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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Deconvolution of Boundary Layer Depth and Aerosol Constraints on Cloud Water Path in Subtropical Stratocumuli" *by* Anna Possner et al.

Anonymous Referee #1

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Comments on: Deconvolution of Boundary Layer Depth and Aerosol Constraints on Cloud Water Path in Subtropical Stratocumuli By Possner et al. In this paper the authors use 10 years of measurements (primarily from MODIS) to investigate the LWP response to changes in cloud droplet number concentrations and boundary layer depth in subtropical Sc. They show that, in agreement with previous studies, LWP increase (decrease) with Nd for precipitating (non-precipitating) clouds. The rate of decrease (or susceptibility) in LWP with Nd under non-precipitating conditions is shown to increase with the BL depth. The authors further claim that the deep BL conditions are underrepresented in previous studies, hence, previous estimations of LWP susceptibility may be underestimated. The paper is well written and presents important and timely results.

Hence, I support its publication after the following comment are addressed: General comment âĂć One of the main conclusions/messages of this paper is that relatively deep BL clouds are underrepresented in studies of aerosol effect on LWP. However, there were previous LES studies simulating the transition between marine stratocumulus (Sc) to cumulus (Cu) and the aerosol effect on it. These studies include phases of deep BL. In addition, there were also many previous studies examining the aerosol effect on LWP in Cu clouds, with BL depth of 1.5 km and even more. I appreciate the focus on Sc, however, it looks to me as slightly artificial separation, especially if the focus is on relatively deep BL. I would expect that many of the physical processes acting in deep Sc and in Cu would be similar (as warm clouds cover the entire spectrum between Sc to Cu). For example, fig. 1 presents PDF of "disorganised" Sc. Looking on Fig. 1 of Muhlbauer et al., (2014), these disorganised Sc could definitely be (or at least be similar to) Cu. The fact that the data used here don't have any information on the decupling level in the boundary layer (L.163) only strength the relevancy of the Cu regime.

Specific comments âĂć Abstract: I think it is better not to use "susceptibility" in the abstract without defining it as some readers may not know what it is. âĂć L27: I think that decreased precipitation rates are a micro-physical effect and not "dynamic or thermodynamic adjustments". âĂć Figure 1. The PDFs taken from Muhlbauer et al., (2014) are based on which data? âĂć These processes (including the effect of the BL depth) were studied in Cu clouds.

Technical comments âĂć L15: "due to be". âĂć L16: "estimates in". âĂć L168: "the stronger".

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