Minor Comments Reviewer 1

The authors have done a nice and sufficient job addressing my previous comments. I have two very minor follow-up comments.

L621-620. It is still not clear to me how mathematically the precipitation decrease (10 mm/year) is estimated. Did you use any of the equations shown in Figure 4? The authors have mentioned that this is calculated by comparing to a reference case without dust at all. So, does it represent the dust effect on precipitation in your piClim-control cases (i.e., piClim-control – no dust)? Or does it represent the effect of doubling dust in piClim-2xdust comparing to piClim-control?

Reply: *We agree that as written the statement is confusing, we have updated the text to emphasize that a doubling of dust could cause a precipitation of up to 10mm/year. It is as the reviewer states, the precipitation decrease is estimated by comparing piClim-2xdust with piClim-control.*

~~We accordingly assess that dust~~ Consequently, we assess that doubling the dust load could decrease precipitation by up to approximately 10 mm year−1~~, compared to a reference case without dust at all~~.

Please check all the references to supplemental figure numbers. There are some mistakes. For example, at L524 in the track changes version, I believe it should be Figure S9, instead of Figure S8. Also, at L626, it should be Figure S8.

Reply: *We thank the reviewer for identifying these errors and we have checked and corrected incorrect references to in the revised manuscript.*

Minor Comments Reviewer 2

I have only a few very minor comments on the revised manuscript, and I believe it could be accepted for publication thereafter.

Lines 38-40: To my knowledge, Marx et al. (2024) present results focused solely on the northwestern Pacific. I do not think their study can be used to support the statement regarding a global increase in dust burden.

Reply: *Yes the citation was inaccurate given the original statement. We have rephrased the sentence:*

Substantial evidence indicating that ~~global~~ atmospheric dust burden has ~~increased significantly~~ significantly increased in several regions around the globe since the beginning of the industrial era has ~~firmly~~ been established by observations (Hooper and Marx, 2018; Marx et al., 2024; Mulitza et al., 2010),

Lines 70-71: The citation of Claquin et al. (2003) might be questionable in this context, as their study investigates the effects of different mixing states of iron oxides (hematite and goethite) and, more generally, the influence of dust mineralogy on dust radiative forcing. Although variations in mineralogy can indeed alter the CRI of dust aerosols and, consequently, the DuERE, the connection between Claquin et al.'s findings and the specific claim in this sentence is somewhat indirect.

Reply: *We have removed the Claquin et al (2003) citation and added Myhre and Stordal, 2001; Li et al., 2021, modelling studies emphasizing the effect of CRI of dust on the magnitude of DuERE.*

Line 73: I am not entirely certain whether particle shape should be considered a dominant factor in determining the DuERE. However, based on the authors' citation of Ito et al. (2021), dust asphericity, under their modeling assumptions, leads to a relative change of approximately 15% in the top-of-atmosphere dust shortwave direct radiative effect (see their Table 5).

Reply: *We have added one sentence describing the findings of Ito et al 2021. While we agree that particle size is not the dominant factor in the uncertainty of the DuERE at the TOA, the study shows that asphericity increases the surface cooling by almost 40%.*
Ito et al.(2021) found that dust asphericity alone increased the SW TOA cooling by around 15% (−0.32 vs. −0.28 W m−2 on a global scale), however, asphericity had limited impact on net TOA DuERE due to increased LW warming.

Lines 74-75: It may be helpful to include additional or alternative references, either from the list below or others known to the authors.

Laboratory studies:

Di Biagio C, Formenti P, Balkanski Y, Caponi L, Cazaunau M, Pangui E, Journet E, Nowak S, Andreae MO, Kandler K, Saeed T. Complex refractive indices and single-scattering albedo of global dust aerosols in the shortwave spectrum and relationship to size and iron content. Atmospheric Chemistry and Physics. 2019 Dec 19;19(24):15503-31.

Lafon S, Sokolik IN, Rajot JL, Caquineau S, Gaudichet A. Characterization of iron oxides in mineral dust aerosols: Implications for light absorption. Journal of Geophysical Research: Atmospheres. 2006 Nov 16;111(D21).

Modeling study:

Li, L., Mahowald, N. M., Miller, R. L., Pérez García-Pando, C., Klose, M., Hamilton, D. S., Gonçalves Ageitos, M., Ginoux, P., Balkanski, Y., Green, R. O., Kalashnikova, O., Kok, J. F., Obiso, V., Paynter, D., and Thompson, D. R.: Quantifying the range of the dust direct radiative effect due to source mineralogy uncertainty, Atmos. Chem. Phys., 21, 3973–4005, https://doi.org/10.5194/acp-21-3973-2021, 2021.

Reply: *We have included some additional and alternative references according to the reviewer suggestions.*

Line 83: The authors may also want to explicitly identify which ESMs are still using OPAC data.
Reply: *We have now included the ESMs that we are aware that still is using the OPAC data.*

Line 100: Lastly, clarification is needed regarding the size range of super-coarse particles. Kok et al. (2017) consider only particles smaller than 20 µm.

Reply: *Thanks for pointing out the lack of clarity regarding the particle size definition. We now include how we define "super-coarse" and clarify that the Kok et al. (2017) study only consider particle size up to 20µm.*
However, later observations have shown that coarse to super-coarse ~~dust(> 10 µm)~~—sensu Adebiyi et al. (2023a) > 10, ≤ 62.5 µm—is transported in non-negligible quantities further than expected (e.g., Ryder et al.,2018; Adebiyi et al., 2023a). . ~~Including~~ Kok et al. (2017) showed that including super-coarse particles ~~in ESMs has been shown to reduce~~ up to 20µm reduced the TOA DuERE by 50% (from −0.46 to −0.2 W m−2) due to the shift of the PSD to larger sizes, reducing SW extinction while increasing LW warming~~(Kok et al., 2017)~~.