Saharan Dust Affects Thunderstorm Behavior in Florida

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Scientists using NASA satellite data have discovered tiny particles of dust blowing across the Atlantic Ocean from the Sahara Desert can affect Florida thunderstorms.
Dust affects the size of the top or "anvil" of a thunderstorm, the strength and number of updrafts of warm winds. It also affects the strength of convective (heat generated) thunderstorms by influencing the amount of rain that builds up and falls.

Susan van den Heever, Gustavo Carrió, William Cotton, Paul DeMott and Anthony Prenni, all of Colorado State University, Fort Collins, Colo., co-authored the study presented today at the 2005 annual meeting of the American Meteorological Society in San Diego.

The researchers found when saharan dust is in the air, the anvils produced by Florida's convective thunderstorms tend to be a little smaller in area, but better organized and thicker. This affects the amount of incoming sunlight and warmth reaching the ground, potentially affecting long-term climate. If occurring over time, more sunlight and warmer temperatures would mean a warmer climate.

The researchers also noticed the updrafts of warm moist air, which build into thunderstorms were stronger, and there were more updrafts produced in the presence of the dust. The updrafts also carry tiny particles of pollution, called aerosols, up into all levels of the building thunderclouds.

Florida residents see more updrafts developing during dust events, and the dust affects the amount of rainfall that reaches the ground. Dust is an aerosol. Aerosols serve as the cloud condensation nuclei around which droplets form. These cloud droplets then combine to form raindrops, which fall to the ground. In this way aerosols affect the production of rainfall.

Saharan dust can act as cloud condensation nuclei, giant cloud condensation nuclei and ice nuclei. Van den Heever ran two types of computer model simulations, one that included saharan dust and another without the desert dust.

She then compared the results and found something unusual. The increased concentrations of cloud condensation nuclei due to the dust decreased the amount of rainfall at the Earth's surface.

The scientists also found that greater concentrations of giant cloud condensation nuclei, as well as ice nuclei, initially resulted in more rainfall at the surface. However, as storms continued to develop, the two types of nuclei were removed from them by the precipitation. These nuclei then had less effect on the amount of rain reaching the surface. Van den Heever concluded the overall effect of the saharan dust on the surface rainfall was to reduce it.

The scientists used data from NASA's 2002 CRYSTAL-FACE (Cirrus Regional Study of Tropical Anvils and Cirrus Layers -- Florida Area Cirrus Experiment) field campaign to examine the impact of increased nuclei concentrations. The purpose of the mission was to study cirrus clouds, to improve forecasts of future climate change.

Modeling results were compared to airborne radar data. The researchers also used sounding data from two ground sites, as well as Geostationary Operational Environmental Satellite data specifically tailored by NASA's

Langley Research Center, Hampton, Va., to compare their simulation results.

This research has several implications. Saharan dust can have a major impact on the amount of precipitation produced by thunderstorms in Florida, and it can help answer questions about the transport of aerosols and other pollutants in the upper atmosphere.

The study will appear in a future issue of the Journal of Atmospheric Sciences.

Source: NASA