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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Climatic effects of 1950–2050 changes in US anthropogenic aerosols – Part 1: Aerosol trends and radiative forcing" *by* E. M. Leibensperger et al.

Anonymous Referee #1

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The paper presented by Leipensperger and colleagues summarizes in a clear and well documented way a study on US radiative forcing, its recent history and prospects. It is of interest for ACP readers and should be published after (seriously taken) minor revision. Especially some of the discussions with policy relevance should be reconsidered. The documentation of the basic model results is also lacking.

General remarks

1) Introduction: The motivation why the study concentrates on the US and its emissions is not very well laid out. Why is "The US (is) an interesting testbed to analyze the climate implications of environmental regulations" as stated by the authors? Sorry to

insist, but it would be interesting to put this in perspective to a global model analysis done by other groups. Would the authors be ready to argue more explicitely, that it is useless to regulate BC in the US? What implications for BC emission standards in the world if this would become US policy?

2) How uncertain are the emission scenarios used? Is the scenario IPCCA1B used to derive the future evolution of emissions still a valid assumption in view of recent work on new IPCC scenarios? How much differ the emissions against other published work?

3) I think the paper misses some supporting material on emissions, global burdens, optical depth and direct radiative forcing for the major aerosol species for the decades under investigation. Which part of all that is anthropogenic? I suggest a table being added with such basic model characterization. Examples why I think the work is not fully traceable in its present form: The authors mention: "The global mean tropospheric lifetime of sulfate in the model is 4.0 days". Is that derived from sulphate burden and total deposition? Also the emissions seem to be a mix of different inventories. It is thus not possible to see which emission history was used for the US and globe. AOD per species would allow to better compare the forcing to other model results. The anthropogenic fraction is important to understand the BC forcing history.

4) Chapter4 "By 2010 we find that the radiative forcing from anthropogenic US aerosol sources has decreased to $-0.03 \mathrm{Wm}-2$ globally, amounting to just 8% of the total from worldwide anthropogenic sources ($-0.36 \mathrm{Wm}-2$), reflecting the rapid decline of emissions in the US and growth in Asia (Fig. 1)."

=> The comparison of regional to global forcing, given as percentage, should be separated for BC and the scattering aerosol. If BC forcing would have increased in the US, then the total US forcing would decline to 0 Wm-2 and the importance of the US forcing would be numerically close to zero %. This is misleading for forcing discussions, where absorbing and scattering aerosol components contribute to total anthropogenic aerosol forcing.

5) In the end of chapter 4 the authors state: "Thus most of the climate response from controlling US anthropogenic sources should have already been realized. Second, the present-day radiative forcing from BC is small (and even less if external forcing is assumed), weakening the argument of a “win-win” scenario for public health and climate from controlling BC emissions."

This is a little quickly written.

=> Which anthropogenic sources do you mean ? (GHGs as well? Open fires?)

=> Is it really important whether aerosol RF in 1980 was much higher than that for present day when discussing future policy choices? A discussion of present day forcing uncertainty and the future scenario should be added.

=> Which present day BC forcing do you mean? That of US-BC for the globe? What is the BC global forcing in the model (see also my suggestion for a table added)?

=> Who suggested a win-win scenario "just" for the US?

Specifically I’d like to suggest also the following changes/clarifications:

xx Regarding multiple mentioning of forcing "over the eastern US (east of 100_ W)":

=> please add to regional foring information always global values. E.g. put in parentheses always behind the regional forcing also the global forcing. Radiative forcing has a global significance (since climate effects spread) and it is can be misunderstood if only the local forcing values are mentioned.

xx"The small positive radiative forcing from US BC emissions (+0.3Wm−2 over the eastern US in 2010) suggests that an emission control strategy focused on BC would have only limited climate benefit."

=> What of the global BC forcing does this value of 0.3 Wm_2 represent? First - what is the global BC forcing from the US? Second - what is the global anthropogenic BC forcing in the model used here. I believe these are two numbers are crucial here

for underpinning whether and US BC emission strategy would have benefits. Please include this info also in the abstract.

xx "It has been argued that decreasing BC emissions (and hence aerosol absorption) could provide a “win-win” strategy for air quality and climate change mitigation (Jacobson, 2002; Bond, 2007; Grieshop et al., 2009)."

=> It should be mentioned here that these papers probably did not have US emissions in mind. Since the sentence before this one the US is explicitely mentioned the reader is misguided.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 24085, 2011.