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Comment on acp-2020-1245

Anonymous Referee #1

Referee comment on "Evaluation of the CMIP6 marine subtropical stratocumulus cloud albedo and its controlling factors" by Bida Jian et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-1245-RC1>, 2021

Jian et al. "Evaluation of the CMIP6 marine subtropical stratocumulus cloud albedo and its controlling factors"

This study provides a comprehensive evaluation study about the CMIP6 model simulations regarding the cloud albedo and its controlling factors over the marine subtropical stratocumulus cloud regions. Many interesting results have been found. I would recommend its acceptance for publication after necessary modifications.

Further effort is necessary to improve the writing language of this paper.

Line 11, please change "the subtropical marine subtropical stratocumulus" to "the subtropical marine stratocumulus"

Line 12-13, please change "the long-term, monthly and seasonal cycle averaged cloud albedo at five stratocumulus regions were investigated" to "the long-term, monthly and seasonal cycles of averaged cloud albedo at five stratocumulus regions were investigated"

Line 16-18, past tense and present tense cannot be used together in a sentence.

Line 38, "those of" -> "those over"

Line 50-53, it is only true when considering the cloud albedo for particular clouds that the cloud albedo is determined by COT and solar zenith angle. From a statistical view, it is also strongly dependent on cloud fraction. In addition, regarding the change of COT with cloud droplet number, size, and liquid water path, a couple references could be mentioned, Zhao et al. (2012, doi:10.1029/2012GL051213) and Xie et al. (2013, doi:10.1175/JCLI-D-12-00517.1). Also, changing "cloud droplets number and sizes" to "cloud droplet number and sizes".

Line 57-59, are you sure these three referred studies are for aerosol-cloud-radiation interaction over subtropical marine stratocumulus regions? In my memory, Twomey (1977) studied the clouds over continent and over the tropical ocean. Anyway, how did you define your study regions here?

Line 67-69, not only the cloud supersaturation, but also other properties (such as aerosol amount, entrainment, detrainment, and so on) would be changed by the dynamical processes. You may read and cite some recent studies to emphasize this point, such as the effect from aerosols and vertical velocity.

Line 90, you may change "addresses" to "provides", "showes" or "gives".

Line 94-96, how would you expect the extra errors caused by this kind of interpolation?

Line 98, "is required" -> "requires"

Line 101, delete "also" since they are from different product.

Line 104-107, a little information about the potential uncertainties from these data process could be helpful.

Line 109-112, two comments I would like to give here. First, you should indicate whether the time is local time or UTC time. Second, regarding the use of the average of two time point cloud observations to represent daily average, it would introduce the time

representation error as indicated by Wang and Zhao (2017, doi:10.1002/2016JD025954). This representation error is significant when considering short-term studies (up to 14%), but is negligible when considering long-term statistical analysis. This representation error which is negligible in this study should be acknowledged.

Line 121-123, As mentioned above, this time representation error could be large for short term, but becomes negligible when considering long-term period.

Line 147, delete "for"

Line 153-154, why do the authors put this single sentence as a paragraph? Also, I am a little confused about the method described with this sentence, may you please explain a little more?

Line 158, why 90% instead of 95% confidence level is selected here?

Line 160, this is not a complete sentence, you might use "The regression model of cloud albedo *acloud* is as follows"

Line 198-200, it is still not clear to me how the model NorESM2-LM improve the stratiform cloud parameterization?

Line 205, "shows" -> "show"

Line 226-230, what do these positive and negative correlations indicate?

Line 246-247, please rephrase this sentence.

Line 260-261, please rephrase the sentence.

Line 266-267, sorry that I do not understand this sentence, please rephrase it or explain.

Line 270, "are" -> "have"?

Line 272, "the smallest"

Line 278-280, how could you explain the large cloud albedos in winter? The following sentences in Line 280-292 did not explain this except they show some influential factors to marine cloud properties.

Line 323-324, what are the potential reasons for the superior performance of AMIP6 at the Australian region?

Line 328-329, these two sentences show almost the same meanings and have been described earlier. You may delete them or one of them to avoid redundant descriptions.

Line 329-331, regarding the significant role of LWP on the relationship between aerosol and clouds, some recent studies are worthy to read and mention here, Qiu et al. (2017, doi:10.1016/j.atmosenv.2017.06.002) and Zhao et al. (2019, doi:10.3390/atmos10010019).

Line 332-333, you may rephrase this sentence to make it more clear.

Line 341-342, "that the cloud albedo increase with increasing BC and decrease with increasing" -> "that the cloud albedo increases with increasing BC and decreases with increasing"

Line 355-365, in addition direct effect of dust on cloud properties, the dust aerosol can even further influence the meteorological environment that the clouds form as indicated by Sun et al. (2020, doi:10.1029/2020JD033454)

Line 374-376, do you mean "SO42-"?

Line 383-384, you cannot compare time scale with region scale. I think what you would like to deliver is the time scale difference between "monthly average" and "instantaneous"?

Line 407-408, while this result could be right, personally, I think theoretically the meteorological factors should have important influence on the interactions between aerosols and cloud albedo for low LWP conditions.

Line 410-414, have you used the data of "SO₂"?