Particular Particles

Little-known aerosols take a bow on the global climate stage

Abstract: The effect of aerosols on climate change might be comparable to greenhouse gases. But discoveries by LANL scientists may turn some aerosols to our advantage.

Miniscule droplets -- each smaller than a grain of sand -- are creating an ocean of knowledge about global climate change

When these airborne particles--called aerosols--figuratively hold hands in a group, they form a foundation upon which clouds are built. And, their reflection or absorption of sunlight is a key factor in moderating Earth's temperature.

Like wearing light-colored clothing in the summer to reflect heat and dark attire in winter absorb it, it turns out that shades of aerosols play a critical role in climate change.

Researchers at Los Alamos National Laboratory are studying human-generated aerosols and their extreme effect in changing the global climate. In fact, aerosols could be having an impact equal to greenhouse gases, but the effect is lesser known and more complicated.

The Los Alamos scientists are using powerful supercomputers to model and simulate these aerosols and the results their interactions create. They also are focusing a virtual microscope on the differences between the shades of aerosols. Lighter-colored particles, such as sea salt or acidic sulfate from power plants, cool the planet because they reflect sunlight. Dark aerosols, such as soot from industrial smokestacks, vehicles, and jet airplanes absorb sunlight and raise temperatures.

At the same time, these aerosols also affect climate indirectly because they help determine the size and number of cloud droplets. This determines how much sun a cloud reflects and how much rain it produces.

Manvendra Dubey [Man-ven-dra Doo-Bay] a Los Alamos environmental scientist, has taken to the air to get a close-up view of these aerosol particles. In fact, he has deployed the world's first aircraft-mounted, triple-laser photoacoustic instrument. Like a barracuda munching on minnows, Dubey's [Doo-Bay's] unique device sucks in skyborne aerosol particles.

Once the particles are ingested by the instrument, laser light heats them, causing a sound like that from an oboe. This musical note reveals important information about the darkness or lightness of the aerosols.

Dubey has analyzed a wide spectrum of climates and environmental situations, including parts of the United States, Mexico, South Korea, and the Arctic.

Collaborating with Dubey is Petr Chylek [Peter Ky-Lek], a pioneer in aerosol science who wrote a technical paper 35 years ago about aerosols and climate for the prestigious scientific journal

Science. Long before worrying about climate warmth became cool, Chylek's [Ky-Lek's] scientific crystal ball revealed a critical need to study aerosols and their effect on Earth's climate.

Now a Los Alamos satellite scientist, Chylek [Ky-lek] uses data gathered by space-bound instruments from NASA and DOE to model the worldwide effects of aerosols, while his colleague Dubey [Doo-Bay] focuses on the individual climates of particular cities.

This combo of research, mixing the results of Dubey's [Doo-Bay's] detailed city-by-city work with the global big-picture of Chylek's [Ky-lek's] research, has produced valuable results and another example of science serving society.