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Aerosol and the development of precipitation from cloud regimes

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Atmospheric aerosols play an important effect on the climate both directly by affecting radiation and indirectly by modifying cloud processes. The role of aerosols on clouds is very uncertain, especially with regards to precipitation processes.

Recent work has shown a correlation between satellite retrieved aerosol optical depth and retrieved precipitation intensity, appearing to suggest that aerosols might control up to half of the precipitation in the tropics. It has also been suggested that this relationship might be generated by meteorological covariation of the aerosol and cloud properties rather than an aerosol effect on precipitation.

In this study we investigate how tropical precipitation changes are related to changes in MODIS Aerosol Index (AOD times Angstrom Exponent). We use the objective method of separating clouds into different regimes from Gryspeerdt and Stier (2012). Using time resolved satellite products, we investigate how the diurnal cycle of precipitation changes with aerosol environment within these regimes. The time resolved nature of our study also allows us to reduce the influence of meteorological factors in the aerosol retrieval giving a clearer picture of how aerosols are linked to precipitation. We find a smaller link between aerosols and precipitation than previous work, especially over ocean.

Wet scavenging of aerosol is also important for determining the links between aerosol and precipitation and has been suggested as the reason for the difference between models and observations when considering some of these links. Using a combination of models and observations, we examine the influence of wet scavenging and possible sampling issues when comparing aerosol cloud interactions in models and observations.

Gryspeerdt and Stier (2012). Regime-based analysis of aerosol-cloud interactions. Geophys. Rev. Lett. 39, L21802.