Using an intermediate complexity climate model, Recchia and Lucarini investigate how the Asian monsoon responds to absorbing aerosols. They perform perturbations of increasing magnitude, and they also look at the individual sensitivities to perturbations in three Asian subregions as well as the linearity in these latter simulations. Additional simulations are performed to study the effect of simultaneous aerosol and CO2 increases. They find reduced summertime precipitation in the regions of applied forcing, approximately linear with the magnitude of the forcing, and a more variable response in surrounding regions. CO2 acts to partially offset the noted precipitation reduction.

With the large ongoing and potentially future emission changes in the Asian region, it is more important than ever to understand how the Monsoon responds to such a forcing. While e.g. Earth System Models include more of the processes potentially at play, the reduced-complexity model used here have the strength of increased transparency and can be easier to interpret. I therefore believe that, given some edits noted below, this paper can be a good contribution to the field and may be fit for publication in Earth System Dynamics.

General comments:

The paper is well written, starting with a good presentation of methods data and cases. Results are clearly presented with a fluent language and well-designed figures. I have two general comments, that will recur in the specific comments below:
1) authors need to be clear that their "aerosol forcing" emulates absorbing aerosols only, not scattering aerosols. This should be evident if not in the title, then at least in the abstract and throughout the text.
2) the authors present many good figures, but there is a general lack of quantification and statistics.

Specific comments:

P2: both in terms of the response of the monsoons and in the future climate forcing.
Could you please consider rewording this sentence as it's a bit confusing. How the monsoon evolves in a changing climate is uncertain because we don't know enough about the how the monsoon reacts to a forcing. We also don't know exactly how the future forcing of the climate will be. Was that the point?

P2: The multi-model mean usually performs better than any single model [14–17].
Does this have some physical explanation or is it just pure luck?

P3: Generally, aerosols have a stabilising effect on the atmosphere, through surface cooling and mid-tropospheric warming, increasing the stratification of the atmosphere and causing a drying trend [35–37]
This is indeed an important effect, but I disagree that is a *general* effect. This is an example of places in the text where the fact that authors are focusing on absorbing aerosols needs to be made clear.

P3: but moving forward, greenhouse gas forcing is expected to dominate, which is associated with a likely increase in monsoonal rainfall in the northern hemisphere
I agree that aerosols have played a stronger role historically than they will in the future. However, in the near-term we may see quite strong aerosol trends (reductions, presumably, but still) in certain regions. In the longer terms, greenhouse gases will indeed dominate, but I think the authors should consider adding the point that aerosols are still important in the near-term (also elevating the importance of your analyses).

P4: The main goal is to understand the impact of aerosol forcing on the
Please add "absorbing" before "aerosols".

P6: Here, we use a combination of our own simulations with the PLASIM model and results from existing literature that use a hierarchy of models to quantify the responses of the South and East Asian monsoons to a range of future climate scenarios
It is not entirely clear what is meant here: are results from other studies used in this study? If you just refer to

other studies in the text it would be good to reword this sentence so it doesn't seem like they are a direct part of this study.

P7: Figures1–4 show the performance of a 50-year control simulation with the PLASIM model
I usually think of a model's performance as how the model does compared to the real world (i.e., compared to observations). I realize that you show and explain how the model does display real-world features, but section 2.1 in general lacks the observation element. It is obvious that the authors know their field and the description of the PLASIM features in the text is excellent, but the reader needs to be shown – not just told, without any references – that it agrees with observations. Adding references to the literature when describing different dynamical features, as well as a figure or two comparing PLASIM directly with observations is needed here.

P10: The added aerosol forcing causes the surface to cool
It would be very interesting to see a regional average of the vertical temperature profile, to see how it changes with this "aerosol forcing".

Figure 7, arrow sizes: In the figures with wind arrows, it is extremely difficult to see the direction of the arrows. Would it be possible to play with the plotting here, trying e.g. to make the arrowheads larger, to have fewer but larger arrows, or something like that?

Figure 7, arrow directions and wind speed anomalies: I'm having difficult with these winds, and I would like to underline that if there is a well established consensus that this is how wind changes are displayed, then the following comment may be disregarded: Authors have chosen to show anomalies in both wind speed and in wind direction. I'm not sure this is the best way to convey the results, and to show how the climate of the region looks under a strong aerosol-like perturbation. For instance, looking at the 850hPa panel for ~150W/m2, there is a strong blue band stretching across south India and towards the southwest. This dark blue color should be read as: the SW monsoon wind has weakened dramatically and is close to zero. This, to me, is very counter intuitive. Also, when arrows point in the opposite direction, this does not necessarily signify that the average wind direction has turned? It would be easier to interpret the changes if maps showed absolute wind speeds and directions, so they could be compared directly to the first green maps. Lighter/darker colors than that "baseline" map would mean stronger/weaker winds, and arrows would point in actual wind directions.

P13: There is a strengthening of the low-level southwesterly wind in East China, causing dry air to be advected towards East Siberia
I'm probably misreading this but: a stronger wind from southwest sends dry wind *towards* the west?

P14: We note again that between 0 and60W/m2forcing, although the convective precipitation is gradually reducing,the precipitable water does not correspondingly decline.
Why was that?

P15: A more quantitative angle
This paragraph is one place where I believe the authors could have been more quantitative in their analyses. Could you try to put a quantitative number on the "sensitivity to aerosol forcing", for instance? The numbers would be contrasting nicely between convective precip. and precipitable water.

P15: Regarding the analysis of forcing vs regional climate impact: it would be good to see a few concluding sentences reminding the reader why these results are relevant – what are their link to the real world (small/large emission changes)?

P16: Although the precipitable water is considerably greater when carbondioxide levels are doubled
Provide the reader with a quick explanation of why that is.

P17: noting that the elevated levels of precipitable water do not correspond to comparable increases in precipitation
Please provide a physical explanation to this.

P17: Considering Figures 9&10, there is little difference in the three columns, which represent approximate forcings of 30W/m2, 60W/m2 and 90W/m2. This indicates a fairly linear behaviour.
These linearities must be quantified. Spatial correlations between the maps are one suggestions, but I'm sure there are other.

P17: Our results suggest that in the future, the anticipated reduction in aerosol concentration may have a greater impact on monsoonal precipitation than the increase in greenhouse gases.
This is a nice and clear result, written in a way that conveys the relevance of this study. This message should be underlined – in the abstract and/or in the final conclusion.

P18: The precipitation response of India to forcing applied over East China is nearly as strong as when the forcing is applied locally, albeit with opposing trends.
Again, please provide a physical explanation, or at least a suggestion to one.

P20: On removal of the aerosol forcing, we find that the monsoon system recovers fully, indicating that there is no hysteresis in our model simulations.
Where is this shown? The reader needs to see this finding.

Conclusion: Given the tool used, I believe the method of emulating absorbing aerosols is as good as any. However, it would be good to see a short discussion of caveats connected to the very idealized nature of this type of perturbation.

Technical corrections:

Line numbers on the document will greatly ease the reviewer job in the next round!

First sentence of introduction: "region economy" → "region's economy"

P14: a little bug: ¡60W/m2

P14: form → from: form 0 to 150W/m2

P14: sdepends → depends with 2xCO2andaerosol only, sdepends