

Interactive comment on “The relative importance of impacts from climate change vs. emissions change on air pollution levels in the 21st century”
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Anonymous Referee #2

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The study addresses an interesting issue relevant with the compared impact of climate change and emissions on the air pollution changed levels in the 21st century. The scientific tools used to address the issue are well documented and the methodological approach is scientific sound. The paper gives some answer to the question of whether climate change or emissions can drive mostly the pollutant concentration changes in the future. However, in many cases, in-depth explanations of the reasons why climate change or emission changes can be more effective in the determination of the future air pollution changes are lacking. Under this view, the manuscript can only be published after important additions and more discussion about the physical and chemical mechanisms that contribute to the air quality change either due to climate change or to

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changes in pollutant emissions.

Following are some comments that the authors would like to consider:

- 1) In the manuscript, primary sulfates, nitrates and ammonium are no mentioned. How are they addressed in the analysis?
- 2) Natural emissions are represented mainly by isoprene emissions. Dust emissions are they included in model runs? Which other natural sources are missing (eg sea salt)?
- 3) Figure 1 and 2 shows changes in precipitation frequency and mixing height between present and future time. How can these changes be explained?
- 4) In the paper there are no figures to show the changes between present and future time emissions for chemical species like ozone precursors (NO_x, VOCs), BC, PM2.5. These figures could better help the reader to understand the air pollution changes linked to emission changes (figures 3b, 4b, 6b and 7b).
- 5) The negative values in the figures 3d, 4d, 6d and 7d should be presented with separate bins in the arithmetic scale. Provide explanation why they appear.
- 6) The changes in physical and chemical processes that cause the PM2.5 concentration changes and the climate to emission signals ratio shown in figure 6 are not thoroughly explained in section 4.2 (as it is done for BC). Probably a figure could be presented also for PM2.5 that is similar with the figure 5.
- 7) In section 4.3, there should be more discussion on the scientific reasons for the signals and impacts shown in figures 7 and 8.
- 8) Please give in the manuscript the definition of NO_y (=NO_x + HONO + PAN + HNO₃ organic nitrates + other N-species??) and NH_x?
- 9) Conclusions should be shortened because they repeat what is written in the previous sections.

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10) It is clear that in figures 3,4, 6 and 7 the relative impacts from (a) climate change, (b) emission change and (c) total change, (d) the climate signal relative to emission signal are shown. No need to repeat it many times in the manuscript.

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