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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impacts of climate change on air pollution levels in the Northern Hemisphere with special focus on Europe and the Arctic" *by* G. B. Hedegaard et al.

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First of all, we would like to thank reviewer number three for a very thorough review of our paper, with relevant comments and spelling corrections. All the spelling corrections have now been included in the revised manuscript and we reply to each comment in turn in the following:

Reviewer: Section 2.3 and Section 7: Which emissions have been kept constant for the three decades is not really clear to me, especially concerning natural emissions. Are biogenic emissions the only natural emissions to vary? I think it would be helpful to have more details about the emissions used for the different scenarios. For example, a table giving global annual emission for the three decades could be added.

Answers: In this experiment the anthropogenic emissions is kept constant in order to separate out the effect from climate change on the future air pollution levels. The biogenic emissions are allowed to vary and these are calculated according to the BEIS model which currently only includes isoprene. This has now been specified in the manuscript in the introduction and in section 2.3. Other natural emission sources are also included in the model, as e.g. NOx from lightning or soil and even SO2 from volcanic activity, but these emissions are not a function of temperature in the model as the biogenic isoprene emissions.

Reviewer: The authors mention that different parameters can affect biogenic emissions but how have those emissions been calculated in this study? Which inputs (vegetation distribution, leaf area index) have been used? Which biogenic compounds have been considered (this should be specified before the conclusion)?

Answers: The biogenic emissions in the DEHM model is calculated by the BEIS sub-model, which currently only includes isoprene. A detailed description of this submodel can be found in Guenther et al. 1995 (cf. this manuscript section 2.3). It is beyond the scope of this paper to give a detailed description of this submodel and therefore the interested reader is referred to find this information in the detailed paper about BEIS (Guenther et al., 1995). The fact that BEIS model only accounts for isoprene emissions has been specified in the revised manuscript in the introduction and in the end of section 2.3.

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