



## **Aerosol indirect effects in marine stratocumulus: The importance of explicitly predicting cloud droplet activation**

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Climate models generally simulate a unidirectional, positive liquid water path (LWP) response to increasing aerosol number concentration. However, satellite observations and large-eddy simulations (LES) show that the LWP may either increase or decrease with increasing aerosol concentration, influencing the overall magnitude of the aerosol indirect effect (AIE). We use LES to investigate the LWP response of a marine stratocumulus cloud and its dependence on different parameterizations for obtaining cloud droplet number concentration (CDNC). The simulations confirm that the LWP response is not always positive – regardless of CDNC treatment. However, the AIE simulated with the model version with prescribed CDNC is almost three times larger compared to the version with prognostic CDNC. The reason is that the CDNC in the prognostic scheme varies in time due to supersaturation fluctuations, collection and other microphysical processes. A substantial spread in simulated AIE may thus arise simply due to the CDNC treatment.