

In this study, the authors examined the response of SASM and EASM to idealized reductions in anthropogenic emissions of carbonaceous and SO₂ under SSP3-7.0 scenario. The authors found that reducing both scattering and absorbing aerosols intensifies monsoon systems. The overall impact is dominated by scattering aerosols, while absorbing aerosols have the opposite effects. The reduction in scattering aerosols advances the monsoon onset but delays its withdrawal. The experiments are well designed, and results are clearly presented. I have a few comments for the authors to consider.

General Comments:

1. I would suggest the authors add more discussions, especially for section 3.1 and 3.2, to clarify a bit more. The authors tend to only describe the figures very briefly and don't give much explanation (dynamical mechanism) to the changes induced by reductions in scattering and absorbing aerosols. Most of the content for Fig. 3 is introduction of the method. Maybe the authors can put method/calculation related content to section 2 so that there is more room for detailed discussion. The interpretation is blended with method, which is easy to get lost. There is also little discussion related to Fig. 4 and 5.

2. It is interesting to see the linearity/non-linearity when combining reductions in both scattering and absorbing aerosols. However, I would give a second thought about discussing this mostly in the last result section (sect. 3.4). The authors can either blend this section with other sections and give an overall discussion in the conclusion section or at least say a few words about the linearity in other sections.

3. How would the model biases, such as in precipitation and monsoon onset/withdraw, affect the signals from perturbed simulations? For example, the overview paper of UKESM1 by Stellar et al. (2019) shows considerable low biases of precipitation in JJA over South Asia.

4. Have the authors looked at the impact of reducing local (with SA and EA) anthropogenic emissions versus the impact of reducing anthropogenic emissions outside of the two regions? How much of the changes in SASM and EASM are induced by the reduction of local anthropogenic emissions?

Specific comments:

Lines 116-117, what do you mean by "includes the physical core climate model of"? Could you rephrase it?

Lines 143-144, just would like to check that anthropogenic emissions of SO₂, OM, and BC are reduced globally, not just for South and East Asia, right?

Line 156, what do you mean by “different random perturbations in the stochastic physics”? Perturbing temperature of the initial state? Could you be more specific?

Lines 178-179, I would suggest the authors mention Fig. S1 here or even before to explain the definition of the two domains.

Line 215, missing a space between C_m and of.

Lines, 272-274, the conclusion seems to be too general, and may not be the situation for both EASM and SASM. For example, how about the increase of SLP over China in Fig. 8c?

Lines, 279-282, I would argue that Fig 8a seems to be more close to Fig 8c, indicating SCT dominating. Fig. 8i does not like Fig. 8j-l, indicating strong non-linearity?

Lines 295-300, should it be “atmospheric warming associated with the SCT reduction” according to Figure 7? Should it be “The geopotential height increases in the uppermost troposphere ...” instead of “The pressure ..”? I would argue that it is not so obvious in Figure 7 that the geopotential height changes strengthens the poleward pressure gradient force in the north flank of this area.

Line 345, should be “may not be a linear summation of”?

Lines 384-393, I would suggest the authors state the impacts for SCT and ABS in two separate sentences instead of putting antonyms in parentheses. It is easy to get lost when reading long sentences.

Figure 2, I would suggest changing the title for middle column to be MON to be consistent with PRE and PST. Or maybe it is better to just pre-monsoon, monsoon, and post-monsoon.

Figure 3, could you change scale for left y-axis of panel b from day to pentad? It may be clearer to compare panel a and b. Is it possible to add values showing linearly combined SCT-75% and ABS-75%?

Figure 6, similar as Figure 3, could you change scale of panel b from day to pentad for better comparison and consistency?

