Contribution of the Saharan Air Layer to Northern Atlantic Ocean Temperatures

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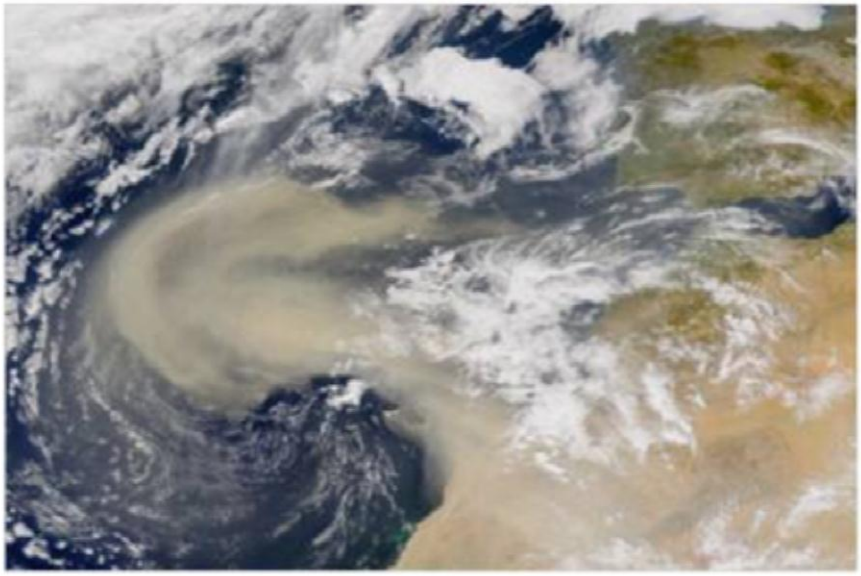
Dust storms from Africa are a persistent feature in the skies over the northern tropical Atlantic, and strong variability in Atlantic dust cover has been observed on seasonal to decadal timescales. Over water the net surface radiative effect from mineral aerosols is negative, translating to localized cooling of the mixed layer. Recent studies have demonstrated that over the last quarter century roughly 25% of the observed upward trend in sea surface temperatures in the tropical North Atlantic can be attributed to declines in Atlantic dust cover.

While there is compelling evidence suggesting that African dust storms contribute to Atlantic surface temperatures on decadal timescales, studies investigating dust-forcing of temperatures have generally neglected other important environmental factors that are associated with Atlantic dust outbreaks, such as the dry air, the mid-level warm anomaly, and increased surface wind speed. The Saharan Air Layer (SAL) is the term given to this warm, dry, dusty air mass. The net effect of the reduction in water vapor, warm anomaly, and increase in surface winds is to further cool the mixed layer via negative longwave radiative forcing at the surface.

In collaboration with Amato Evan (U. Virginia) and Dongziao Zhang (U. Washington), I am investigating the impact of the Saharan Air Layer on Atlantic Ocean surface temperatures over the last 60 years. By exploring the effect of the SAL on temperatures using an ocean general circulation model, we will quantify the effect of the SAL in shaping decadal scale surface temperature variability. We are also developing a model to correct shortwave radiation records from moored buoys for biases caused by dust accumulation on the sensors. The corrected time series, together with satellite data, will be used to assess the importance of clouds and dust in shaping tropical Atlantic climate variability over the past 30 years, complementing the longer timescale numerical modeling study.



A large dust cloud moves west over the Atlantic Ocean from the coast of Africa on February 26, 2000 (SeaWiFS satellite image courtesy of NASA).