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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Could aerosol emissions be used for regional heat wave mitigation?" *by* D. N. Bernstein et al.

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We would like to thank the referee for the positive and helpful comments on the manuscript.

In response to the general comments:

1. Regarding the dependence on meteorology, we agree, and this is one of our points. We illustrate with a particular heat wave event, and we have expanded on the fact that, for instance, different injection heights would likely be chosen at different times for a regional application depending on the meteorology. We have clarified this point by inserting a sentence in the introduction (second last paragraph of section 1), and being more specific about the meteorology-dependence of the choices in the discussion of

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the added Figure 11 which contains wind speed profiles, suggested by Referee 2. We also expand discussion of this slightly in section 6.

2. Regarding how much temperature reduction would be needed, we have inserted a sentence making the Referee's point that the exact amount of temperature reduction needed to mitigate expected deaths or economic damage would be context-dependent.

3. Regarding deposition: Thanks for suggestion, we have inserted a vertical profile of the aerosol concentrations (Fig. 11 a) to help make this point clearer. Within the timeframe of this experiment, there is no deposition, because the vertical transport by diffusion and vertical velocity only spreads the aerosol through less than a 250 mb layer around the injection level. However, this is enough for the given injection level to put aerosol into the upper troposphere where downstream deposition can be a concern (beyond the timescale of the runs feasible here), and we have added discussion of this near Fig 11. This provides more quantitative background for our discussion in section 6 of the associated concerns.

4. Regarding the color schemes, and sign of the differences displayed: The contour interval is chosen so that it can be the same for all panels and all experiments while still seeing features like the different response in the Central Valley at 12:00, or the reduced response near the margins in the smaller scale experiments (Fig. 12). We have changed the terminology to use "reductions" in short wave and in temperature consistently throughout, and added a sentence defining this at first use (first paragraph of section 3.3), which should make this considerably easier to follow, thanks.

5. Regarding the term "last resort" we are simply following the language used in well-cited papers, for instance Robock (2008) and Matthews and Caldeira (2007), which are cited in our introduction. Regarding pages 23804 and 23805, we have rewritten sentences in first paragraph of section 4 to refer to the aerosol masses that have been added to Table 1, using these to better motivate reasons why the very large-scale area would be a less likely choice than smaller scale regions.

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6. Regarding the use of “trade-offs”, we have gone through and made the language more specific at each usage (including the cases noted by the reviewer p. 23806, Line 24, and p. 23805).

7. Regarding aerosol bins, on p. 23798, Line 14, we have repeated the size bins in the first paragraph in section 3.2, for the reader’s convenience.

In response to the specific comments:

Abstract, lines 3-4: Removed "adaptation to" to clarify the sentence.

p. 23795, lines 19-20: We have included the reviewers point that Pierce et al. and English et al. find less effectiveness.

p. 23795, line 21: Soden et al. (2002) and Robock (2000) references added.

p. 23795, line 27-p. 20 3796, line 2: We have removed the sentence.

p. 23796, lines 2-3: We have removed the sentence.

p. 23797: Although we agree with the reviewer that this is a nice example, we couldn’t find a compact way of mentioning the Russian heatwave without breaking the flow, so we did not add this.

p. 23801, lines 5ff: Sentence on the injection timing added as suggested. The usage of "LT" follows journal style.

p. 23802, line 24: Value for midday downward surface shortwave added for reference.

p. 23803, line 15: Ordering of references to figures corrected.

p. 23803, lines 22-24: Sentence removed, and the first sentence of the next paragraph rephrased.

p. 23804: Wording in this paragraph has been modified to clarify when we are referring to temperature reductions as opposed to total temperature.

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p. 23804: Thanks, inserted a phrase (3rd sentence of section 4) regarding lack of interaction.

p. 23805, lines 13-15: Sentence rephrased.

p. 23805, line 26: Inserted "begins". Also made a similar sentence more precise in the discussion of Fig. 9.

p. 23805, line 29: Word corrected.

p. 23806 lines 20-21: Sentence altered to define edge effects more specifically.

p. 23809, line 8: We have changed to use altitude here, since this is more precise (also changed in several other places for consistency, including the abstract.

p. 23809, lines 20-23: Thank you for the comment. We have expanded the discussion in this paragraph accordingly.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 23793, 2012.