

The authors aim to quantify an albedo and forcing susceptibility for stratocumulus in the NE Pacific by following Pearl 1984 and more recently Gryspeerd's 2018 work by using  $N_d$  as a mediating variable in observed aerosol-cloud interactions. The authors find the albedo susceptibility exists in different regimes depending on the cloud state and environmental influence, with most occurring in the "Twomey brightening," "entrainment-darkening," and "precipitating-brightening."

While the study adds information on regime specific, aerosol-cloud interactions, it is difficult to follow at times. The study chooses an interesting region to focus on, where ACI are not always leading to a cooling effect, and these effects are heavily dependent on the environmental conditions. If the study can clarify its main message, and how the meteorological factors work to influence ACI on a process level, this would be a great resource for understanding aerosol-cloud-environmental interactions.

Major comments:

The authors explore the LWP and  $N_d$  space to begin, then rapidly transition into explaining the albedo and forcing susceptibilities. The authors say that using  $N_d$  mediates any confounding effects of the environment on observed patterns of aerosol-cloud interactions, however  $N_d$  would be similarly affected by environmental influences (though not to the same degree) as AOD.

When discussing each meteorological factor, the authors explain the observed patterns of the meteorological factor, while completely avoiding how these factors themselves initiate or influence the effects. There is too much emphasis on how each factor changes with the seasonal cycle, which obfuscates the message of the last section of the paper away from how these MF control ACI. The authors also rarely connect how the MF may work in tangent to influence ACI. Because you are working with real observations, the observed effects would have all MFs working in tandem on the cloud layer at all times.

The paper assumes CTH reflects the state of the cloud, and does not address the inherent relationship between increasing  $N_d$  and increasing CTH. CTH, and the deepening/invigoration effect aerosol has on shallow, warm clouds, would be an additional cloud adjustment effect. The authors should state or explore how increasing LWP, through precipitation suppression, may then act to deepen clouds.

Please cite studies to add more context to the forcing sensitivities given.

Minor comments:

Line 98: Is there any potential for sampling issues by using the  $N_d$  equation from Grosvenor et al. 2018 as opposed to other  $N_d$  or aerosol proxies?

Line 143: How does removing samples with low  $A_c$  and  $N_d$  correlations affect the validity of your results, since those scenes imply a null hypothesis?

Lines 173-175: How does weighting by CF affect the results? Does this introduce some type of bias that reduces the effects Nd has on smaller clouds like cumulus?

Line 192: Does this assume that higher Nd clouds have experienced some form of precipitation delay/suppression before precipitating?

Could using  $1^\circ \times 1^\circ$  means obscure less frequently occurring phenomena?

Line 243: What additional proof is there that entrainment-evaporation is occurring other than the daily means showing a slight “darkening?”

Line 269: If CTH reflects the cloud state and meteorological state, couldn't that be said of most cloud properties, as almost all cloud properties respond to LWP changes and MFs?

Line 323: If the precipitating-brightening regime is spread out along the meteorological space, could that indicate that you are missing a key meteorological factor that would explain this spread?

Section 4.3.3 How does LTS affect clouds and ACI on a process level?

Section 4.3.4a Does deepening occur due to aerosol, which then leads to increasing LWP, or does LWP increase first, which then deepens the cloud? Or does LTS decrease, increasing CTH, then LWP? Or do all of these occur simultaneously?

Section 4.34c How does stability work with the other MF?

Line 415: Please cite a reference for the comment on free tropospheric humidity conditions influencing LWP.

Section 4.3.4d How does SST influence the impact of other MF?

Line 459: Please add more discussion on confounding factors. Further, you state that because you are using Nd, you can infer a causal relationship, however this is not the case. Please clarify this in some way that using Nd alone does not constrain the effect of confounding factors.