

# **Mechanisms by which aerosols may affect tropical cyclone frequency and intensity**

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Aerosols are a pervasive feature of the atmosphere, and changes in aerosol loading have been shown to alter the Earth's energy budget on regional to global scales. It is well known that over-water an elevated aerosol layer will cool the temperature of the upper ocean via the aerosol direct effect, and it has been argued that tropical cyclone frequency and intensity may be sensitive to such SST anomalies. At the same time, more recent work is suggesting that aerosol-forced SST anomalies can also alter regional atmospheric circulation patterns, and therefore the possibility exists that such changes in the circulation may also be relevant to understanding the relationship between aerosols to tropical cyclones. Here I use models and observations to examine the ways in which variability in tropospheric and stratospheric aerosols may influence tropical cyclone frequency and intensity via aerosol-forced SST anomalies and the atmospheric response to these changes in surface temperatures. I specifically examine the relationship between 1) African dust and Atlantic hurricanes, 2) the Southeast Asian Atmospheric Brown Cloud and Arabian Sea cyclonic storms, and 3) global tropical cyclone activity and stratospheric aerosols from the eruptions of Mount Pinatubo and El Chichón. My results suggests that systematic changes in aerosol loading over time, like the decrease in Atlantic dust cover from 1985–2005 or the secular upward trend in the thickness of the Atmospheric Brown Cloud, have conspired to make conditions in the tropical North Atlantic and Arabian Sea more favorable for storm intensification. Additionally, I show that the dramatic surface cooling associated with the eruptions of Chichón and Pinatubo was of a magnitude sufficient to impede cyclone genesis and limit storm intensification.