

Credit: TROPOMI, ESA, Copernicus, KNMI



NASA Earth Observatory and Worldview

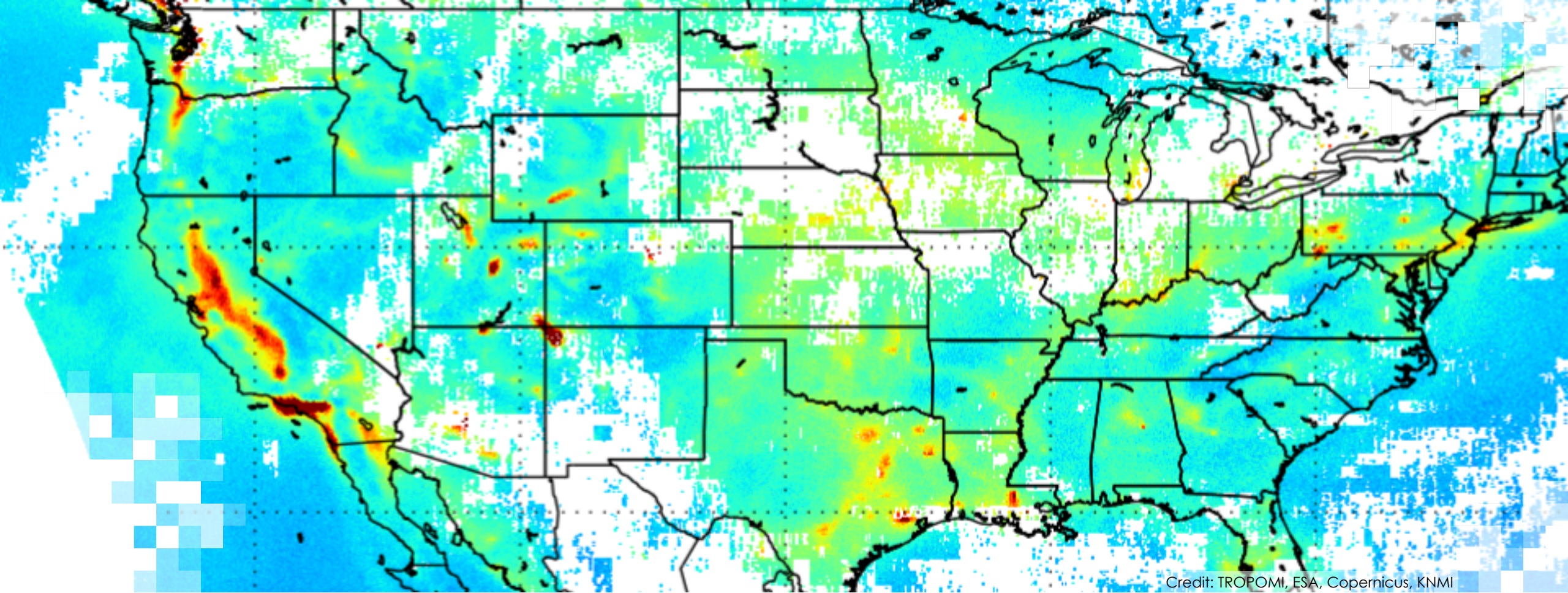
Melanie Follette-Cook and Pawan Gupta

Application of Satellite Observations for Air Quality and Health Exposure, Oct 9 and 11, 2019

Learning Objectives

By the end of this exercise, you will be:

- familiar with the NASA Earth Observatory and NASA Worldview websites
- able to generate and download imagery/animations for an event

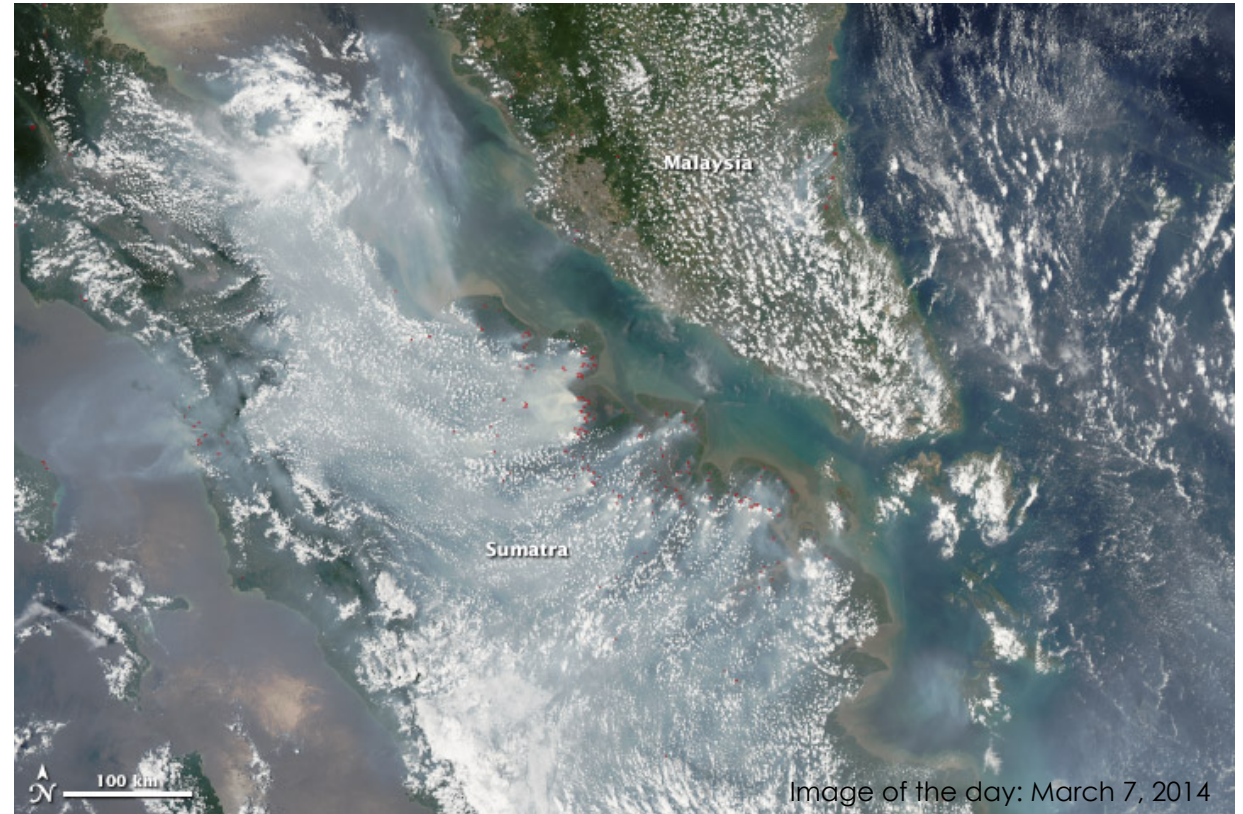


Earth Observatory

NASA Earth Observatory

<https://earthobservatory.nasa.gov/>

- Shares images and stories that result from NASA research and satellite missions
- Things you will find:
 - Image of the day
 - Research highlights
 - Blogs
 - Global maps



Step 1: Go to <http://earthobservatory.nasa.gov>



- Images:
 - Image of the day by date and/or topic
- Global Maps:
 - Monthly average maps of land, ocean, and atmosphere
- Articles:
 - News articles
- Blogs
 - Earth Matters, Notes from the Field, Climate Q&A, and Elegant Figures
 - EO Kids (for ages 9-14)

Step 2: Search for “Tracking Dust Across the Atlantic”



Tracking Dust Across the Atlantic

NASA earth observatory

Topics



Featured Article Published Aug 28, 2019

Earth – A Photo-Essay

NASA has a unique vantage point for observing the beauty and wonder of Earth and for making sense of it. The images in this book tell a story of a 4.5-billion-year-old planet where there is always something new to see.

Atmosphere

Land

Water

Snow and Ice


Step 3: Click on the Top Result





Search the Earth Observatory

Please use the search box below to search The Earth Observatory.

About 3,170 results (0.17 seconds)

[Tracking Dust Across the Atlantic](#)
<https://earthobservatory.nasa.gov/.../tracking-dust-across-the-atlantic>
 Aug 28, 2013 ... Hundreds of millions of tons of dust are picked up from the deserts of Africa and blown across the Atlantic Ocean each year. That dust helps ...

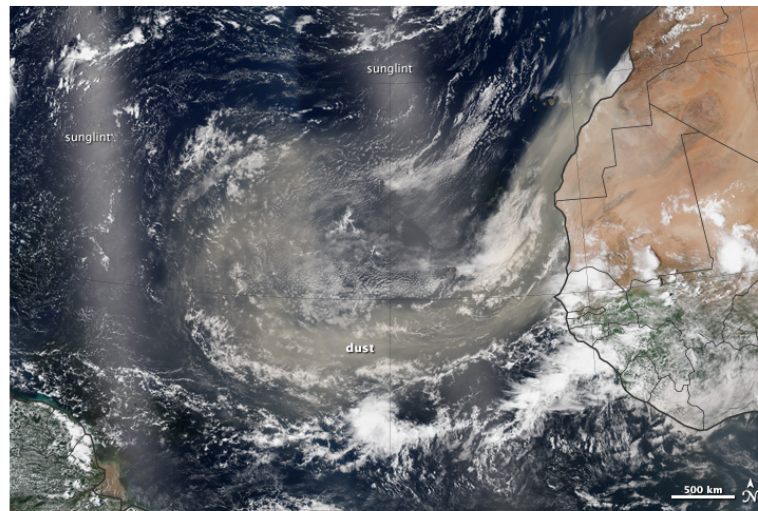
[Here Comes the Saharan Dust](#)
<https://earthobservatory.nasa.gov/.../here-comes-the-saharan-dust>
 Jun 30, 2018 ... The dust in the skies over the Caribbean and Southern United States has ... NASA Earth Observatory (2013) Tracking Dust Across the Atlantic.

[Images related to Tracking Dust Across the Atlantic](#)
<https://earthobservatory.nasa.gov/.../tracking-dust-across-the-atlantic>
 Dust Storm off Western Sahara. Saharan dust hovered over the Atlantic for several days in mid-January 2008. This image shows two different areas of dust ...

Step 4: Read Through the Result to See What Information is Available



Tracking Dust Across the Atlantic



July 31, 2013

JPEG

Hundreds of **millions of tons of dust** are picked up from the deserts of Africa and blown across the Atlantic Ocean each year. That dust helps build beaches in the Caribbean and fertilizes soils in the Amazon. It affects air quality in North and South America. And some say dust storms might play a role in the suppression of hurricanes and the decline of coral reefs.



Dust storms in mid-summer 2013 spanned the Atlantic Ocean, depositing particles in the Americas and perhaps suppressing hurricanes.

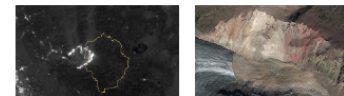
Image of the Day for August 29, 2013

Instruments:
Suomi NPP — OMPS
Suomi NPP — VIIRS

Image of the Day

Atmosphere

View more Images of the Day:

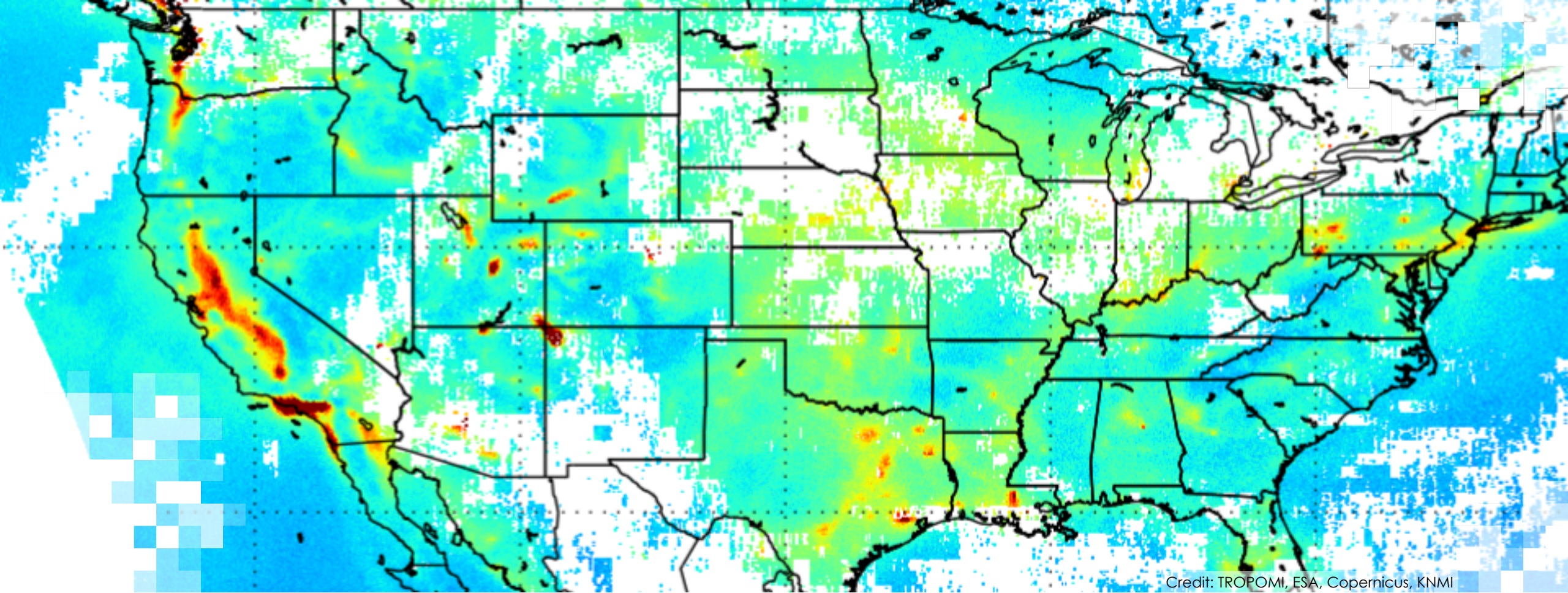


Exercise:

- Explore the Earth Observatory site for about 5 minutes. Specifically these sections:
 - Images
 - Global Maps
 - Blogs
- Using the search option, search for an air quality event in your area of interest. You can use keywords like smoke, dust, or air pollution, along with the name of a geographical area (for example, “Smoke and Fires in Australia”)
 - If you cannot find a relevant event in your region, look in another region
 - Select an event that can affect local or regional air quality
 - Note the date, satellite and sensor, region, event type, parameter displayed, and any other relevant information for your selected air quality event

Exercise Questions:

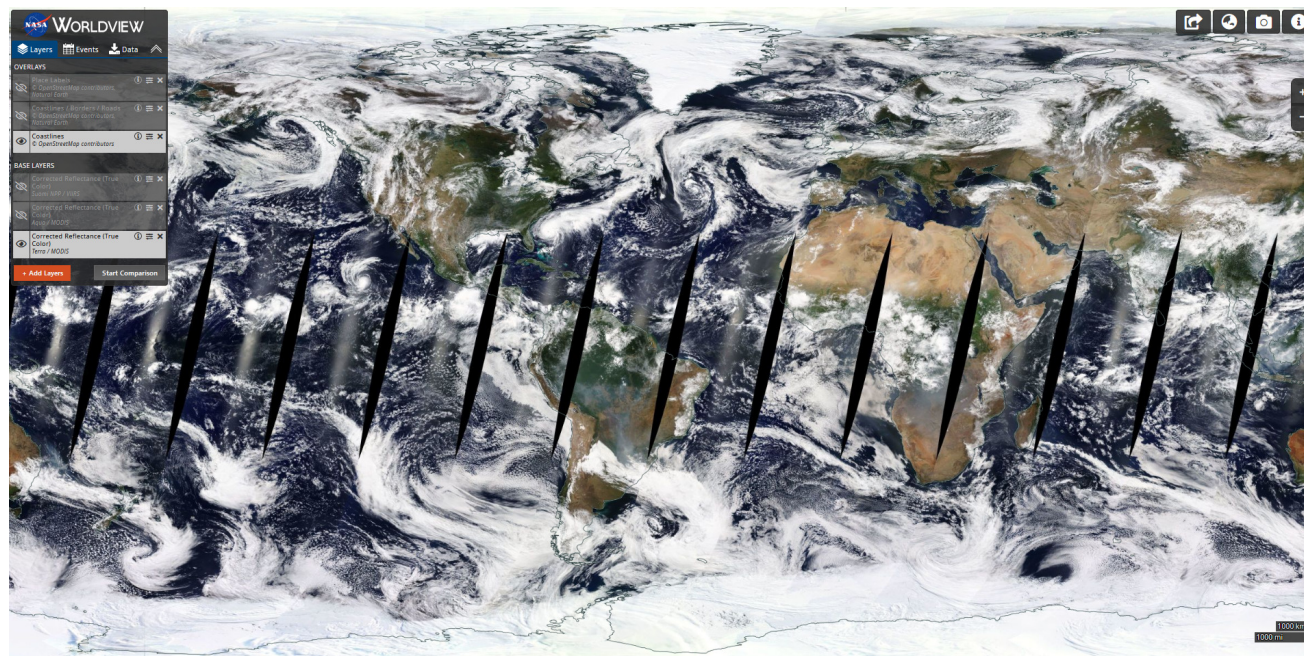
- Which satellite, sensor, and/or datasets have been used in the Earth Observatory story to highlight the selected air quality event?
- Based on visual inspection of the images in the Earth Observatory story, what type of air quality event (e.g., fire, dust storm, urban pollution, etc.) did you select?
- What are two potential applications of the images found on Earth Observatory?



Worldview

NASA Worldview

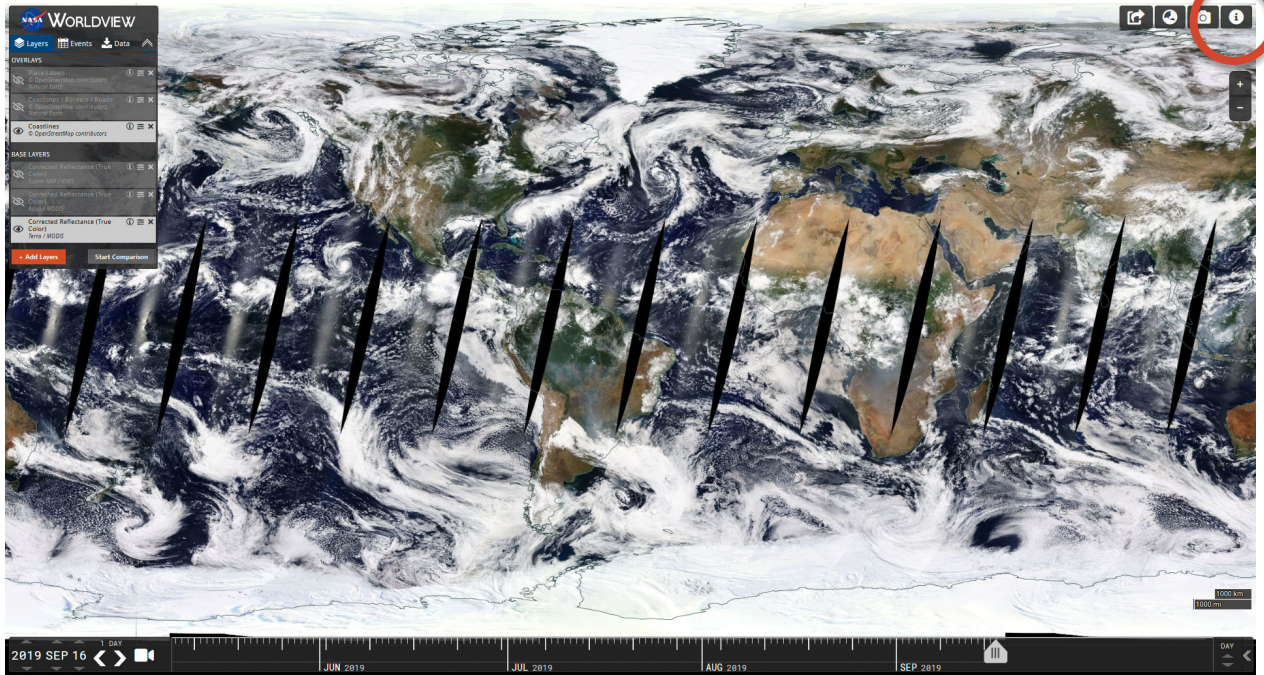
<https://worldview.earthdata.nasa.gov/>



- Application that allows the user to:
 - interactively browse, save, or share satellite imagery layers
 - download the data
- Some imagery available in near real time (NRT) or within three hours of observation

Worldview Tutorials

- Worldview tour can be accessed here



- HAQAST tutorial video, written tutorial (with downloadable pdf)
 - <https://haqast.org/nasa-tools/>
- Earthdata webinar
 - <https://www.youtube.com/watch?v=96Nt36euLJY>

Worldview Controls

The screenshot shows the NASA Worldview web application interface. On the left, a 'Layers' panel is visible with a list of layers including 'Coastlines' and 'Corrected Reflectance (True Color)'. Below this panel are buttons for '+ Add Layers' and 'Start Comparison'. The main area displays a satellite view of Earth with several black arrows pointing to different regions. At the bottom, a timeline slider is set to '2019 SEP 16' and shows months from 'JUN 2019' to 'SEP 2019'. On the right side, there are icons for sharing, zooming, and help.

Take a snapshot and download image

Share image

Change projection

Zoom in/out

Help /Info

View layers, events, Or download data

Add image layers

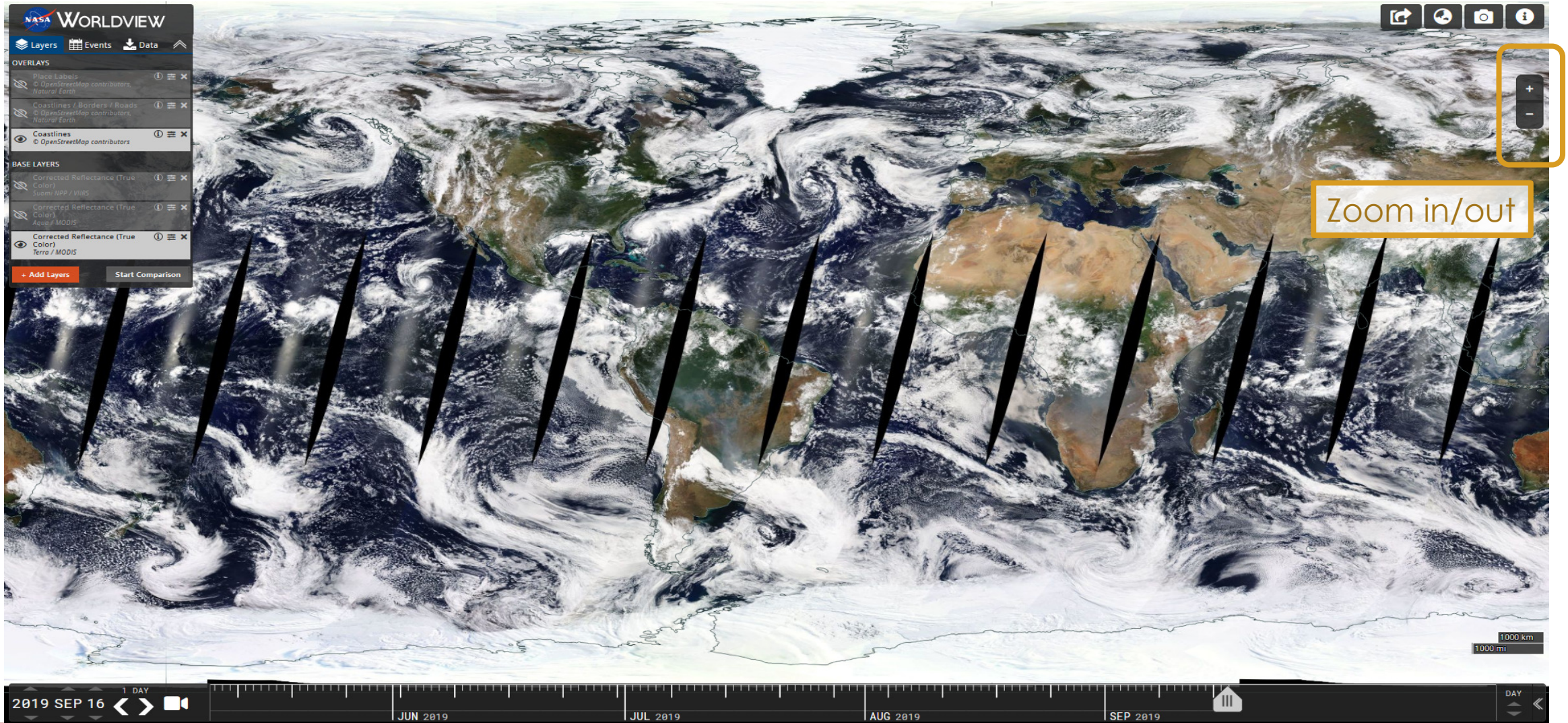
Choose date and time

Create an animation

Step 1: Select Date

The image shows the NASA WorldView web application interface. On the left, there is a 'Layers' panel with 'OVERLAYS' and 'BASE LAYERS' sections. The 'OVERLAYS' section includes 'Place Labels', 'Coastlines / Borders / Roads', and 'Coastlines'. The 'BASE LAYERS' section includes 'Corrected Reflectance (True Color) Suomi NPP / VIIRS', 'Corrected Reflectance (True Color) Aqua / MODIS', and 'Corrected Reflectance (True Color) Terra / MODIS'. A '+ Add Layers' button and a 'Start Comparison' button are at the bottom of the panel. The main view is a satellite image of Earth showing cloud patterns and landmasses. A yellow box with the text 'Choose date and time' is overlaid on the image. At the bottom, there is a timeline for the month of September 2019, with markers for '2019 SEP 16', 'JUN 2019', 'JUL 2019', 'AUG 2019', and 'SEP 2019'. A '1 DAY' interval is indicated. A scale bar at the bottom right shows '1000 km' and '1000 mi'. In the top right corner, there are icons for sharing, zooming, and information.

Step 2: Zoom in on the Region of Interest



Step 3: Explore the Three Base Layer Options

The screenshot displays the NASA WorldView interface. On the left, a sidebar menu is visible with the following sections:

- OVERLAYS**
 - Place Labels (OpenStreetMap contributors, Natural Earth)
 - Coastlines / Borders / Roads (OpenStreetMap contributors, Natural Earth)
 - Coastlines (OpenStreetMap contributors)
- BASE LAYERS**
 - Corrected Reflectance (True Color) (Suomi NPP / VIIRS)
 - Corrected Reflectance (True Color) (Aqua / MODIS)
 - Corrected Reflectance (True Color) (Terra / MODIS)

Below the menu are buttons for '+ Add Layers' and 'Start Comparison'. A yellow callout box with the text 'Click on an eye to view/hide a layer' points to the eye icons next to the 'Coastlines / Borders / Roads' and 'Coastlines' layers. The main area shows a satellite view of Earth with a timeline at the bottom ranging from 2017 SEP 05 to DEC 2017. A scale bar in the bottom right indicates 200 km and 100 mi.

Step 3: Explore the Three Base Layer Options

The screenshot displays the NASA WorldView interface. On the left, a sidebar menu is visible with the following sections:

- OVERLAYS**
 - Place Labels
 - Coastlines / Borders / Roads
 - Coastlines
- BASE LAYERS**
 - Corrected Reflectance (True Color) - Suomi NPP / VIIRS
 - Corrected Reflectance (True Color) - Aqua / MODIS
 - Corrected Reflectance (True Color) - Terra / MODIS

At the bottom of the sidebar, there are buttons for '+ Add Layers' and 'Start Comparison'. The main map area shows a satellite view of Earth with a grid overlay. A timeline at the bottom indicates the date '2017 SEP 05' and allows for navigation through months from July to December 2017. A scale bar in the bottom right corner shows 200 km and 100 mi. A red-bordered callout box on the right contains the text: 'What are the differences in the features between each of the sensors?' A yellow-bordered callout box on the left contains the text: 'Click on an eye to view/hide a layer'.

Step 3: Explore the Three Base Layer Options

The screenshot displays the NASA WorldView interface. On the left, a sidebar contains a 'LAYERS' panel with 'OVERLAYS' and 'BASE LAYERS' sections. The 'OVERLAYS' section includes 'Place Labels', 'Coastlines / Borders / Roads', and 'Coastlines'. The 'BASE LAYERS' section includes three 'Corrected Reflectance (True Color)' options from different satellite sensors: Suomi NPP / VIIRS, Aqua / MODIS, and Terra / MODIS. A '+ Add Layers' button and a 'Start Comparison' button are at the bottom of the sidebar. The main map area shows a satellite view of the Pacific Northwest coast of the United States, with a semi-transparent grid overlay. In the bottom left, a timeline shows the date '2017 SEP 05' and navigation arrows. A yellow box highlights the 'Create an animation' button, which is represented by a camera icon. A scale bar in the bottom right indicates 200 km and 100 mi.

Step 3: Explore the Three Base Layer Options

The screenshot displays the NASA WorldView web application interface. On the left side, there is a vertical menu with the following sections:

- OVERLAYS**
 - Place Labels (© OpenStreetMap contributors, Natural Earth)
 - Coastlines / Borders / Roads (© OpenStreetMap contributors, Natural Earth)
 - Coastlines (© OpenStreetMap contributors)
- BASE LAYERS**
 - Corrected Reflectance (True Color) (Suomi NPP / VIIRS)
 - Corrected Reflectance (True Color) (Aqua / MODIS)
 - Corrected Reflectance (True Color) (Terra / MODIS)

Below the menu is a red button labeled "+ Add Layers" and a grey button labeled "Start Comparison". A yellow rectangular box is drawn around the "+ Add Layers" button. Another yellow rectangular box is overlaid on the map area, containing the text "Add image layers".

The main map area shows a satellite view of the Earth, centered on the Pacific Ocean and the western United States. A timeline at the bottom indicates the date "2017 SEP 05" and allows for navigation between months from July to December 2017. A scale bar in the bottom right corner shows "200 km" and "100 mi".

Step 5: Add a Layer

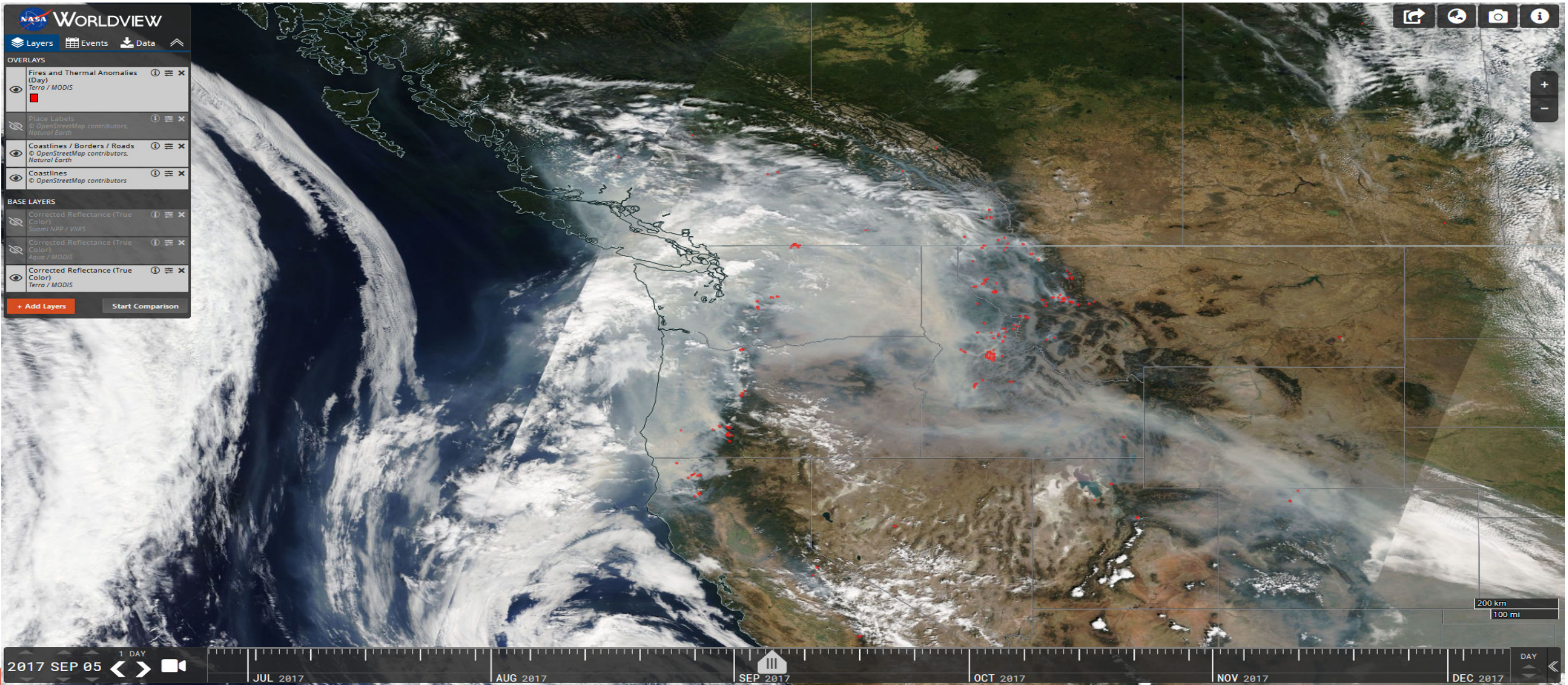
The screenshot displays the NASA WorldView interface. On the left, a sidebar shows 'OVERLAYS' and 'BASE LAYERS' with various map layers. The main area is a satellite map of a coastal region. A central panel is open, showing a search bar and two tabs: 'Hazards And Disasters' and 'Science Disciplines'. The 'Science Disciplines' tab is active, displaying a grid of layer categories with their respective icons and lists of available layers. A yellow box highlights the 'Fires and Thermal Anomalies' layer in the 'Fires' category. At the bottom, a timeline shows the date '2017 SEP 05' and navigation controls for time and zoom.

Category	Available Layers
All	Absolute Dynamic Topography, Aerosol Index, Aerosol Optical Depth, Aerosol Albedo, Albedo, Amphibian Richness
Air Quality	Aerosol Index, Aerosol Optical Depth, Carbon Monoxide, Corrected Reflectance, Dust, Fires and Thermal Anomalies
Ash Plumes	Aerosol Index, Aerosol Optical Depth, Corrected Reflectance, Fires and Thermal Anomalies, Human Built-up And Settlement Extent, Land Surface Reflectance
Drought	Corrected Reflectance, Dams, Drought Hazard, Human Built-up And Settlement Extent, Land Surface Reflectance, Land Surface Temperature
Dust Storms	Aerosol Index, Aerosol Optical Depth, Dust, Corrected Reflectance, Human Built-up And Settlement Extent, Land Surface Reflectance
Fires	Aerosol Index, Fires and Thermal Anomalies, Carbon Monoxide, Corrected Reflectance, Earth at Night
Floods	Corrected Reflectance, Cloud Fraction, Cloud Multi Layer Flag, Cloud Phase, Cloud Pressure, Cloud Effective Radius
Severe Storms	Corrected Reflectance, Cloud Fraction, Cloud Multi Layer Flag, Cloud Phase, Cloud Pressure, Cloud Effective Radius
Shipping	Corrected Reflectance, Brightness Temperature, Land Surface Reflectance, Radiance, Sea Ice, Sea Ice Brightness Temperature
Smoke Plumes	Aerosol Index, Aerosol Optical Depth, Carbon Monoxide, Corrected Reflectance, Fires and Thermal Anomalies, Human Built-up And Settlement Extent
Vegetation	Corrected Reflectance, Forests, Mangrove, Freeze/Thaw, Fraction of Photosynthetically Active Radiati..., Gross Primary Productivity, Heterotrophic Respiration
Other	Areas of No Data (mask), Blue Marble, Brightness Temperature, Chlorophyll a, Dams, Earth at Night

Step 5: Add a Layer

The screenshot displays the NASA WorldView interface. On the left, the 'OVERLAYS' panel shows the 'Fires and Thermal Anomalies (Day)' layer selected. The main map area shows a satellite view of a coastal region. On the right, a 'Categories / Fires' panel is open, listing various fire-related layers. The 'Fires and Thermal Anomalies' section is expanded, showing options for 'Day and Night', 'Day', and 'Night'. The 'Day' option is checked and highlighted with a yellow box. Below this, the 'Orbital Tracks' section has 'Ascending/Night' and 'Descending/Day' options. A description for the 'MODIS (Terra/Aqua, Terra & Aqua) Fire and Thermal Anomalies' layer is visible, stating 'Temporal Coverage: 8 May 2012 - present' and '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...'. The bottom of the interface features a timeline for the month of September 2017, with the date '2017 SEP 05' selected. A scale bar in the bottom right corner indicates 200 km and 100 mi.

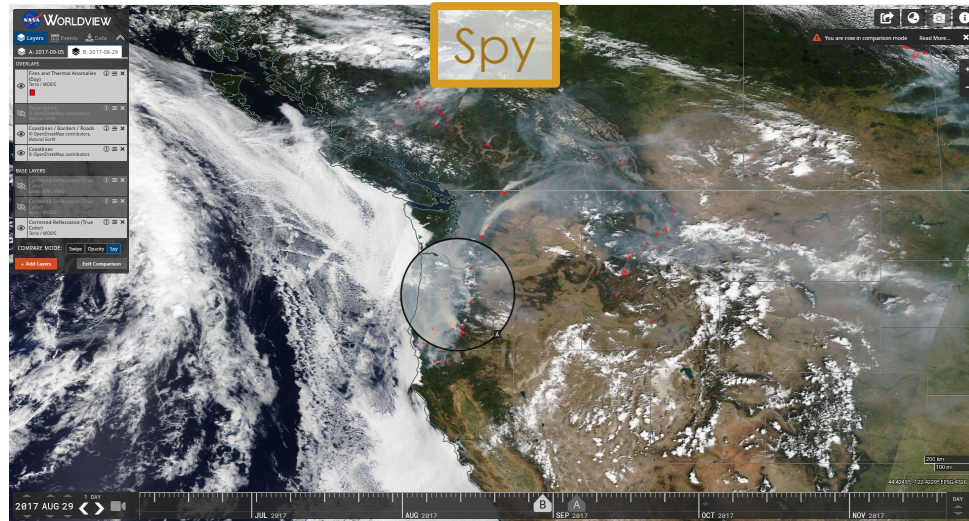
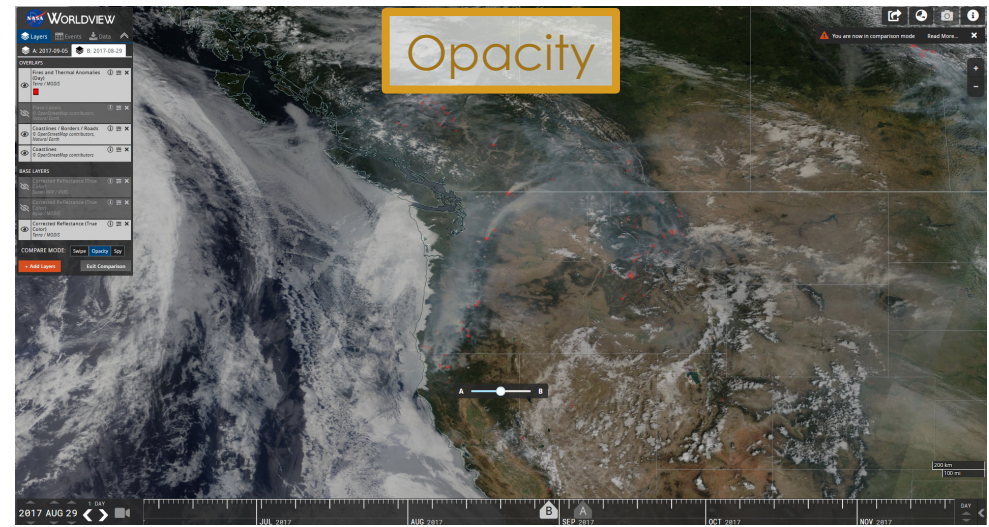
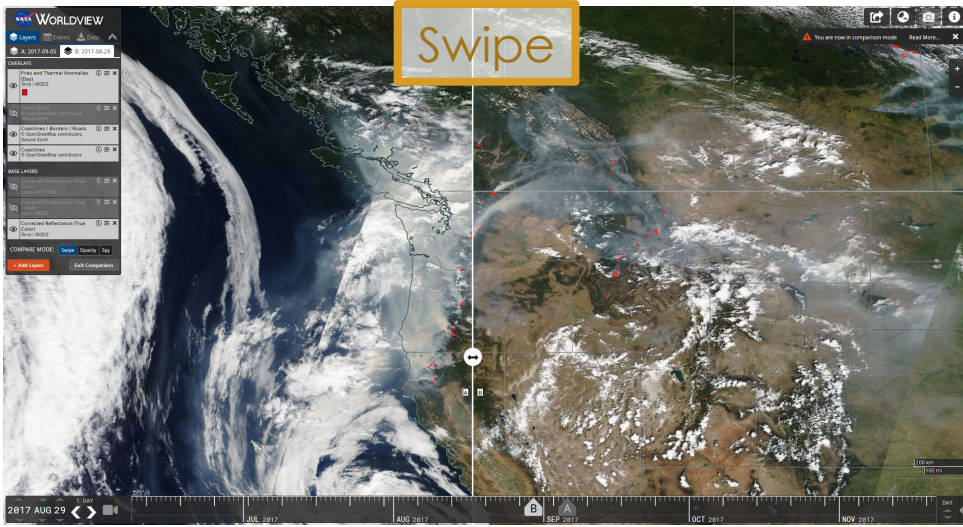
Step 5: Add a Layer



Step 6: Compare Two Days

The screenshot displays the NASA WorldView web application interface. The main map shows a satellite view of North America with a semi-transparent overlay of a different day's data. The left sidebar contains a 'Layers' panel with two sections: 'OVERLAYS' and 'BASE LAYERS'. In the 'OVERLAYS' section, the 'Fires and Thermal Anomalies (Day)' layer is selected and highlighted with a red square. Below it, the 'Start Comparison' button is highlighted with a yellow box. The 'BASE LAYERS' section includes 'Corrected Reflectance (True Color)' for Suomi NPP/VIIIRS, Aqua/MODIS, and Terra/MODIS. The bottom of the interface features a timeline navigation bar with a date selector set to '2017 SEP 05' and a '1 DAY' interval. A scale bar in the bottom right corner indicates 200 km and 100 mi. The top right corner contains standard map controls like zoom in/out and a home button.

Step 6: Compare Two Days



Exercise:

- Use the Date Selection at the bottom of the page and go to the date of an air quality event
 - Suggestions:
 - British Columbia Fires 2017, Sep 5, 2017
 - Mount Sinabung, Indonesia volcanic eruption, Feb 19, 2018
 - Camp Fire, CA, Nov 8, 2018
- Zoom in on the region of the air quality event using the '+' and '-' sign on the top right side of the page
- Explore the different base layer options (top, left side of the page)
- Change the date to see the progress of the event over several days. You can use the animation feature (camera sign on bottom left side) to create an animation
- Add an additional interesting layer (e.g. MODIS/VIIRS AOD, fire detection, OMPS SO₂)

Exercise Questions:

- What additional information did you learn from the Worldview portal that wasn't on the Earth Observatory page?
- What additional satellite layer did you add? What additional information did it provide?
- You can use the 'share this map' feature (on the top right corner of the page) to copy the link and paste it here: