

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-1055

Anonymous Referee #2

Referee comment on "Causal influences of El Niño–Southern Oscillation on global dust activities" by Thanh Le and Deg-Hyo Bae, Atmos. Chem. Phys. Discuss.,
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This paper aims to investigate the effect of ENSO on global dust emissions, concentration, and deposition. A multivariate predictive model and the Ganger causality test were used to analyze dust-relevant output from 12 CMIP6 models.

General Comments

A major and critical shortcoming of this paper, in current form, is the lack of detailed presentation of methodology, results, and discussion. The paper seems to be written hastily.

- **Methodology:** Authors only provide a few lines about their approach, and refer readers to their previous works and the supplementary document. However, a brief description of the method should be presented in this section. Additionally, authors stated that they studied confounding effects of other climates modes, namely NAO, SAM, and IOD. First, what is the basis for choosing these modes(?), and second, no analysis or sensitivity test regarding this treatment was provided. Finally, what is the basis for choosing these 12 models as data crucial for these analyses are missing in three of them (table S2)?
- **Results and Discussion:** Results were presented and discussed in a highly qualitative manner without any in-depth analysis as required in a manuscript with an archival value. Authors only reported the fraction of total "affected area" over ocean and land, but this number alone is not useful in understanding the true impact of ENSO on dust activities in different regions of the globe. As expected, individual models show drastically different results (figures 4-6), but conclusions of the paper were based only on the ensemble mean results with minimal discussion about the difference between models. Note that the chosen models use different dust emissions and deposition, as well as dust size partitioning schemes, so ensemble mean results must be interpreted with caution. Finally, several conclusions of the work are not supported by the current results, for example, "ENSO may initiate dust activities in (line 93)", "dust deposited

in the South Pacific and the Southern Ocean might be originated from central Australia and southern South America (line 117)", "weak causal impacts of ENSO on regional dust emissions of major dust sources (Figure 3) may indicate the important role of human influences in igniting local dust activities... (line 132)".

Specific Comments

- Line 15 and all other places through the manuscript: Caution must be practiced with the term "concentration" as the relationship between dust concentration and dust AOD depends on the pre-defined and assumed dust particle size distribution, which is different in different models.
- Line 15 and all other places through the manuscript: Change "transportation" to "transport"
- Line 57: "Dry and wet deposition is related to different types of dust and aerosol." Not clear what authors mean here.
- Line 82: How are "areas affected by ENSO" defined? What are the criteria considered?
- Line 116: Change "original" to "originated"
- Figure 1: What is the significance of studying dry and wet deposition separately in figure 1, as paper provides no insightful comparison between the two?
- Figure 2(b) and S2: There two figures don't provide any addition information beyond just one number mentioned in the text, so they should be removed.
- Table S1 and S2: Should be merged into one table
- The following recent publication might be of interest to the authors:
<https://acp.copernicus.org/articles/22/2095/2022/>