This article analyzed the inter-model discrepancies of the spatial distributions and interannual variability over dust source regions and climate zones, and quantified the total and relative explainability of wind speed and 5 hydroclimate parameters with the dominance analysis. The analyses of this study could help better understand the uncertainties of dust emissions among various Earth system models. The analyses and methods are reasonable. However, it would benefit from several improvements in terms of the size distribution and size cut of emitted dust, model resolution, model screening, and comparisons of dust burden and physical parameters against observations.

General Comments

1. As the simulated size distribution and size cut would largely affect the total dust emissions, it is recommended to better reconcile the total dust emissions for a defined size cut for a fair comparison and attributing the physical drivers. As shown in Table 1 in the study, there are large variations in the maximum diameter simulated in different Earth system models. In addition, different size distributions used would induce different total dust emissions even with the same model and dust emission scheme, but there is no information shown in this study about the size distribution of emitted dust.
2. As suggested in this study and various prior studies, different model resolutions could induce substantial and even orders of magnitude differences in total dust emissions. It is recommended to add the information of the model resolution used and potentially reconcile or better separate the differences induced by the model resolution.
3. It was suggested several times that some models may have intrinsic unreasonable representation in terms of dust emissions, for example in lines 218-223 and 368-370. Why are these models included in the inter-model comparisons for dust in this study? Would it make more sense to exclude them if they showed unreasonable representation of dust emissions?
4. What are the model performances in terms of total dust burden compared to ground-based and satellite-based observations? Why are the 5 hydroclimate parameters specifically chosen?
5. Out of curiosity, what are the annual trends of dust emissions and driving factors for different regions and climate zones? Are regions showing insignificant trend of total dust emissions the regions with larger interannual variability among models?

Specific Comments

1. For Table 1, what are the size distributions of emitted dust, and horizontal resolutions for different models?

2. Line 111-115: what the rationality of including these additional models or generally what is the criteria for selecting certain models for comparison?
3. Line 125-127: why are these two reanalysis products chosen? Are they treated as the reference? What are their model performance compared to observations?
4. Line 139-141: what is the data source of the aridity index? Are they climatological mean from a certain Earth system model? What are the annual trends of the aridity over these climate zones? Would semiarid zones shift to arid zones over the climatological range considered in this study?
5. Lin 173: are the target grid cells the same among different models? Do they vary as different models have different grid cells with nonzero dust emissions? If they vary, would the different number and location of target grid cells affect the intercomparisons?
6. Line187-190: why do these models use a truncated version of dust source function? How do they compare against observations for dust optical depth? If they show worse results, should they be excluded for the comparisons? As E3SM2-Zender uses the original dust source function and CESM2-Zender uses the truncated dust source function, this would be misleading for the conclusion about the effects of different dust emission schemes shown in line 481-487 as they are different Zender schemes.
7. Line 234-236: how about the size distribution in other models?
8. Line 247-249: how do the winds in MIROS-ES2L and MIROC6 compared to observations?
9. Line 263: what are their original resolutions?