Atmos. Chem. Phys. Discuss., 15, C10621–C10627, 2015
www.atmos-chem-phys-discuss.net/15/C10621/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Potential impact of a US climate policy and air quality regulations on future air quality and climate change" *by* Y. H. Lee et al.

Anonymous Referee #2

Received and published: 18 December 2015

The manuscript of Lee et al. investigates the potential US air quality and climate impacts of different emission controls assumed for the future. Strictly air quality-focused controls are contrasted to the effects of CO2-focused controls. The conclusions are based on a series of simulations that aim to separate the role of different emissions reductions and of different interactions within the climate system.

The manuscript is well within the scope of ACP, and it includes useful new results that will be helpful for designing future air quality and climate policy, while providing some insight into processes involved. I do not have any major concerns, except of the fact that the "Simulation setup" (3.1) section is rather confusing and needs some improvements and clarifications (see below). Furthermore, there is a range of mostly minor suggestions that I list below which I believe will improve the manuscript. Following

those, I believe that it will be ready for publication.

SPECIFIC COMMENTS:

Page 31386, Line 4: Presumably, it is not just CO2 that is changed in this hypothetical scenario (as it is seen later in the abstract). This needs to be clarified early on.

Page 31386, Lines 7-8: Suggest changing “and other US emissions” to “and other US emission datasets”.

Page 31386, Lines 10-11: By when? (same in subsequent sentences)

Page 31386, Line 23: Suggest adding “simultaneously” before “target”.

Page 31389, Line 8: Suggest changing “electric” to “electricity”.

Page 31389, Lines 16-17: Maybe intended to write “additional” instead of “additionally”?

Page 31389, Lines 19-20: Suggest rephrasing to “in part because of compensating effects of improved fuel efficiency and growing demands.”

Page 31390, Lines 22-24: Why is this? Worth explaining.

Page 31391, Line 15: Suggest rephrasing to “and radiation calculations are performed every 2.5 h”.

Page 31391, Line 20: Suggest rephrasing to “and four for silt”. Also suggest substituting “with” with “for” earlier in the sentence when referring to clay.

Page 31391, Line 20: Please change “sulfuric dioxide” to “sulfur dioxide”.

Page 31391, Line 28: Spelling of “releaseed”.

Page 31393, Lines 3-4: Some more detail is needed here: What are the oxidation processes that affect aerosols in the model(s) (OH, H2O2, ozone, others)? How well are the oxidants simulated in the model (e.g. as found in previous papers)?

ACPD

15, C10621–C10627, 2015

Page 31393, Lines 6-9: Some mention of model performance in capturing aerosols would be helpful here (for both aerosol modules).

Page 31393, Line 11: Suggest rephrasing to “ModelE2, except for CO2 RF”.

Page 31393, Line 13: “utilize” -> “utilizes”.

Page 31393, Line 14: “timescale” -> “timescales”.

Section 3.1: I am not entirely convinced that there is a good reason for the FIXMET/FUTURE simulations and INTERACT to have different lengths (3 vs 20). The reason why in fixed-SST ERF estimates we perform multi-year simulations (typically 20 or 30) is not that the rapid atmospheric adjustments take that long to occur, but that we need a higher signal-to-noise ratio, which is an issue even if the SSTs/sea ice are fixed. In that sense, I cannot see why the FIXMET/FUTURE cases would not similarly warrant 20-year simulations. Please explain.

Page 31393, Line 24: For it to be entirely “CTM-like”, the atmosphere should be constrained to observations as well (e.g. via nudging). I would avoid this characterization here, as it is somewhat misleading.

Page 31393, Lines 26-28: Similar to above: The prescribed SSTs and sea-ice will not lead to exactly identical meteorology. I suggest adding “approximately” before “the same”.

Page 31394, Line 3: For radiative forcing, and especially for climate response (not studied here), I expect that indeed the signal will be partly obscured by internal noise. But for air quality, the differences in emissions between 2005, 2030 and 2055 are so large, that it is hard to imagine that the signal would not exceed the noise. In a nutshell, I think this statement is too strong when it comes to air quality signals.

Page 31394, Line 15: I suggest removing “overall” here, as that implies full ocean-atmosphere simulations.

ACPD

15, C10621–C10627, 2015

Page 31394, Line 18: Suggest rephrasing to "...can estimate the radiative response following "rapid" adjustments in the atmosphere ..."

Page 31394, Line 20: Suggest adding "in the same model" after "estimate aerosol effective forcing".

Page 31394, Line 20: It is not clear from the reference list which is 2013a.

Page 31394, Line 22: Is "cloud" mentioned intentionally here? Perhaps just stating "the resulting radiative forcing is not identical to aerosol effective radiative forcing" would be more accurate.

Table 1: The title of the last column is a bit confusing – for example, for FIXMET, it gives the impression that aerosols and non-CO2 gas emissions impact climate. Also, I suggest changing the caption to "Summary of simulation categories used in this study".

Table 2: The table could be made substantially simpler if all the 05 simulations could be named "bs05". Given that for 05 the conditions are the same in all cases (noaq05, c50nq05, bs05, c5030-c5005), it would make sense to substitute all of them with bs05, in which case all of the bs05 occurrences would cancel, and the table would be much simpler and easier to comprehend.

Furthermore for Table 2: I suggest reminding the reader in the caption what the different notations mean in the "Simulations" column. It would help so as to avoid having to refer back to Fig. 1 or to the text in order to recall.

Table 2 is referenced after Table 3 in the text.

Page 31397, Line 16: "PM related" -> "PM-related".

Page 31397, Line 25 onwards: It is somewhat hard to follow what the difference is between CO230/CO255 and BOTH30/BOTH55. It is stated that the former is "for the impact of CO2 reduction policy under the air quality regulations", so why is it not equivalent to both? It may become clearer later on, but it is worth making it clearer here

ACPD

15, C10621–C10627, 2015

too.

Page 31398, Lines 5-7: Why? Briefly explain.

Page 31398, Line 14: “PM related” -> “PM-related” (same for ozone).

Page 31398, Line 18: “Since no more emission constraints are added after 2020. . .”: I am not sure that this has been made clear earlier in the text. Worth revisiting and maybe adding a statement on this earlier.

Page 31399, Line 8: Worth adding “. . .due to the longer lifetime of these pollutants” at the end of this sentence.

Page 31399, Lines 11-13: Why? Please briefly explain as this is quite a prominent feature.

Page 31399, Line 15: Suggest changing “direction” to “sign”.

Page 31399, Line 23: Suggest adding “reductions” after “NOx emissions”.

Page 31399, Line 24 onwards: This part of the text seems to be suggesting that the air quality effects of CO2 measures are more effective in the absence of measures that target air quality directly. Perhaps this is sort of obvious and not particularly informative, for the amount of attention/text that has been devoted to it, but if the authors wish to keep this discussion, there should be a correction to avoid confusion: The sentence “Lastly, impacts on air quality are larger in the absence of the air quality regulations. . .” should be rephrased to “Lastly, impacts of measures targeting CO2 on air quality are larger in the absence of the air quality regulations. . .”. Otherwise, the reader may think that it is suggested that CO2 measures are more effective for tackling air quality than the air quality measures themselves (which is not the case).

Page 31401, Line 2: Please add “to” between “similar” and “each”.

Page 31401, Lines 14-15: Suggest rephrasing to “as ozone is a secondary air pollutant with a longer lifetime than aerosol constituents”.

ACPD

15, C10621–C10627, 2015

Page 31401, Line 20: And due to ozone?

Page 31401, Line 23: “direction” -> “sign”.

Page 31402, Lines 10-11: Suggest rephrasing to “emphasizing the importance of utilizing more than one aerosol models for estimating health benefits from pollutant emission controls”.

Page 31402, Lines 13-15: Are all RFs referenced at the tropopause?

Figure 9: Suggest removing “F” from “ADF” and “AIF”, or, for consistency, it would need to be added to all components (i.e. OzoneF, CO2F etc).

Page 31402, Lines 17-18: Why are some RFs calculated from FIXMET and some from INTERACTIVE? Does this create inconsistencies?

Page 31404, Lines 10-16: These conclusions come from comparing to Fig. 9, right? Worth stating it in this paragraph.

Page 31404, Lines 22-23: “that closely follows NOx changes” – how do we know this? And is this due to lightning NOx, impacted by the warmer climate? Does the changing STE play some role? Some insight would be useful here.

Page 31405, Line 8: “Significant” can be misleading here. “Large” would be more appropriate.

Page 31405, Line 9: Suggest changing “with” to “by”.

Page 31405, Lines 13-15: As for the FUTURE results, some insight into what may be causing these changes in ozone would be useful.

Page 31406, Line 17: Suggest adding “reflective” before “aerosols”.

Page 31406, Line 24: “:” -> “;”.

Page 31407, Lines 3-5: Some rephrasing is needed (e.g. “but” appears twice).

ACPD

15, C10621–C10627, 2015

Page 31407, Line 17: Suggest changing “shows” to “reinforce”.

Page 31408, Line 4: “lead a considerable” -> “lead to a considerable”.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 31385, 2015.

ACPD

15, C10621–C10627, 2015