National Aeronautics and Space Administration
Langley Research Center
Hampton, VA 23681-0001
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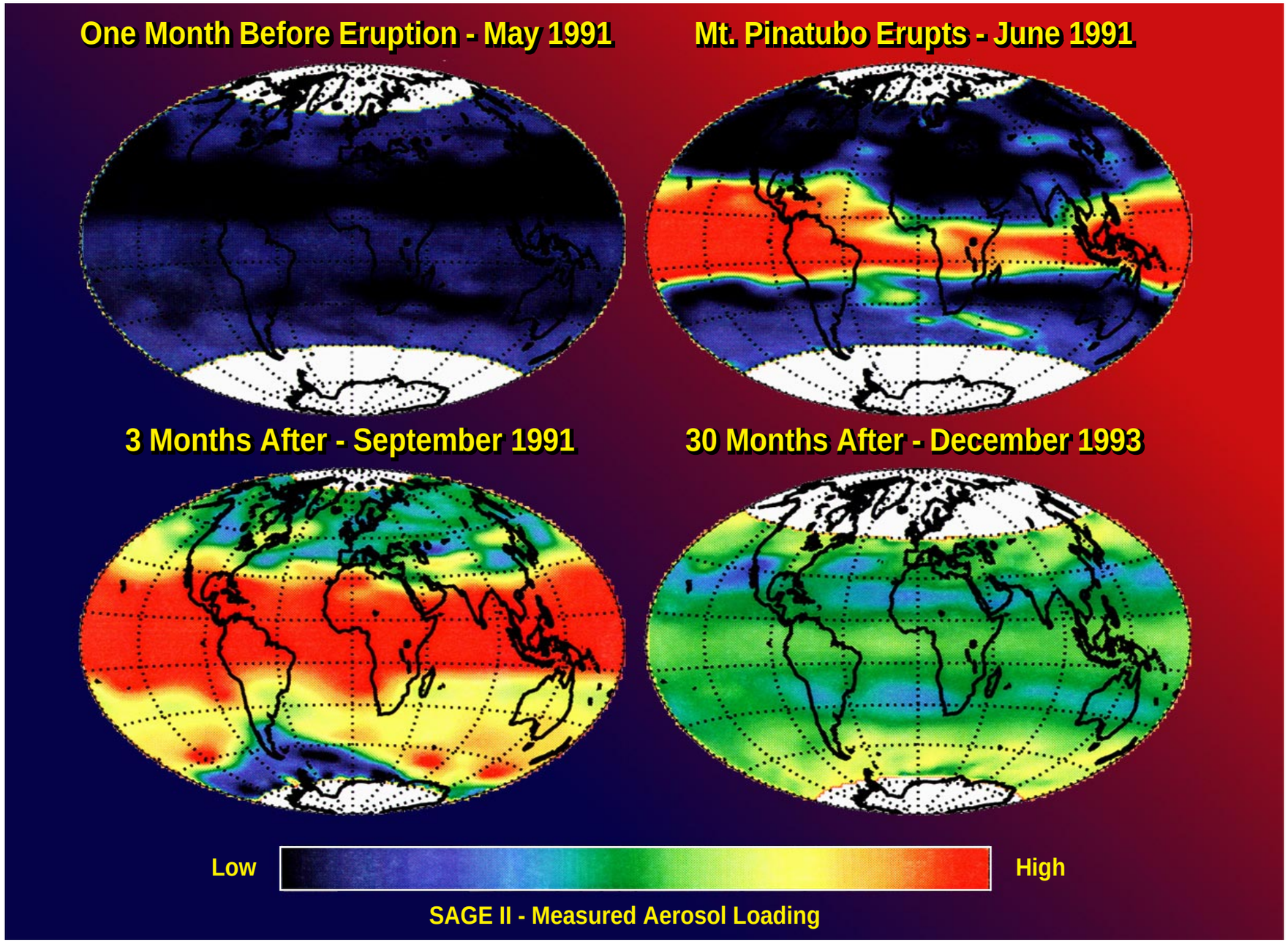
Global Aerosols (SAGE II Data)



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Global Aerosols (SAGE II Data)

Space exploration has changed the way we look at Earth. Satellite observations from space give us global views of our planet and its unified system of land, atmosphere and sun – all exchanging energy in a fine balance.

Satellite data, however, is telling scientists that this balance is changing. The amounts of chemicals and particles in our atmosphere are increasing and altering the relationships between the Earth, its protective atmosphere and the Sun.

Stratospheric Aerosol and Gas Experiment II

NASA Langley launched the **S**tratospheric **A**erosol and **G**as **E**xperiment **II** (**SAGE II**) instrument aboard the Earth Radiation Budget Satellite in October 1984. More than ten years after being deployed from the Space Shuttle Challenger, it is still identifying and measuring gases and airborne particles – or aerosols – in Earth's atmosphere, each of which has its unique "signature." SAGE II data continues to make important contributions to studies of the Antarctic ozone hole, and is providing a wealth of data on polar clouds and atmospheric water vapor.

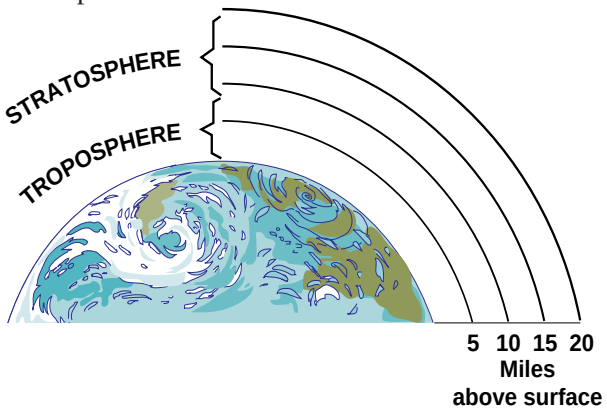

Diagram of Earth, troposphere and stratosphere.

Aerosols

In addition to measuring clouds and water vapor, SAGE II is also known for its measurements of stratospheric aerosols. These aerosols scatter and absorb incoming solar and outgoing Earth-emitted energy, affecting the energy balance of the atmosphere. Large concentrations of aerosols in the stratosphere, as well as in the underlying troposphere, can cause global surface cooling by reflecting sunlight back into space before it has a chance to warm the Earth's surface. Aerosols also participate in chemical reactions, some of which destroy the Earth's protective ozone layer.

Three months after the 1991 Mt. Pinatubo volcano eruption in the Philippines, scientists found that the atmosphere above Mt. Pinatubo had warmed due to the increased concentration of aerosols. In the months that followed the eruption, SAGE II measurements showed the transport of these volcanic aerosols across the entire tropical region, and into the middle and high latitudes as well.

Human activities contribute to global aerosols even more. Global biomass burning, for example, releases carbon particles into the atmosphere. Aside from obscuring sunlight, the particles unbalance the Earth's heat exchange and can contribute to global warming. The same is true with human-produced chlorofluorocarbons (CFCs) which are used for refrigeration and industrial solvents and cleaners.

Solar Occultation Technique

SAGE II measures aerosols in the atmosphere using a process called solar occultation. In this process, a sensor measures sunlight coming through the atmosphere to determine how much sunlight is absorbed by atmospheric aerosols or chemicals. The amount of absorbed sunlight indicates the amount of aerosols or chemicals present. Solar occultation occurs as a satellite experiences sunrises and sunsets.

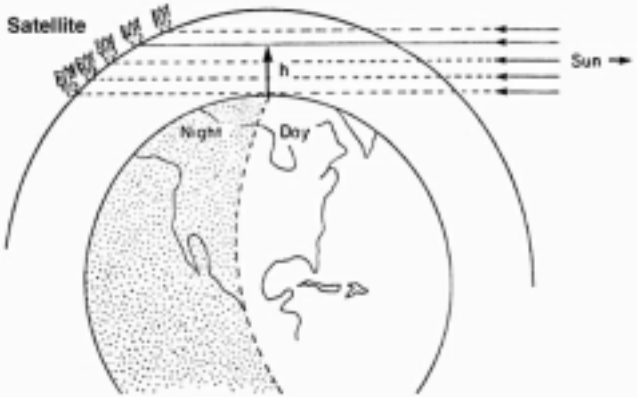

Diagram of solar occultation technique

What About SAGE I?

SAGE I was launched in 1979 aboard the Explorer spacecraft and measured ozone until 1981. It, too, used solar occultation and produced the first global atmospheric data of this type. It paved the way for the more advanced SAGE II.

Activities for the Classroom

1. Research the types of human activities that produce aerosols, such as global burning and industrial chemicals like CFCs. Suggest alternatives to those activities or chemicals.

2. Research the stratospheric ozone layer and why it is essential to life on Earth. Be able to describe how it is being depleted. Also understand what forms ozone in the troposphere and why this is bad.

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