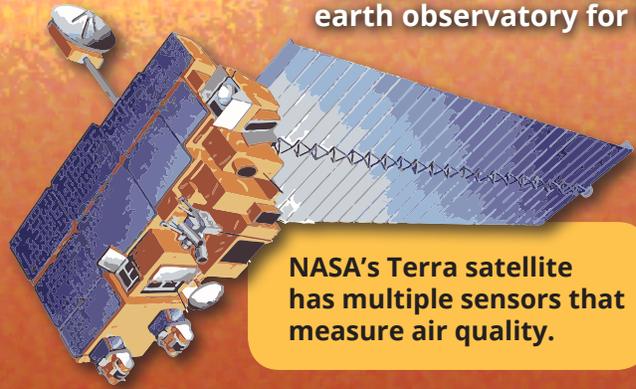


Air Pollution

Seeing Small Specks from Space



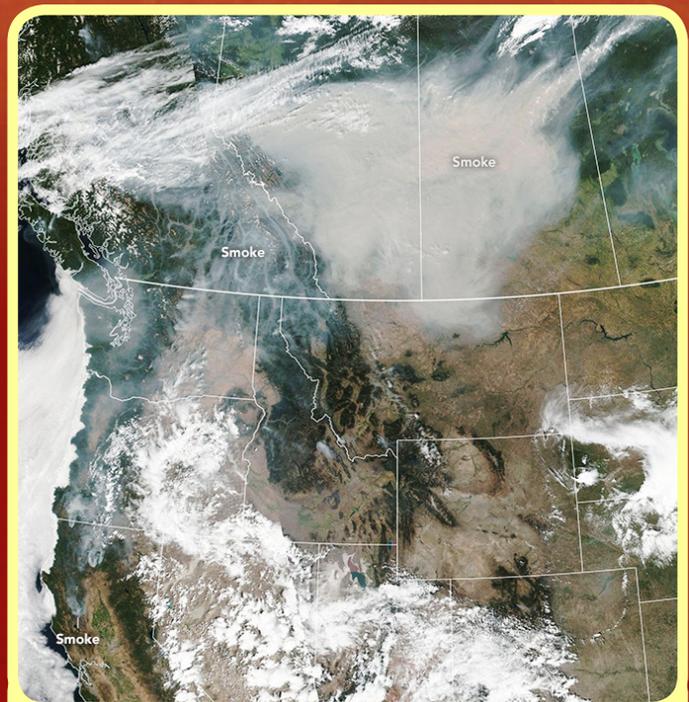
NASA's Terra satellite has multiple sensors that measure air quality.

Air pollution causes health problems for millions of people every year. A particularly dangerous kind of pollution is called particulate matter. These particles come from cars, factories, power plants, wildfires, and other sources. The size is what makes them so harmful. Some are small enough to get into our lungs and pass into the bloodstream. Many scientific studies have shown that this type of air pollution can lead to heart attacks, strokes, lung cancer, and many other diseases, and can increase the chance of having an asthma attack.



Size of particulate matter compared to a human hair.

For all of these reasons, it is important to measure the amount of particulate matter in the air. Satellites can measure air pollution over large areas, not just where ground sensors are located. Observing from space can help us track pollution as winds blow it far from its original source – from the cities to the countryside, and even from one continent to another.



One source of air pollution, wildfire smoke, can spread across large areas and make air quality poor. In August, 2018 particles from fires in Canada and the western United States affected air quality as far away as Wisconsin.

Vocabulary:



particulate matter (PM_{2.5}) -

Air pollution particles that are less than 2.5 micrometers in diameter, much smaller than the width of a human hair.

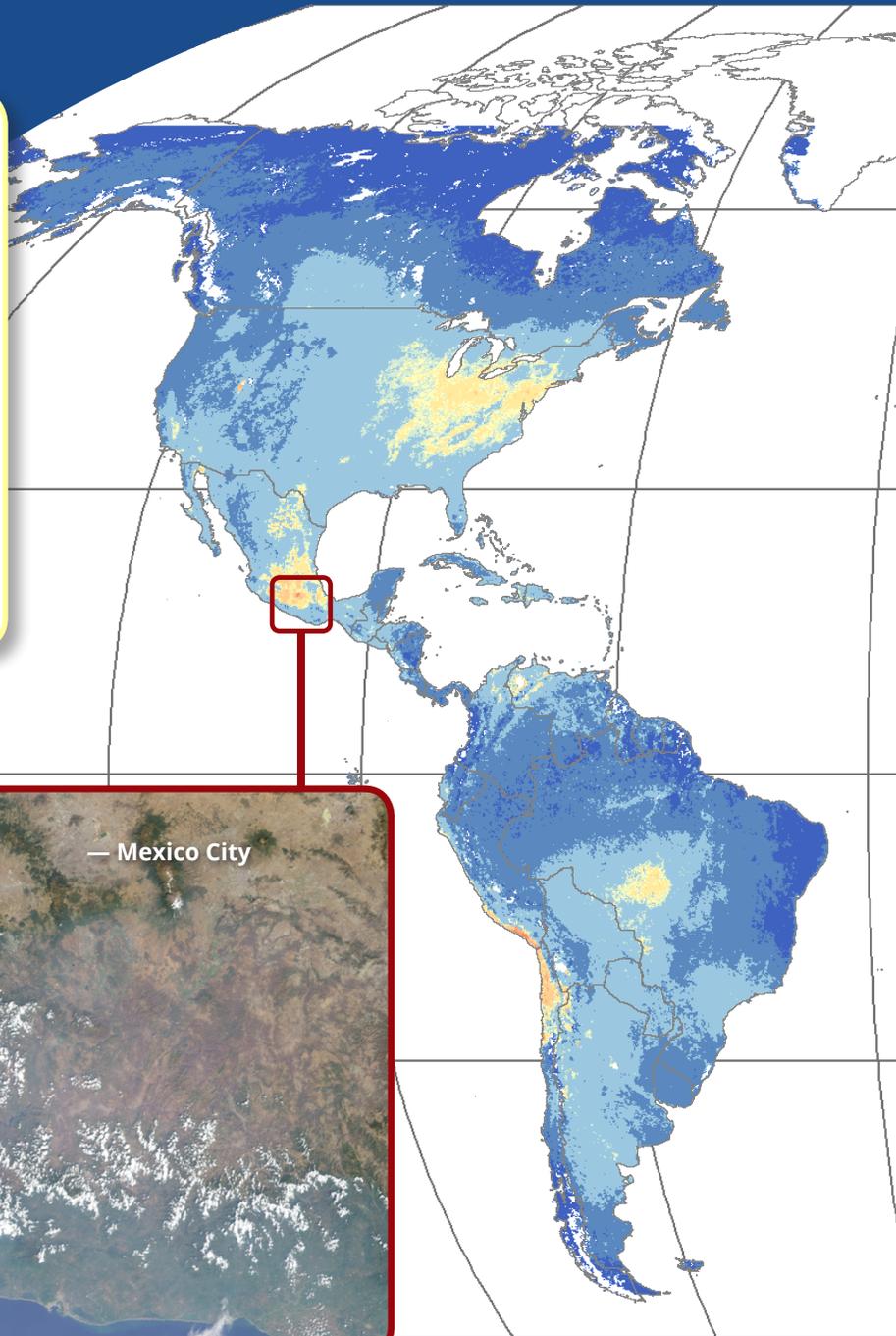
Particle Pollution on Our Planet

NASA's satellites collect information about fine particulate matter by measuring how much of the Sun's light is blocked and scattered by particles in the atmosphere. This information, combined with measurements from the ground, allows scientists to make global maps of pollution.

Fine Particulate Matter (PM_{2.5})



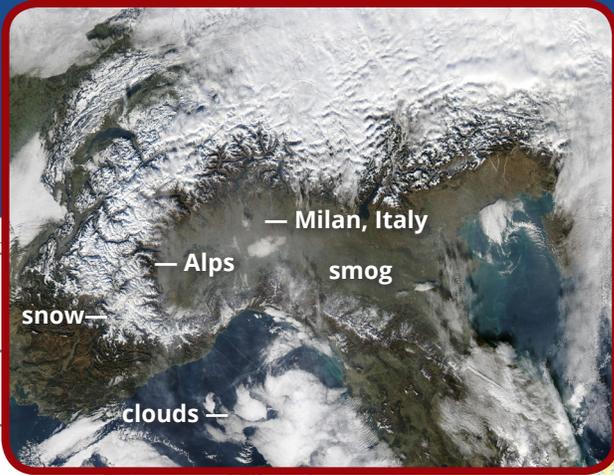
This map shows the regional and worldwide concentrations of PM_{2.5} from the years 2001-2010 using data from NASA satellites. Blue areas are where people are exposed to the least fine particulate matter, while red areas have the most particulate pollution. More than 90% of the world's population lives in areas where the average PM_{2.5} concentration is greater than the level considered safe by the World Health Organization.



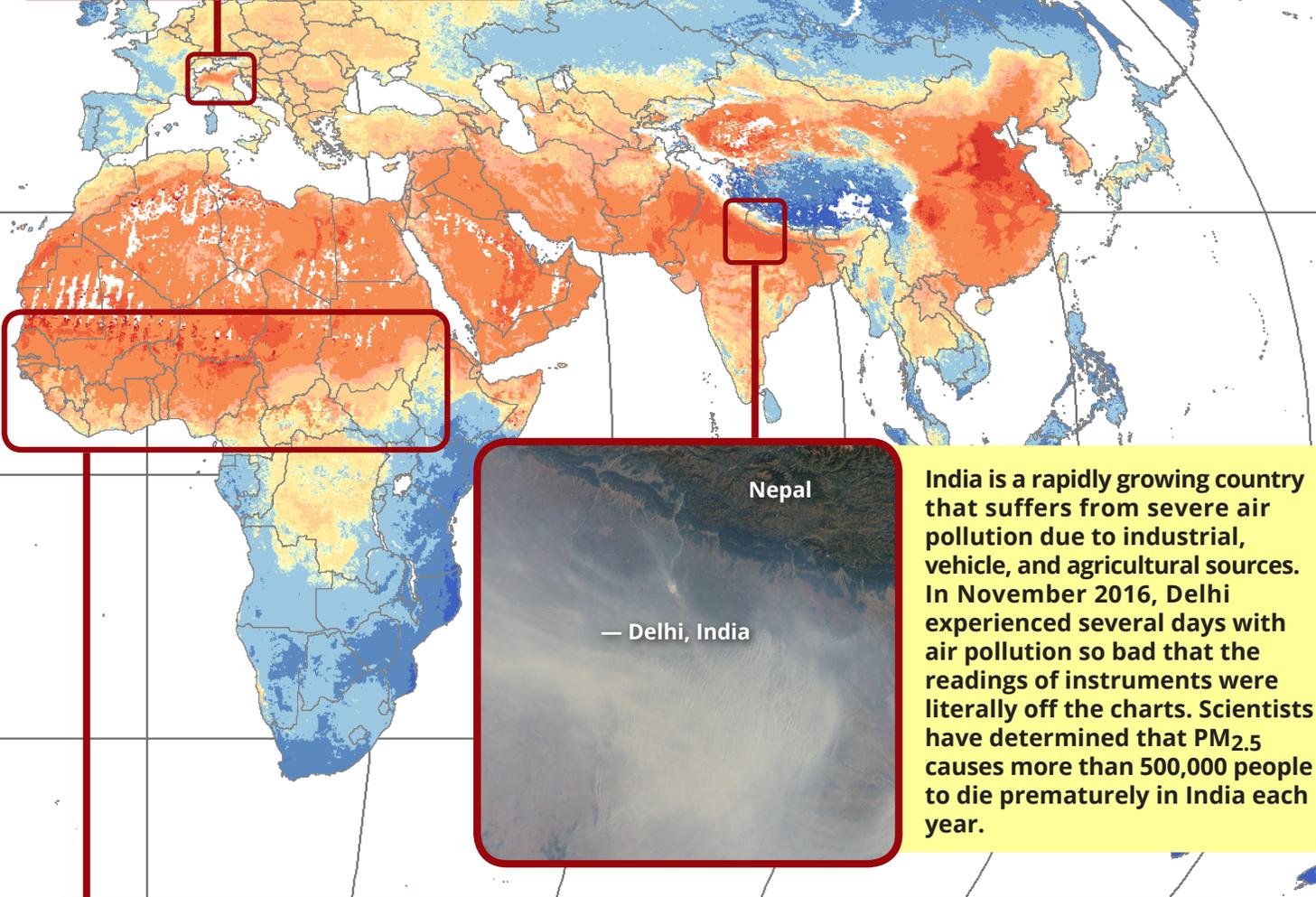
Mexico City, surrounded by mountains, experienced bad air quality in the past. However, the city has taken actions to reduce pollution: regulating the types of gasoline for sale, relocating factories and other sources of industrial pollution, expanding public transportation, and limiting the number of cars on the road during bad air days.



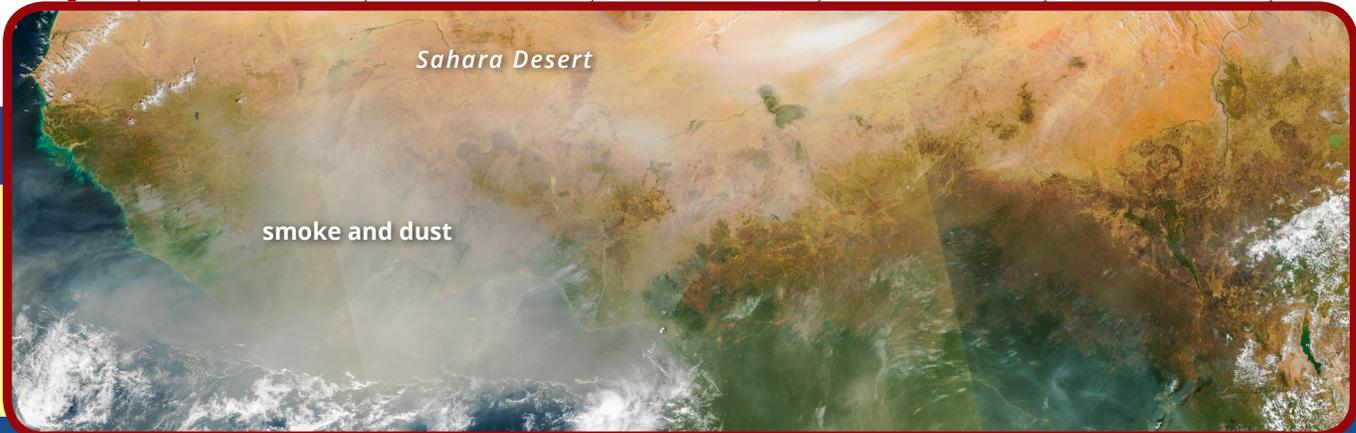
In sub-Saharan Africa, farmers often use fire to clear their fields for the new planting season. From November through March, satellites often observe smoke over the region. Studying this region is difficult because there are very few instruments on the ground and tracking health records can be hard.



The European Alps can trap air pollution in northern Italy. PM_{2.5} in this region is mainly caused by car and truck emissions and other non-industrial sources.



India is a rapidly growing country that suffers from severe air pollution due to industrial, vehicle, and agricultural sources. In November 2016, Delhi experienced several days with air pollution so bad that the readings of instruments were literally off the charts. Scientists have determined that PM_{2.5} causes more than 500,000 people to die prematurely in India each year.



DIY Science

How Clean Is Your Air?

It can be pretty hard to tell what is floating around in the air because most airborne particles are too small for the naked eye to see. Here is an easy way to collect and observe some of the larger particles in your air. How clean is your air?

You will need:

- 4 white paper plates
- petroleum jelly
- duct tape
- 4 wooden blocks/bricks
- camera

Directions:

1. Find four locations you would like to test including an indoor and an outdoor location. List the locations in the table below.
2. Create four sensors. Use the duct tape to securely attach a paper plate to a block/brick. Then coat the top of the paper plate with petroleum jelly.
3. Place a sensor in each of the four locations.
4. Take photos of the plates and their locations.
5. Let these particle sensors sit for at least 24 hours. Make sure you test a time period during which there is no rain or snow.
6. After 24 hours, take photos of the plates and compare with the pictures from step 4. Rank the locations from cleanest (1) to dirtiest (4) in the table.



Location	Inside / Outside	Rank

Questions:

1. Can you see any particles in the petroleum jelly?
2. Do the outdoor sensors have less or more particles than the indoor sensors?
3. What location had the cleanest air?