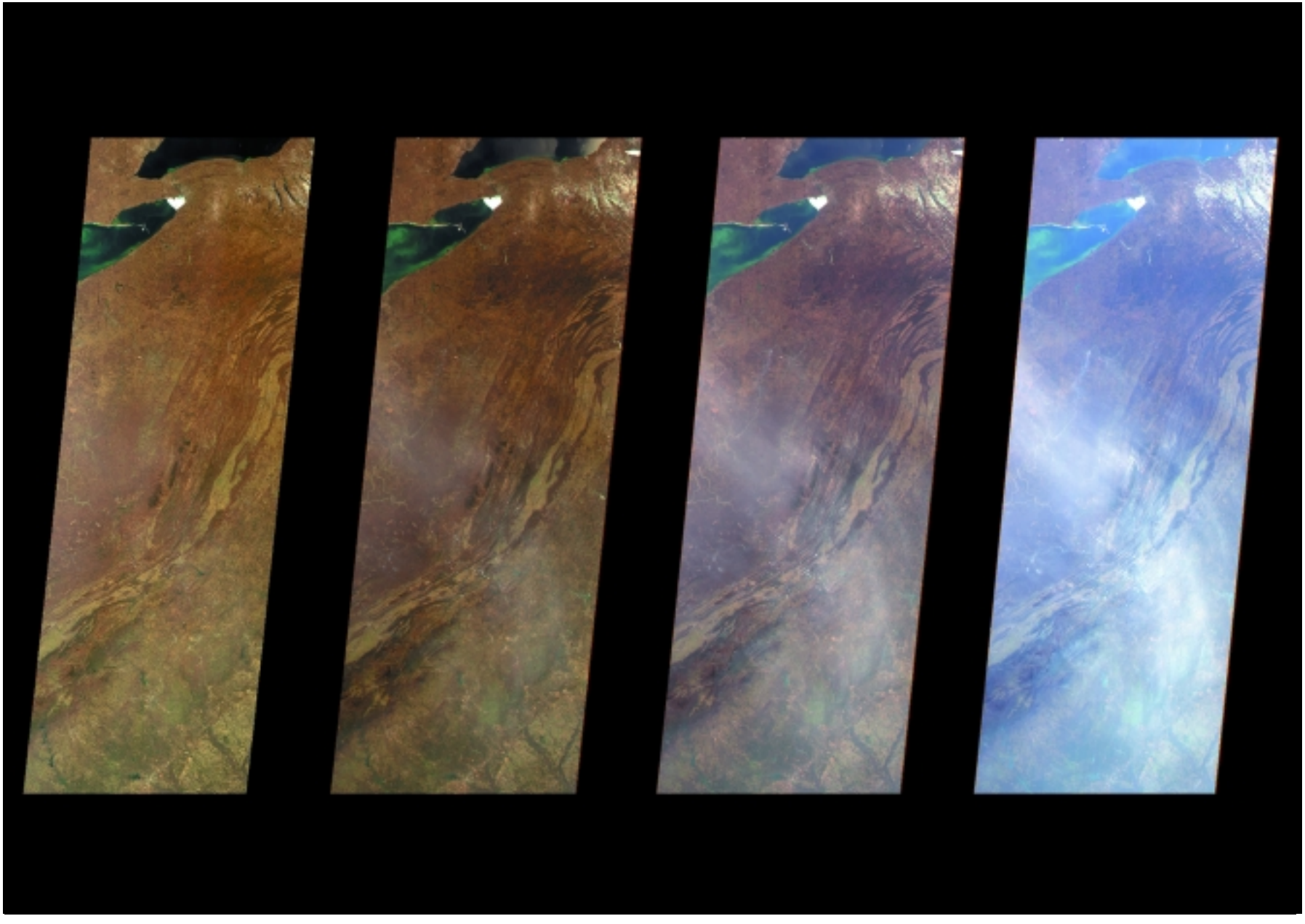
National Aeronautics and
Space Administration

Goddard Space Flight Center
Jet Propulsion Laboratory

Multi-angle Imaging SpectroRadiometer (MISR)



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About This Image

The true-color image at left is a downward-looking (nadir) view of the eastern United States stretching from Lake Ontario to northern Georgia and spanning the Appalachian Mountains. The three images to the right are also in true-color taken by the forward 45.6-degree, 60.0-degree, and 70.5-degree cameras, respectively, of the Multi-angle Imaging SpectroRadiometer (MISR) instrument on NASA's Terra satellite. As the slant angle increases, the line-of-sight through the atmosphere grows longer, and a pall of haze over the Appalachians becomes progressively more apparent. You can see a similar effect by scanning from near-nadir to the horizon when standing on a mountaintop or looking out an airplane window. MISR uses this multi-angle technique to monitor particulate pollution and to distinguish different types of haze. These observations reveal how airborne particles, called aerosols, are interacting with sunlight, a measure of their impact on Earth's climate system. The images, taken on March 6, 2000, are about 400 km (250 miles) wide, and the spatial resolution is 1.1 kilometers (1,200 yards). North is toward the top.

About Aerosols

Aerosols, or the dust and dirt in the atmosphere, can alter the sky's appearance during the daytime. These aerosols originate from both human and natural activities. Exhaust from internal combustion engines makes carbon monoxide gas, nitrogen oxide gas, and carbon (soot) particles. Industrial and home heating and forest fires, such as slash and burn agriculture, also contribute to the dust and dirt in the sky. Natural processes, like lightning-caused forest fires and volcanic eruptions, and salt from the world's oceans, add large amounts of aerosols to the air. All these extra particles in the air not only filter out sunlight, causing redder sunsets and sunrises, but also give the sky a hazy appearance. Mountain hazes, such as those associated with the Appalachian Mountains and the Great Smoky Mountains, are formed mainly due to the emissions of hydrocarbons from the leaves of the numerous plants and trees blanketing the mountain range. Scientists are using the MISR instrument to monitor and study the effects of aerosols on the Earth's climate.

About MISR

MISR, built and provided by NASA's Jet Propulsion Laboratory, Pasadena, California, measures the variation of surface and cloud properties, and particles in the atmosphere, with cameras pointed in nine simultaneous different viewing directions. MISR monitors monthly, seasonal, and long-term interactions between sunlight and these components of Earth's environment. Over a seven-minute period, points on the Earth within a 400 km (250 mile) wide swath are observed successively at all nine angles.

For The Classroom

Grade Level: 5-12

Particulates And Temperature Change

Problem:

Does particulate matter in the atmosphere have an effect on rate of temperature change?

Key Concept: Particles in the atmosphere can affect temperature change.

Materials:

2 fish tanks or large glass containers with covers
blocks to elevate tanks
2 ring stands
incense
2 thermometers
2 stopwatches
2 heat lamps

Procedure:

Set 2 fish tanks on end, side by side. Raise them several inches on blocks. Set up a heat lamp above each tank and a thermometer under each tank. Thermometers and heat lamps must be placed the same distance from each fish tank.

In one tank burn 5 or more sticks of incense (whatever it takes to make it smoky).

Record initial temperatures of both thermometers.

Turn on lamps and direct them toward the fish tanks. Record temperatures at one-minute intervals for 10 minutes.

Turn off and remove lamps and continue recording temperatures at one-minute intervals for 10 more minutes.

Graph your results on the same graph, using different colors for smoky and smokeless fish tanks.

Calculate the rate of temperature increase for each fish tank. Calculate the rate of temperature decrease for each tank.

Questions:

Did the presence of smoke in the fish tank have an effect on temperature change?

Did one tank heat faster? Why or why not?

Did one tank cool faster? Why or why not?

How does this experiment relate to changes in temperature following a volcanic eruption?

What other changes on Earth might you expect as a result of the temperature changes?

Alternative:

In the above lab, a thermometer is used to measure incident radiation with variable amounts of aerosols. An alternative would be to build a simple light meter that would measure the radiation more directly. All that is required is a 6-volt (or similar) photocell and an inexpensive multimeter. Both can be purchased from a local electronics supplier. Simply connect the leads from the photocell to the multimeter and select DC current on a scale that can read 0-6 volts. Place the photocell in the fish tanks and read the meter to measure incident radiation. The amount of current generated by the photocell will vary proportionally with incident radiation.

Adapted with permission from Discover Earth, Institute for Global Environmental Strategies. http://www.strategies.org

Resources:

Terra Website: http://terra.nasa.gov

NASA's Earth Observatory – What are Aerosols
http://earthobservatory.nasa.gov/Library/Aerosols/

Image Credit: NASA/GSFC/JPL, MISR Science Team Operations

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