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Validation of Satellite-Retrieved CCN based on a Cruise Campaign over the polluted Northwestern Pacific Ocean

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In this study, a methodology for satellite retrieval of cloud condensation nuclei (CCN) in shallow marine boundary layer clouds is presented and validated. This methodology is based on retrieving cloud base drop concentration (N_d) and updrafts (W_b), which are used for calculating supersaturation (S). The N_d is the activated CCN concentration in clouds at a given S . The accuracy of the satellite retrieval is validated against the surface-measured CCN of a cruise campaign over the heavily polluted northwest Pacific Ocean. Clouds which are coupled with the sea surface have good agreement between satellite retrieved N_d and surface-measured CCN after performing corrections for temperature and adiabatic fraction. This study broadens the applicability of the methodology from aerosol-limited to contaminated regions. The validation shows $\pm 30\%$ accuracy in retrieving CCN of both clean and polluted regions. The results further demonstrate the strong dependence of marine shallow cloud N_d on CCN number concentrations and updraft, which allows us to further apply this methodology to quantify the relationships between CCN and cloud microphysical properties and reduce the uncertainty of radiation forcing caused by aerosol cloud interaction (ACI).