EGU22-4075
https://doi.org/10.5194/egusphere-egu22-4075
EGU General Assembly 2022

Temporal and spatial dependence of aerosol-cloud interactions in marine stratocumulus clouds

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Aerosol-cloud interactions (aci) are a key climate process causing significant cooling by perturbing Earth's radiative budget, especially in stratocumulus clouds that cover extended areas of the planet. However, the exact value of the global radiative forcing associated with aci has proven difficult to quantify. In fact, estimates still differ between models and satellite data. Satellite studies are limited by the fact that the variable of interest, i.e. the aerosol concentration that the cloud forms on, remains unobservable. Instead, the satellite can only retrieve a proxy metric, such as Aerosol Optical Depth (AOD), which is retrieved in cloud-free pixels, requiring an aggregation technique -either spatial or temporal- to recreate aerosol-cloud data pairs. Furthermore, until now, aci has been most often quantified using polar-orbiting satellites, which only provide one daily snapshot of cloud and aerosol optical properties. In this study, newly available geostationary satellite aerosol products are used to explore the temporal and spatial dependence of aci in stratocumulus clouds. Preliminary results indicate that the sensitivity of cloud properties to AOD changes depending on the spatial and temporal scales chosen for the analysis, indicating either a shift of prevailing physical processes in time and space, or statistical biases and spuriousness. This dependence of sensitivity with the scale of analysis is also confirmed in reanalysis data. However, it seems that the sensitivities captured in reanalysis data are of opposite signs than in the satellite data. Ongoing work focuses on investigating the role of spatial and temporal scales as well as resolving the discrepancy between the observational and reanalysis estimates at these different scale