**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Could aerosol emissions be used for regional heat wave mitigation?" *by* D. N. Bernstein et al.
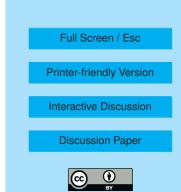
Anonymous Referee #3

Received and published: 5 January 2013

Review of ACP-2012-472 by Bernstein et al. Could aerosol emissions be used for regional heat wave mitigation?

This paper is nicely done and is relatively straightforward. I have no major complaints and think minor revisions will be sufficient.

General comments:

There is a lot of time spent on seeing whether the plume stays over the desired area, which is important for regional climate changes. This result obviously depends on the meteorology (the injection height was chosen because winds were low at that height on that day). I think this point must be made more explicitly and that one may not always find such favorable meteorology.

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There is much focus on plume location, shortwave reduction, and temperature reduction. But these results are not put into context. If a heat wave yields a maximum temperature of 45°C (for example) on a given day, how far would one need to reduce that temperature to avoid a certain number of deaths, economic damage, power consumption from air conditioning, etc.? Asserting that 7°C of cooling might be too much isn't particularly meaningful without context.

I'd love to see a figure of deposition rates, particularly in terms of acidity. A lot of effort was spent in the 1970s to clean up sulfur from U.S. cities. Is the amount you're adding significant compared to the acid rain levels experienced a few decades ago?

The color schemes used on the figures do not help understanding. One expects to see negative values on the figures showing temperature and shortwave radiation changes, but all values are positive. Also, divisions every 30 W/m2 on a figure that shows a maximum of over 520 W/m2 is excessive. You could certainly use many fewer divisions to get your point across.

There are a few instances of inappropriate prescriptive language. For example, in the abstract, geoengineering is called a "last resort" which may not be true. On page 23804, you assume what you're simulating is over a greater area than what might be done, but we don't know what might be done. Similarly on page 23805.

Use of the word "trade-off" is very unclear in this paper. This implies a choice between doing one thing to experience a particular effect and doing another thing to experience a different effect. But, for example, the trade-off on page 23806 does not clearly state which two actions one could take to achieve these two different effects. Similarly for page 23809, as well as other locations.

You refer to the aerosol size bins enough in this paper that it would be useful to the reader if you repeat what sizes those bins cover.

Specific comments:

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Discussion Paper

Abstract: Sentence in lines 3-4 is unclear.

Page 23795, Lines 19-20: This isn't a direct comparison because injections at the 10 Tg S yr-1 levels as in Pierce et al. and English et al. showed much less effectiveness.

Page 23795, Line 21: Soden et al., 2002, Science or Robock, 2000, Rev. Geophys. are probably better references

Page 23795, Line 27 – Page 23796, Line 2: I'm not sure what this sentence means or why it's necessary.

Page 23796, Lines 2-3: Remove this sentence. The authors' personal reservations, however poignant they may be, have little to do with this study.

Page 23797: It might be worthwhile to mention the Russian heat wave and its effects to give another example of why managing heat waves could be really important.

Page 23801, lines 5ff: Mention later that you do a sensitivity study to injection timing, and say why you don't do this for the large scale experiment. Also, all of your times are in California, so use Pacific Time. LT is nonstandard.

Page 23802, line 24: 350 W/m2 out of how many? Is this a lot?

Page 23803, line 15: Strange ordering of figures.

Page 23803, lines 22-24: I'm not sure what this sentence means.

Page 23804: Calling these peaks is misleading. They're actually temperatures for which the aerosols do not compensate.

Page 23804: I assume the regions are far enough from each other that there are no interactions between them. But if you're including them both in the same experiment, you need to say that.

Page 23805, lines 13-15: Rephrase this sentence so the trade-off is clear.

Page 23805, line 26: "four hours after the injection begins"

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Page 23805, line 29: Change "choose" to "chose"

Page 23806, lines 20-21: What are the edge effects?

Page 23809, line 8: The cold-point tropopause is specifically a tropical feature, but you're doing simulations in the mid-latitudes. Just give an altitude.

Page 23809, lines 20-23: This is pretty weak justification. Your study is much better than this sentence gives it credit for.

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