



Morning-to-afternoon decrease in satellite-derived stratocumulus cloud droplet number concentration: what can a retrieval artifact tell us about underlying cloud processes?

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Satellite-derived cloud droplet number concentrations (N_d) show a pronounced drop between the morning and afternoon MODIS overpasses as well as in half-hourly GOES N_d retrievals during the more suppressed high- N_d VOCALS time periods. A similar feature has been noted globally by Matsui et al. (2006). Here we examine the causes for this feature using in-situ data. We find that the morning-to-afternoon decreases in N_d are not associated with corresponding decreases in boundary-layer aerosol. Instead, turbulent moisture transport appears to be too weak to compensate for daytime cloud thinning, with N_d proportional to the square root of a reduced cloud optical thickness explaining the daytime decrease. In contrast, for clouds from the lower N_d tercile, a daytime N_d decrease was not evident because the clouds remained more well-mixed, despite precipitation reducing N_d near cloud base. We suggest a morning-afternoon change in satellite-retrieved cloud droplet concentrations can be used to infer these cloud processes.