

## ***Interactive comment on “Improved modelling of atmospheric ammonia over Denmark using the coupled modelling system DAMOS” by C. Geels et al.***

### **Anonymous Referee #1**

Received and published: 14 March 2012

This paper presents a comparison of modeling studies carried out with the coupling of two model systems, a fine-scale Gaussian model and a regional model which has nesting down to about 6km. This comparison is interesting, as it emphasizes some important features of fine-scale deposition, and the ability (or lack of) large-scale models to capture this. I think that this paper can be a good contribution to the literature, but the authors should first take the opportunity to compare the effects of resolution in a more systematic manner.

My main concern is the following. The authors present a good case that DEHM over-predicts because the measurement sites are located in clean areas, and Fig. 7 sup-

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ports this case. This is also given as the reason why DEHM predicts more than DAMOS. I suspect that the authors are right, but I would like to see if they have excluded the possibility that simply DEHM over-predicts everywhere? I miss a side-by-side comparison of DEHM vs. DAMOS for regional averages, for example show DAMOS averages for the DEHM 6km squares. Present a version of Table 5 which is not just for one location, but an average over the domains. It would also be interesting to see the results from different nests of DEHM, showing how the scale issue affects deposition within one model system. DEHM might be different for many reasons, with the vertical dispersion assumptions also being a large source of model differences. How much does this matter?

#### Other comments

P.1, Abstract. Mention the horizontal resolution of the DEHM model.

P.1, line 15. Quantify "locally".

P.1589. This last paragraph is taken from Hertel et al.'s review, and should cite the original reference for this estimates.

P.1590, line 9. Another relevant reference here would be Flechard et al. 2011.

P.1590, line 29. The Van Jaarsveld et al. reference is gray literature. There are plenty of published papers on this issue.

P.1595. I find it hard to believe that an ammonia emission inventory can be accurate to within 5-10%, or farm/field level uncertainties kept within 25-35%. There are usually significant difficulties associated with estimating NH<sub>3</sub> emissions, have these all been overcome in Denmark? No references are given for these assertions.

P.1597. The word "validated" is anyway controversial, and here wrong. No model can be properly evaluated, let alone validated, against just one site.

P.1597. Does OM-DEEP have wet-deposition? If not, how does this affect the compar-

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ison?

Fig. 9. This figure is said to be shown in Hertel et al. 2012. Why? The authors should decide whose paper it fits into best, rather than publishing the same material twice.

English, etc.

P.1588, line 24 and elsewhere. Use 1990s, not 1990ties

P.1589, line 11 deals can be singular

P.1589, line 12 omit "the" management

P.1591, line 12. The paper by Dore et al. in the same special issue is also relevant in this context, although Lagrangian rather than Eulerian.

P.1596, spelling "DEMH", "Shults" Table 3: The use of m:, bias:, r: prefixes is not helpful. Add another header line with this information.

Table 4. The units should be as kg (N), no need for NH3-N.

Fig. 5. Mention also Table 3, where the statistics associated with this Figure are given.

Fig. 7, "give at" should be given at.

In general, the Figures were very small and captions hard to read. This may be a result of the ACPD formatting, but in the final version the authors should make sure these figures are readable.

#### References

Flechar, C. R., Nemitz, E., Smith, R. I., Fowler, D., Vermeulen, A. T., Bleeker, A., Erisman, J. W., Simpson, D., Zhang, L., Tang, Y. S. & Sutton, M. A. Dry deposition of reactive nitrogen to European ecosystems: a comparison of inferential models across the NitroEurope network *Atmos. Chem. Physics*, 2011, 11, 2703-2728 ~

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