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Comment on acp-2021-391

Anonymous Referee #1

Referee comment on "Environmental effects on aerosol–cloud interaction in non-precipitating marine boundary layer (MBL) clouds over the eastern North Atlantic" by Xiaojian Zheng et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-391-RC1>, 2021

Zheng et al. "Environmental Effects on Aerosol-Cloud Interaction in non-precipitating MBL Clouds over the Eastern North Atlantic"

Using a total of 20 non-precipitating single-layer marine boundary layer (MBL) stratus and stratocumulus cloud cases over the eastern north Atlantic (ENA) ocean, this study investigates the impacts of the environmental variables on the aerosol-cloud interaction (ACIr). Interesting results have been found with valuable discussions. For example, it shows that the ACIr values vary from -0.004 to 0.207 with increasing precipitable water vapor (PWV) conditions, indicating that re is more sensitive to the CCN loading under sufficient water vapor supply, owing to the combined effect of enhanced condensational growth and coalescence processes associated with higher cloud droplets and PWV. The paper is also well written. I would recommend its acceptance for publication after necessary minor revisions.

Detailed comments;

Line 41-44, two "verbs" exist for this sentence, which should be rephrased. Also, a few more studies are recommended here, particularly the longwave radiative property change of clouds by aerosols, such as Garrett and Zhao (2006, Doi:10.1038/nature04636).

Line 48-52, a few similar studies have also been carried out over the western pacific regions, which might be worthy to mention, such as Zhao et al. (2019, Doi:10.3390/atmos10010019), and Yang et al. (2019, Doi:10.1016/j.atmosres.2019.01.027).

Line 66-69, Qiu et al. (2017, Doi:10.1016/j.atmosenv.2017.06.002) showed negative relationship between cloud re and aerosol amount for low precipitable water vapor condition in spring, fall and winter at southern great plain site, but positive relationship between cloud re and aerosol amount for high precipitable water vapor condition, which could be also cited here. Similar findings have also been found over other locations, such as western pacific region near Hebei province, China.

Line 281-283, similar height normalization method has been proposed and used by Zhao et al. (2018, Doi:10.1002/2017EA000346), which is worthy to mention here. Also, Similar findings (Line 283-287) have been found earlier in several studies, including the study mentioned here.

Line 319, Eq. (2). Earlier studies often define this for fixed LWC. How could the different definition affect the results?

Line 332-343, These are interesting findings and explanations. I wonder if this is related to the supersaturation adopted for CCN observed, or related to the true supersaturation status within clouds.

Line 358-376, The mechanism proposed here is valuable. If possible, I would suggest the authors illustrate the mechanism proposed here with a diagram.

Line 390, "that more close to adiabatic" should be "that are more close to adiabatic"

Line 432, "to narrows the DSD" should be "to narrow the DSD"