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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The radiative forcing potential of different climate geoengineering options" *by* T. M. Lenton and N. E. Vaughan

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Dear Prof. Lenton and Ms. Vaughn:

Thank you for considering our possible geoengineering solution, enhancing the natural sulfur cycle to slow sea level rise, in your paper, The radiative forcing potential of different climate geoengineering options, currently in discussion in Atmospheric Chemistry and Physics. I would like to clear up some misconceptions in your paper. We considered increasing the concentration of several small areas of the Southern Ocean replete in iron by about one nanomolar. Not one large patch, as stated in your paper, in order to minimize particle growth and maximize new particle formation [Wingenter et al., 2007].

Our proposal could help cool the Western Antarctic Ice Sheet (WAIS) and slow, or prevent the WAIS from raising sea level an additional 6 meters. Comparison of this regional project with a global solution to cool the entire planet is inappropriate in scale. This is covered fairly well in our reply to Vogt et al. [2008] [Wingenter et al., 2008]. Furthermore, a 20 % percent increase of DMS flux could lead to a 10 % increase in cloud condensation nuclei (CCN) based on the work presented in Ayers et al. [1997]. Unfortunately, Vogt et al., apply this treatment and another conversion to the hypothetical 20 % flux increase and arrive at a smaller conversion of DMS to CCN when only one conversion is suitable. This mistake is also discussed in our reply to Vogt et al.

Perhaps what is most import are the uncertainties in both of our approaches and the assumptions we make. In our original paper we describes how to cool the Southern Ocean region 2o C. This estimate is not based on GCM modeling studies and contains no feedback loops. They are simply, first order, calculation as described in this paper. Vogt et al. estimate is also performed at the same simple level. Considering there are very large uncertainties in several key processes, our two estimates are actually in agreement. If this geoengineering method is to be tried, we would advocate fertilizing 2 % of an area before enhancing an 8 % region with iron, which would be required using Vogt et al. s estimate to attain a 2 oC cooling.

However, cooling the Southern Ocean region 2 oC is perhaps 1.5 oC too much and would likely cause undesirable changes to atmospheric and ocean circulation. Perhaps fertilizing just along part of the coast would accomplish the necessary cooling, perhaps a few tenths of a degree, to stabilize the WAIS with less side effects. This idea is only in its infancy and we hope more in depth studies will add insight into this possible climate engineering solution.

Sincerely,

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Interactive Comment