'A-Train' satellites search for 770 million tons of dust in the air

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Desert dust blows off the west coast of Africa and over the Canary Islands in this image from the MODIS instrument on NASA's Terra satellite. Credit: NASA

Using data from several research satellites, scientists will spend the next three years trying to understand the climate impacts of about 770 million tons of dust carried into the atmosphere every year from the Sahara Desert.

Some Saharan dust falls back to Earth before it leaves Africa. Some of it

streams out over the Atlantic Ocean or Mediterranean Sea, carried on the wind as far away as South America and the southeastern U.S. All of it has an as-yet unmeasured impact on Earth's energy budget and the climate by reflecting sunlight back into space.

"The people who build climate models make some assumptions about dust and its impact on the climate," said Dr. Sundar Christopher, a professor of atmospheric science at The University of Alabama in Huntsville.

Christopher will use a $500,000 grant from the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) mission, developed and managed by NASA's Langley Research Center in Hampton, Va.

CALIPSO is an Earth observing satellite that provides new insight into the role that clouds and atmospheric aerosols play in air quality, weather and climate. Christopher will use both CALIPSO and Aqua satellite data in his research.

Aqua was the first member launched of a group of satellites termed the Afternoon Constellation, or A-Train, a group of satellites that travel in line, one behind the other, along the same track, as they orbit Earth. Combining the information from several instruments gives a more complete answer to many questions about Earth's atmosphere than would be possible from any single satellite observation taken by itself.

Understanding Dust

"We want to learn more about the characteristics of this dust, its concentrations in the atmosphere and its impact on the global energy budget so we can replace those assumptions with real data," Christopher said.

Dust is one kind of particle, or aerosol, that floats around in the atmosphere. Most of the recent research into aerosols has focused on particles made by humans, such as smoke, soot or other types of pollution.

"There has been a lot of research looking at the climate effects of man-made aerosols," Christopher said. "Particles from smoke and burning fossil fuels are tiny, sub-micron size. Many of these tiny particles cool the atmosphere because they reflect sunlight back into space before it has a chance to heat the air. That means less solar energy is available at the surface to heat the planet."

Dust particles have a significant effect on heat energy in the air. Dust absorbs thermal energy rising from the ground and re-radiates it either toward space (and colder temperatures) or back toward the surface.

"One thing we want to do is calculate how reflective dust is, because not all dust is created equal," said Christopher. "We're trying to calculate reflectivity so we can say with precision how much sunlight is being reflected."

The composition and shape of dust particles is very complex. They are not spherical, which makes calculating their energy budget challenging and time consuming. Also, the composition of dust varies depending on which part of the Sahara the dust comes from. Some of it absorbs more solar energy than others.

"Climate models are not very sophisticated in the way they handle dust," Christopher said. "And the long-wave or infrared part is something that has been ignored for a long time. We want to nail down those values."

"NASA researchers are especially interested in understanding how dust might suppress hurricane formation and provide nutrients for marine

life," said Langley's Dr. Chip Trepte, the CALIPSO project scientist.

Why the Sahara?

The Sahara contributes about half of all of the dust carried into Earth's atmosphere every year. Studying the Saharan dust is enough of a challenge, in part because it is made of the same stuff as the desert underneath. That means the dust in the atmosphere looks very much like the surface below it. Only in the past few years have new instruments and new techniques been developed that help scientists "see" which is dust and which is desert.

The CALIPSO satellite's instruments include a lidar, which shoots a laser into the atmosphere, then catches light that bounces off particles in the air to learn more about aerosols. CALIPSO is a collaboration between NASA and France's Centre National d'Etudes Spatiales.

Provided by JPL/NASA

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