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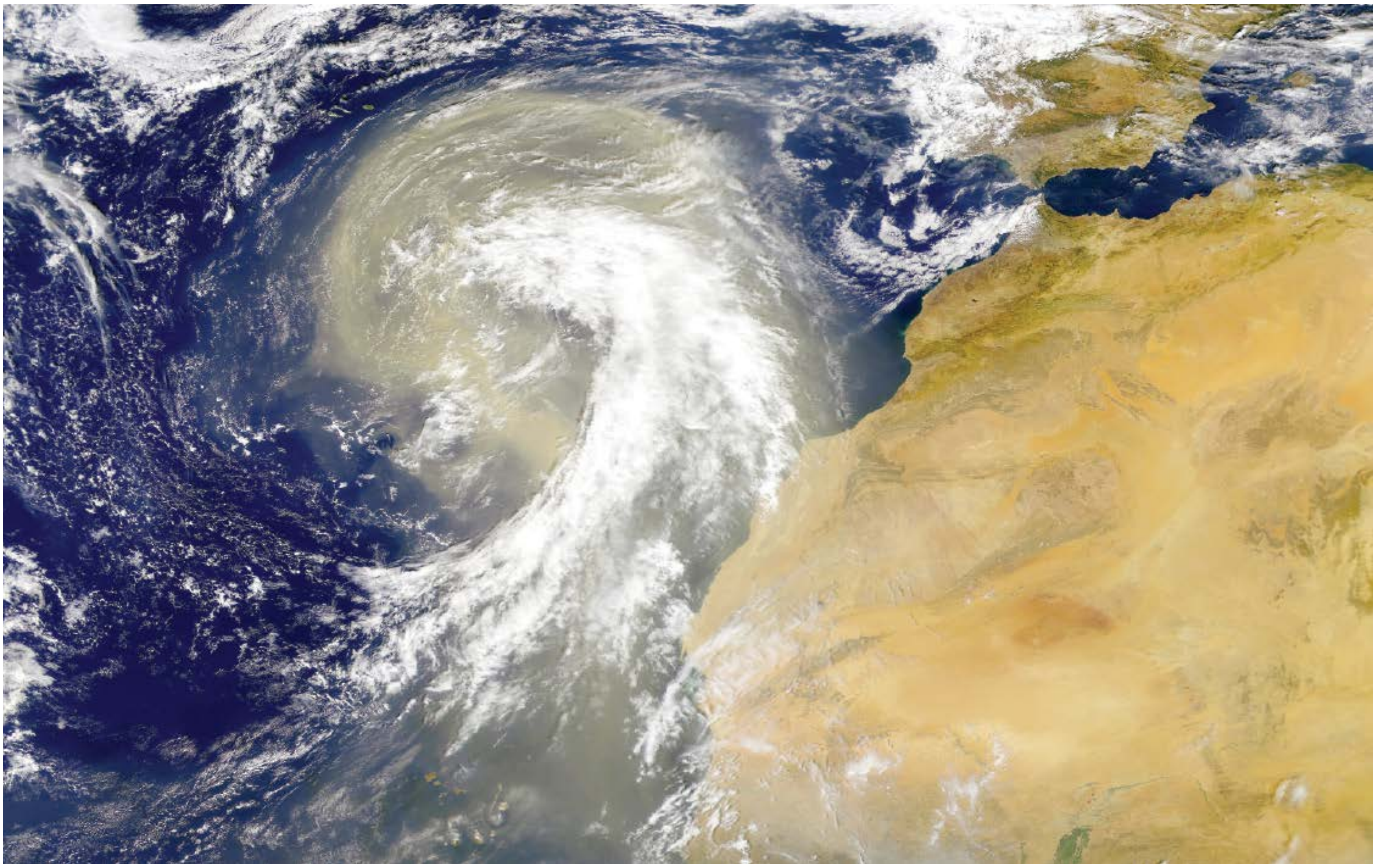
Satellite Data Reveal Effects of Aerosols in Earth's Atmosphere



A dust plume from the Sahara Desert streams out over the northeastern Atlantic Ocean. Researchers are using satellite imagery to better predict how tiny aerosol particles like these might influence global climate. Credit: NASA Visible Earth

Earth's atmosphere is dusted with tiny particles known as aerosols, which include windblown ash, sea salt, pollution, and other natural and human-produced materials. Aerosols can absorb or scatter sunlight, affecting how much light reflects back into space or stays trapped in the atmosphere.

Despite aerosols' known impact on Earth's temperature, major uncertainties plague current estimates of their overall effects, which in turn limit the certainty of climate change models. In an effort to reduce this uncertainty, *Lacagnina et al.* have combined new satellite data, providing, through model simulations and for the first time, data on aerosols' ability to absorb or reflect light globally.

In this new study, the team focused on the direct effects of aerosols on shortwave radiation in 2006. These effects depended on the particles' vertical location with respect to clouds, the reflective properties of the underlying land or water, and the optical properties of the aerosol particles themselves, including how much light they are prone to scatter or absorb.

The researchers used instruments aboard the French Polarization and Anisotropy of Reflectances for Atmospheric Science coupled with Observations from a Lidar (PARASOL) satellite and NASA's Aura spacecraft to measure aerosol optical properties around the world. Data from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) satellite instrument provided measurements of cloud characteristics and land reflectance, and an aerosol climate model known as ECHAM5-HAM2 helped fill in any gaps in the observations.

Using these data, the researchers calculated the global average radiative effect for 2006, revealing an overall cooling effect due to aerosols. At regional scales, however, different mixtures of aerosols led to widely varying effects. For example, the cooling effects of aerosols were larger in the Northern Hemisphere because of higher pollution emissions and infiltration by desert dust.

Overall, the heat transfer measurements in this study were consistent with past measurements using other methods. The authors call for additional studies that also integrate data from multiple sources and for improved global measurements of aerosol absorption to better understand and predict the future effects of aerosols on climate change. (*Journal of Geophysical Research: Atmospheres,* https://doi.org/10.1002/2016JD025706, 2017) **—Sarah Stanley, Freelance Writer**