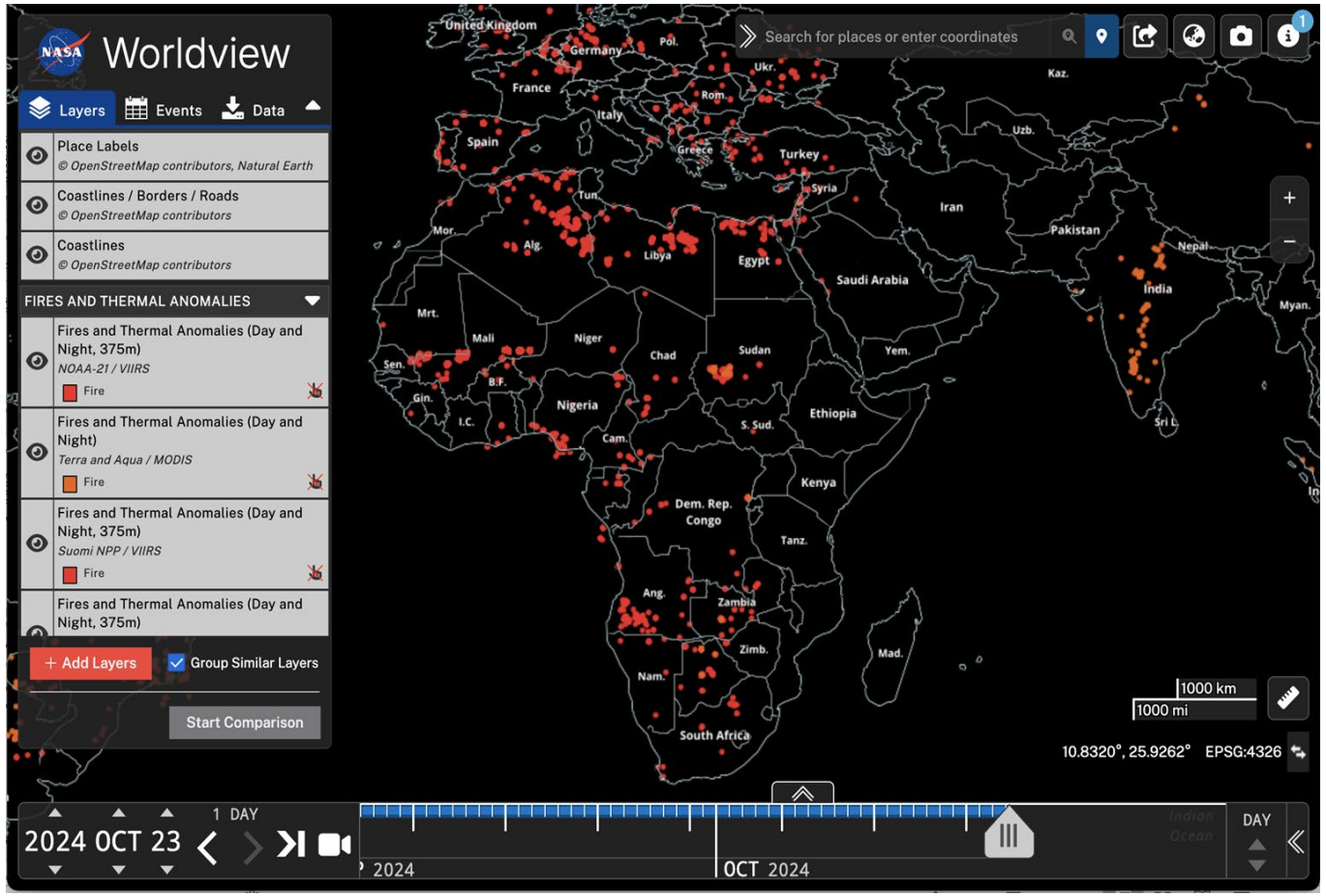
13. Now examine smoke by turning the true color images on from the **BASE LAYERS** – for example start with **Suomi NPP VIIRS** image on. Explore how smoke spreads between 8 to15 September.





Exercise: Monitor Fires in DRC

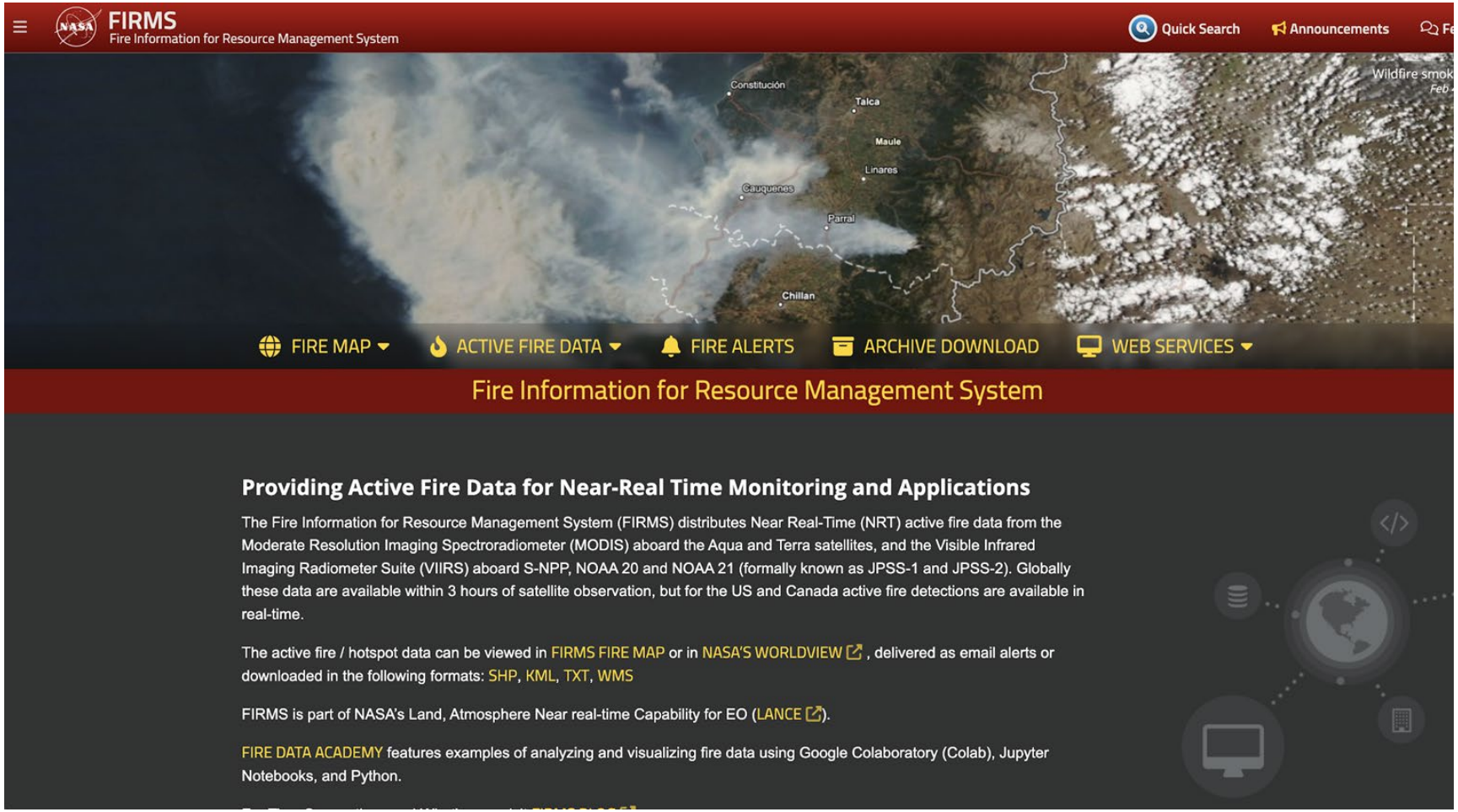
Repeat Steps 5–13 in Worldview but now zoom in on Africa / Democratic Republic of Congo and use the dates 20–31 August 2024.



Drag to move along the timeline

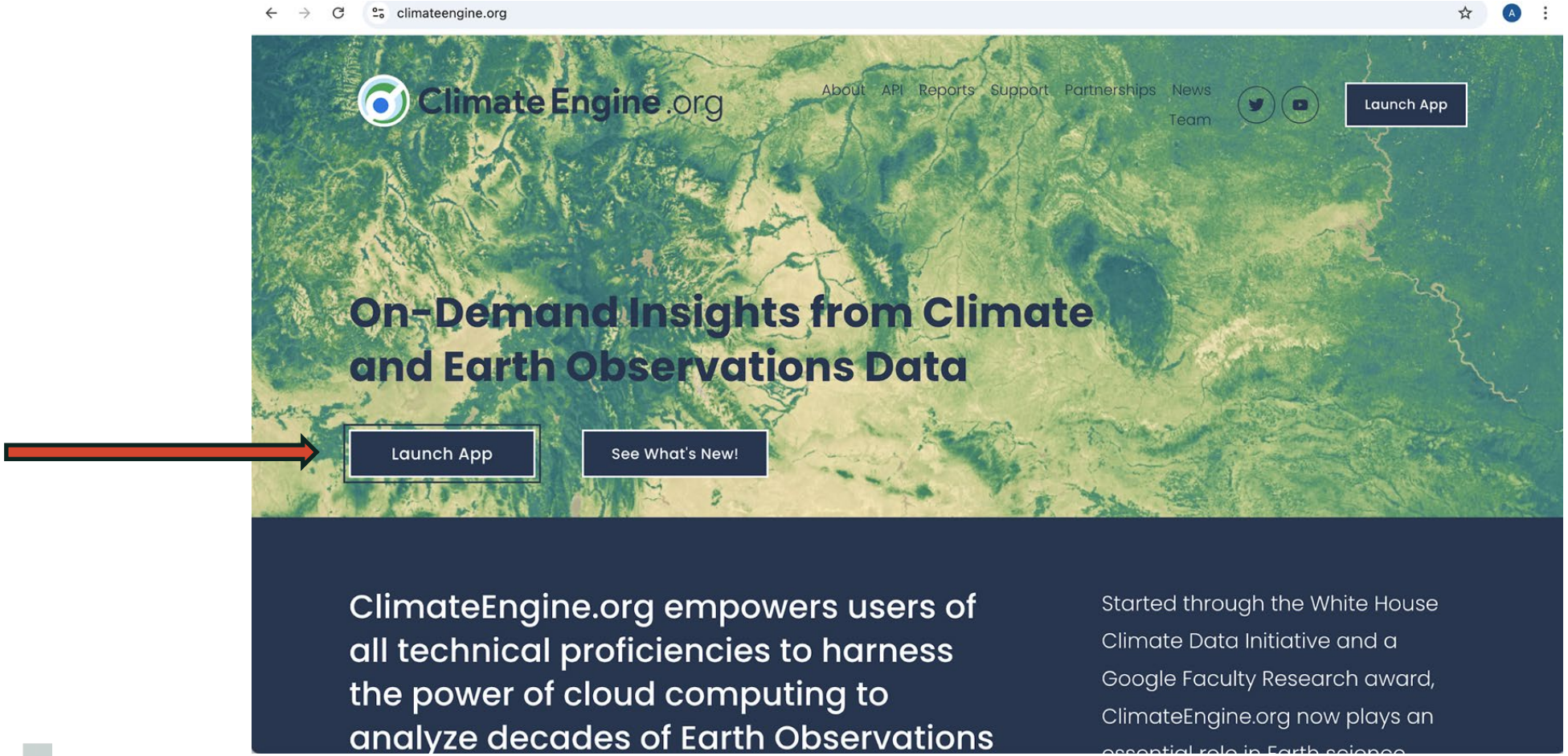
Demonstration: FIRMS

- Fire Information for Resource Management System (FIRMS)



Assess Pre- and Post-Fire Conditions using Climate Engine

- Climate Engine



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

Data Selection

Make Map | Make Graph

GET MAP LAYER

Visualization Layer

Raster

Variable

Search Datasets

Type: Remote Sensing

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

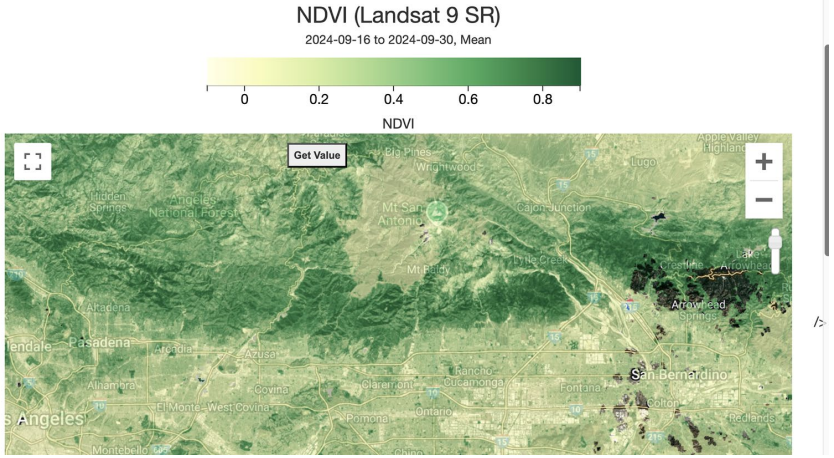
Custom Date Range

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

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

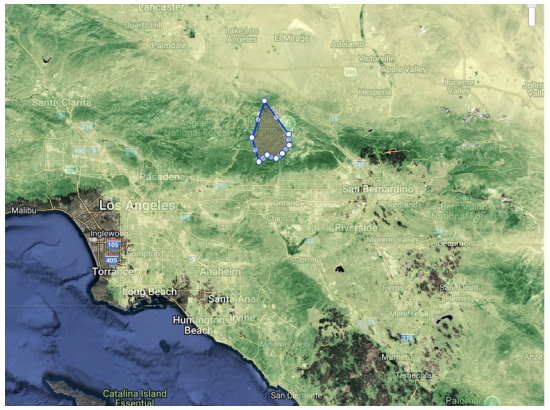
Custom Date Range

Start Date:
2024-08-01

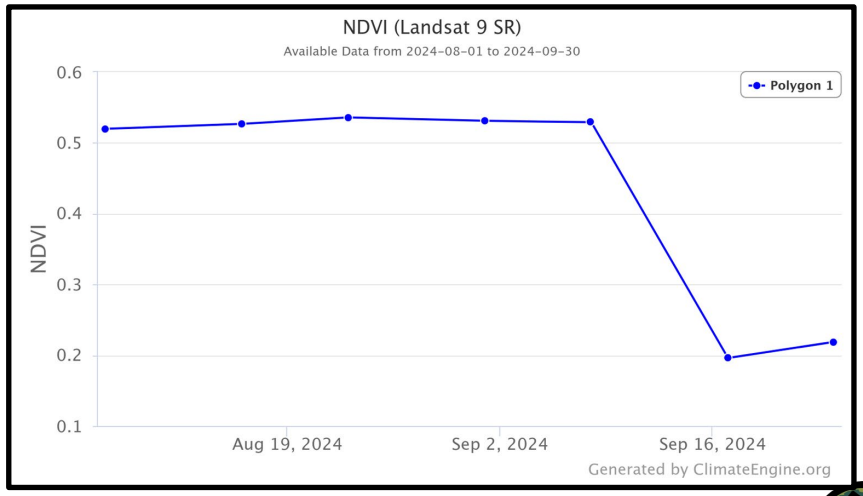
End Date:
2024-09-30

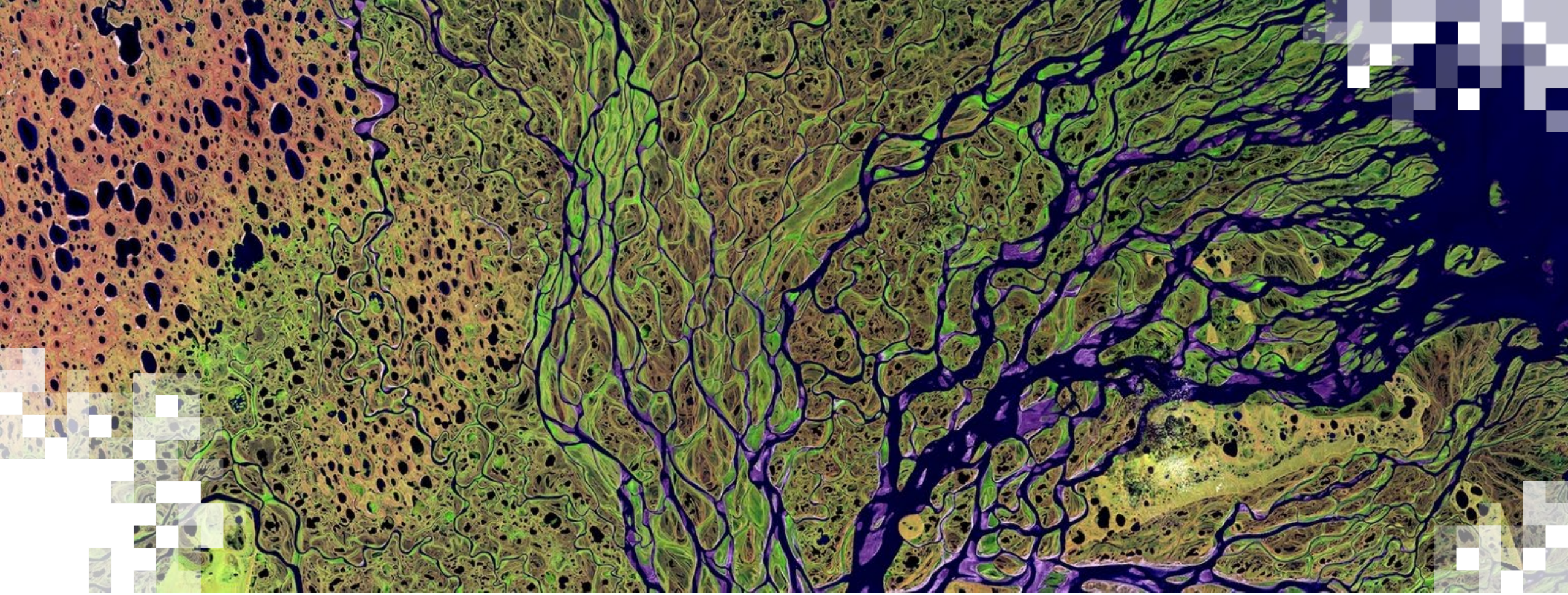
GET TIME SERIES

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 Helath

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

APPLIED REMOTE SENSING TRAINING PROGRAM
TRAIN - EMPOWER - ADVANCE

Thank You!