

Atmos. Chem. Phys. Discuss., referee comment RC3
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Comment on acp-2021-1055

Anonymous Referee #3

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., <https://doi.org/10.5194/acp-2021-1055-RC3>, 2022

The paper presents an analysis on the influence of the El Niño–Southern Oscillation (ENSO) on the global dust activities (emission, concentration and transportation and dry and wet deposition) based on CMIP6 historical simulations. The manuscript is structured and concise and the topic is of scientific interest, therefore I would encourage publication provided that the following point are addressed:

General comments:

Among the key results that are emphasized by the manuscript (abstract included) there is the suggestion of the role of human activity in the intensity of dust emission as a consequence of a lack of clear causal impact of ENSO on dust availability. This point does not seem to be clearly explained, nor properly supported in the discussion. Also, it is not clear why is the human activity the only other possible factor considered when finding a weak role of ENSO in regional dust emissions over major dust sources.

Lines 35–38 list a series of references mentioning studies who observed the ENSO influences on dust activities but only one of them is then compared with the results of the manuscript itself (Marx et al 2009) regarding the emission over Australia. The reader is left questioning if there is any other agreement/disagreement with the previous studies.

The methodology section is way too brief and not explicative, totally referring to the text S1 of the supplementary. I would encourage to better explain the methods and/or move part of the supplementary in this section.

I was wondering also if there is any way to mention how significant is the ENSO variation

on dust activities with respect to the total global dust activity, for example the AOD variation due to ENSO with respect to the global AOD average.

Specific comments:

Lines 68-70: The authors mention the “confounding influence” of SAM, IOD and NAO but should explain at least briefly why and how those modes can be relevant on their study.

Lines 80-91: I do not understand the choice of using the “total earth surface” percentage quantity as a parameter. Especially, this does not make much sense to me when dividing the study on land areas and ocean areas. It would already give more information by dividing in % of total ocean surface when considering ocean areas, and % of total land surface when considering land.

Section 3.2: The authors should explain why there are a different number of models compared for the different cases (12 models for the ENSO effect on dry deposition, 9 for the aerosol optical depth, 11 for the dust emission)

Line 122: It would be worth to mention briefly what is meant by “marine productivity”

Line 134-136: The paper mention before that there is little consensus of the models on the impact of ENSO on dust emissions. Would it be still possible to draw any relevant conclusion on the effect of ENSO on dust emissions, including the suggestion of the possible anthropogenic impact on dust emissions?