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# Non-Monotonic Aerosol Effect on Precipitation over the ITCZ

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Aerosol effects on clouds' microphysics and dynamics are still considered as an important open question that contributes a major uncertainty to climate research and prediction. Using 7 years of observational and reanalysis data, we show a non-monotonic trend in convective cloud properties and rain intensity as a function of aerosol optical depth (AOD). The invigoration effect shifts into weak suppression beyond an optimal AOD ( of ~ 0.3-0.4). Using a cloud model we explain this shift in trend as the result of a competition between two types of microphysical processes: cloud-core-based invigorating processes vs. peripheral suppressive processes. We show that the optimal AOD, for which cloud and rain reach their maximal values, depends on the environmental thermodynamic conditions and it is higher for more unstable or more humid conditions. Our findings improve the understanding of aerosol-cloud interaction and their link to environmental conditions. It can aid in the improvement of parameterizations of clouds in climate models.