## Using Satellites to Track Pollution

**Find a satellite image of your area:**

1. To access daily true color images of much of the world, go to the LANCE Rapid Response System: http://lance.nasa.gov/imagery/rapid-response/
2. Under "quick links" on the right side of the page, click on “subsets”: http://lance.nasa.gov/imagery/rapid-response/subsets/.
3. The page shows list of subset areas. Click on "North America" or your region. If your location is not listed, click on "other."
4. Click on the map over your location.
5. This will bring up the most recent images of the region. Click on previous to browse back to earlier days.
6. Click on the photo-like image (true color) on the left. A full-screen image will load.
7. Under vector options (above the image), select “fires + borders” from the drop-down menu and click "submit."
8. Click on 250m to get the most detailed image available
9. Click on "download a KMZ file for Google Earth.
10. Go to the downloaded file on your computer and open it. It should automatically open in Google Earth. If it does not, right click on the file and select "open with Google Earth."
11. Go to your location. (If you set up a placemarker earlier, you can double-click on it in the left menu under "Places," and Google Earth will take you to your location.
12. What are the conditions at your location? Do you see dust, haze, clouds, or clear ground? Record your observations in the data sheet.
13. If you see haze, dust, or smoke, can you identify a point source? Is pollution entering your area from somewhere else?

***Interpreting Satellite Images***

To improve air quality, it is important to know what contributes to polluting the air. Haze comes from a variety of sources. Your skies may be hazy from local traffic, or industry such as for example coal burning power plants, or the pollution may be coming in from somewhere else farther away. Satellite images help identify large areas of pollution caused by fires, dust or sand storms, volcanic eruptions, large industrial sources, or the transport of man-made pollution from other regions. Smaller sources, such as small industries or local roads won't be visible in satellite images.

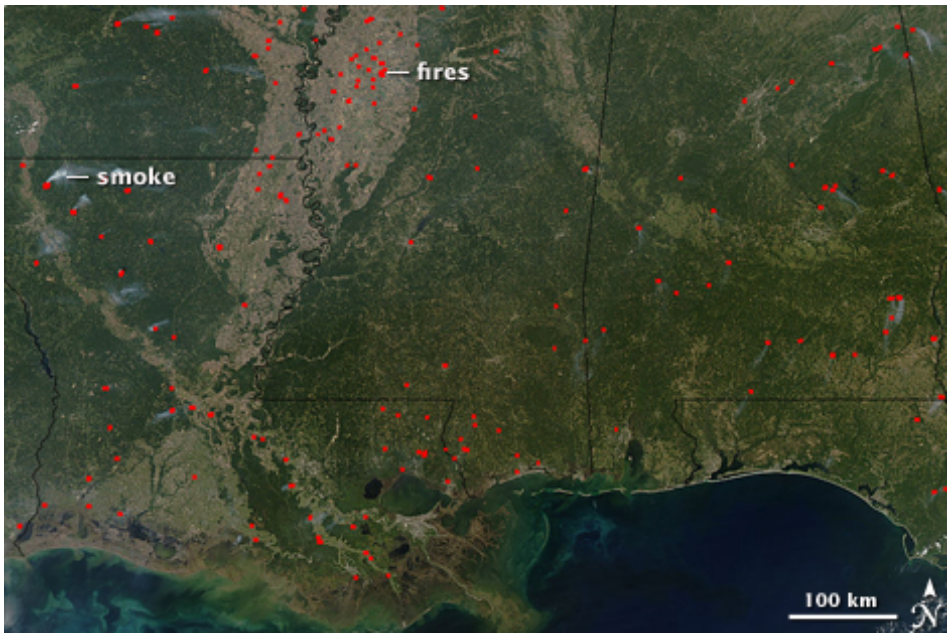
Photo-like, true color images provide a very simple way to see if smoke, dust, or haze is being transported into your region. MODIS Rapid Response System provides true color images of much of the world. MODIS stands for the Moderate Resolution Imaging Spectroradiometer. It is an instrument that flies on two NASA satellites, Terra and Aqua. Both satellites orbit the Earth from pole to pole, so that each MODIS instrument sees the entire Earth every day. Terra MODIS passes overhead in the mid-morning local time,

while Aqua captures images from the early afternoon. The MODIS Rapid Response System typically provides images within 4-6 hours after the satellite acquires them.

Haze is usually gray-white and very uniform in texture. Dust tends to be tan, though the color varies depending on the type of soil that is being picked up by the wind. Smoke ranges from brown to gray-white. It is not always possible to identify what kind of pollution you are seeing, since smoke haze and dust can look alike, but you can look for potential sources in the satellite image.

Smoke

MODIS records the location of fires on the ground by observing unusual hot spots. The instrument doesn't see every fire, but it will see large fires that may be contributing to air pollution. In these images, fires are represented with red dots.



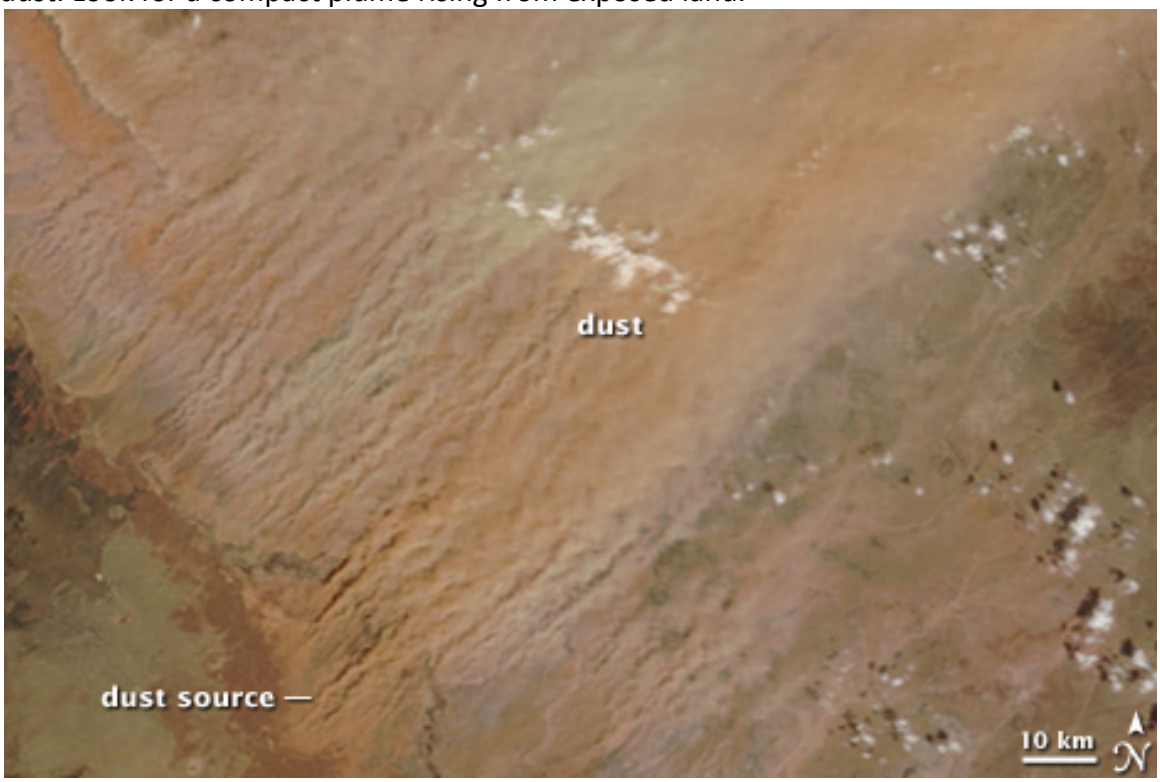

*Red dots mark the locations of fires burning in the southern United States on October 15, 2005. Because there are several fires scattered across a wide region, they are likely agricultural fires, set to manage vegetation. Some of the fires produced white-gray plumes of smoke. Even though the fires are small, widespread burning can seriously impact regional air quality.*

Dust

Not all dust storms are visible, but very large storms that last for several hours or days can be seen. The most common source of dust globally is the Sahara Desert. These giant storms sweep off West Africa and occasionally reach Florida and the Caribbean. By the time the dust reaches Florida, it is diffuse enough that it is difficult to see. If you live in Florida or the Caribbean, and you suspect that Saharan Dust may be clouding your skies, click on the images of northwest Africa and look back through the previous week to see

if dense plumes of dust are coming off the continent. If you see a storm moving towards Florida, you can suggest that dust may be a contributing factor to the air quality.

Other dust storms may have a local source. Often dust storms come from a small area of exposed soil. Click on 250m to see the most detail possible in the image and look at the point from which the plume is originating. You may be able to identify the source of the dust. Look for a compact plume rising from exposed land.




*Dust sweeps northeast from distinct sources in central Arizona in this image from April 3, 2009. The dust plumes are tan and orange, depending on the type of soil that is being pulled into the air.*

<u>Haze</u>

Haze from cars and power plants is gray-white in true color images. It is difficult to pin-point a single source, but you can see where the haze is.

*A band of haze hung over the southeastern United States on August 5, 2002. The haze is gray compared to the bright white clouds to the north. Haze blurs the ground beneath it. Ground features are distinct where skies were clearer (lower right).*

**Overlay air quality data on Google Earth:**

Satellites see pollutants in the entire atmosphere. The pollutants you see in the satellite image could be high in the atmosphere. To find out if the pollution you are seeing in the satellite image is near the ground, you need to compare ground measurements to the satellite measurements.

1. To get ground measurements, go to AIRNow: http://airnow.gov.
2. Click on the AIRNow map, and then, under Resources in the right menu, select, AQI in Google Earth: http://cfpub.epa.gov/airnow/index.cfm?action=google_earth.index
3. Follow the directions on the page to download the Air Quality Index into Google Earth. The file should open on top of the MODIS image.
4. The data points that are exported are current measurements. Click on the circle nearest your observation location and note the time and date the data were updated. Does the date correspond to the date the satellite image was taken?
5. Do the EPA ground measurements match the satellite image? If so, you can attribute at least some of the pollution to the source identified in the satellite image.