

***Interactive comment on “Sea-spray
geoengineering in the HadGEM2-ES Earth-system
model: radiative impact and climate response” by
A. Jones and J. M. Haywood***

Anonymous Referee #2

Received and published: 27 August 2012

The manuscript presents a set of simulations to study the radiative impact and climatic response of sea salt climate engineering in the HadGEM2-ES Earth System model. In addition to investigating the effects of cloud brightening, the study involves simulations aimed specifically at investigating the direct effect of increasing sea salt emissions. In doing so, the manuscript addresses a timely scientific topic that is well within the scope of ACP. The manuscript is very well written and a pleasure to read, however some conclusions seem a bit rushed. I recommend publication after the comments below have been addressed.

Scientific comments:

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- P. 20720, L. 25: Perhaps change "thus acts as CCN" to "may act as CCN" as this depends on the supersaturation reached?
- P. 20722, L. 21: Please rewrite the sentence. "The four combinations" is a confusing set of terms for "two by two".
- P. 20725, L. 4: Replace "using all three" with "using each of the".
- P. 20725, L. 11: This run (D-mask) seems to lead to a significant Antarctic warming. Do you know what is causing this effect?
- P. 20725: I do not think you should expect all readers to know how the precipitation changes from preindustrial times until 2050 in rcp 4.5. In the precipitation discussion it would help if you could include some comments as to how the changes you show here relate to the precipitation pattern we know today. For example, hypothetically, if the precipitation in India was to decrease under rcp 4.5 compared to preindustrial conditions, a positive change due to cloud seeding would perhaps be good. If it was to increase under rcp 4.5, a further increase from cloud seeding should be avoided. It is a bit hard to interpret your results when this bit of information is missing.
- P. 20727: It would be interesting to see numbers for "change in surface T per mass of sea salt emitted". If the emission technique were to change, such numbers could be useful as indicators of effectiveness.
- P. 20728, L. 9 and below: Does the positive change in cloud forcing that you get when emitting in the D-mask region indicate thinning of the clouds/cloud removal or does it indicate a reduced effectiveness of clouds to cool the climate as the emitted sea salt reduces the net SW flux at TOA due to scattering and reflection in clear sky? (Reduced net_clearsky in the following equation: $SWCF = net_allsky - net_clearsky$) Please explain the "feedback via clouds" more thoroughly.
- P. 20728, L. 17: The conclusion that it is inefficient to concentrate on the direct effect seems a bit premature. I feel that a broader study on this effect would be needed before

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such a statement is valid. First, this study only considered emissions of one sea salt mode. For the direct effect, the smaller the particles, the more effective. Second, for the I-case you have shown the importance of excluding certain regions in order to limit precipitation change. No such effort has been presented here for the direct effect. The direct effect may still turn out to be insufficient to cancel global warming, but I do not think that you have studied this effect thoroughly enough to conclude the way you do.

- P. 20728, L. 28: Please specify that the patterns of change are broadly similar between Figure 8 (a) and 8 (b). I do not agree that 8 (c) is similar as there are large differences over land in South America. You get back to this at page 20729.

- P. 20729, L. 10: Same as above. Do not agree with "not fundamentally altered". The eastern side of South America looks pretty different.

- P. 20730, L. 1, conclusion point (2): Again, I feel that concluding that the indirect effect will affect precipitation less than the direct effect is a bit premature. This point could be altered significantly by choosing different regions, different emission fluxes or a different sea salt size. Please make these limitations clear.

- Abstract: Please see point directly above.

Technical corrections:

- P. 20727, L. 12: Please correct "increases" to "increase".

- Figure 3: The dark colors make it difficult to see what regions are shaded. Please choose a different color scale.

- Figures 5, 6 and 7: It would make it easier for the reader if all figure captions list what figures are I-mask, D-mask and I-mask-NSA.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 20717, 2012.