

Interactive comment on “Weaker cooling by aerosols due to dust-pollution interactions” by Klaus Klingmüller et al.

Anonymous Referee #2

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This manuscript describes global model simulations to assess the impact of dust pollution interactions in cloud liquid and ice water content and direct and indirect aerosol radiative effect. The design of numerical simulations is appropriate and methodology to delineate various terms is reasonable. The results indicate dust aerosol interaction will reduce the negative cooling effect of aerosol. The result is quite interesting and worth publication. However, some clarifications of the methodology are required to facilitate better understanding.

P3, L28-29, The sentence reads awkward.

The methodology section, it would be better to move the description of four experiments with ('0', 'dust', 'Anthropogenic', 'Full') first. Then describe the 16 ensemble simulations and the nudged simulations for each experiment.

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Table 1-2 and 3S-4S caption, I am very confused here. The Mineral dust and Anthropogenic pollution by their definition, either only contains dust or pollution and there should be no dust pollution interaction, why do these simulations include the interactive term? Shouldn't 'Mineral dust' effect be simply $X_{\text{dust}} - X_0$ and "Anthropogenic" effect be $X_{\text{pol}} - X_0$ and the last term computed with Eq. 2?

P5 L23-24. What do you mean by neglecting 'aerosol-radiation-interaction'? Do you mean by excluding the aerosol contribution in the radiation calculation? That should not be termed as "aerosol-radiation-interaction".

P5 L28. How do you compute the total radiative forcing? Do you mean "total aerosol radiative forcing"?

Section 5. How do you define the TOA radiative forcing in SW and LW? Is this simply the difference of reflective SW and outgoing long wave (LW)? What direction is considered positive, into the Earth or out of Earth?

P7 Last paragraph and Figure 4: it contains a lot of calculations that are not straightforward to readers. It took me a while to figure out (hopefully I got them correct!). Better to spell out how each term is calculated. For example, $X_p - X_0$ represents total aerosol effect without dust and $X - X_0$ represent total aerosol effect with dust (blue + green). The green part is computed from the difference of two calls of radiative transfer code with or without aerosol contributions. Then the blue part is total minus the green part. The red bar should be result of Eq. (2). Why is this number different from the global total in Figure 3?

I haven't understood the rationale for using maps from nudged simulations while global averaged effect (Table 1 and 2) from SST simulations in the main article. Could you explain how each of these simulation configurations contrast and complement with the story you wish to tell?

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