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# On the correlation between aerosol optical depth and precipitation over hyperarid regions: A case study from the Arabian Peninsula

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Atmospheric turbidity plays a crucial – and controversial – role in the hydroclimatology of arid regions, with atmospheric aerosols both acting as rainfall inhibitors and enhancers. Aircraft observations and model simulations show that cloud development is strongly modulated by dust-cloud interactions at the microscales, during the drop formation process. However, the influence of aerosols and dust on precipitation remains poorly understood, mainly due to our limited knowledge of the dynamical processes that – acting over a wider range of spatial and temporal scales – drive cloud formation and trigger precipitation. The effects of dust and aerosols on precipitation mostly depend on the concentration of dust particles acting as cloud condensation nuclei (CCNs) and ice nuclei (IN), their chemical composition, size and morphology. In the recent years, the application of satellite data to characterize aerosol distribution has advanced dramatically through the systematic acquisition of aerosol optical depth (AOD) data over land from space borne sensors like MODIS onboard the EOS-Terra satellite. Although AOD is not a direct measure of the aerosol concentration in atmosphere, but rather an estimate of the atmospheric optical thickness due to scattering and absorption by aerosols, it is frequently used as a proxy of dust concentration in the atmospheric column.

Many studies have analyzed the coupling between dust/aerosol abundance and precipitation through the use of remotely sensed data of AOD and precipitation. However, their focus has been mainly on the long-term influence (at monthly or annual scales) of dust/aerosols on precipitation onset, and on the influence of transport processes (through Lagrangian tracking). In this contribution, we move our attention to hyperarid regions – and in particular to a large region centered on the Arabian Peninsula, Persia and Eastern Africa – where precipitation events are highly sporadic and scattered in space. We use aerosol optical depth (AOD) data from MODIS Terra and precipitation fields from the Tropical Rainfall Measuring Mission (TRMM), to investigate the diverse correlation patterns between aerosols and rain-occurrence across the region. The main focus is on daily scales, due to the extremely intermittent nature of precipitation events in the region. The role of data uncertainty and validation is also put in context and discussed.