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Biogeosciences Discussions

Interactive comment on "The influence of model grid resolution on estimation of national scale nitrogen deposition and exceedance of critical levels" *by* A. J. Dore et al.

Anonymous Referee #2

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Deposition in excess of critical loads for protection of ecosystems is widely used as an indicator for protection of ecosystems. Unfortunately for national and international policy making different models tend to estimate quite large differences in ecosystem exceedance using the same critical load data. This paper systematically examines one cause for this, the grid size resolution of the model, illustrated by the application of the FRAME model in the case of the UK. It also illustrates the need for more detailed modelling at the national scale to complement European scale modelling used in development of international policy.

I feel the paper could indicate some other reasons for which models may estimate

exceedance erroneously. For example the paper indicates the 5 land classes and vegetation specific canopy resistance: this is important because deposition averaged over different ecosystems in a square can not be used to estimate exceedance (witness problems with earlier versions of the EMEP model in the EC's CAFE program). Similarly the paper mentions local scale orographic enhancement, where models that exclude this will systematically underestimate deposition. This would help to emphasize that the analysis undertaken focuses on using a single set of model results for the finest grid, and averaging them over coarser grids; so that no differences between models or model runs is involved.

I am a little concerned how the results might be extrapolated to other situations. A finer grid resolution can either lead to a higher or a lower exceedance, as is evident from table 3 for different ecosystems. This can be explained very simply mathematically by a figure comparing the frequency distributions of deposition for different grid sizes for a specific class of ecosystem, where the curves will cross over; and whether the area exceeded increases or decreases depends on the critical load relative to the cross-over level. Such a figure could be useful, and used to contrast the situation for montane for example, with other eocystem classes. It also makes it clear why exceedance for the highest 5%ile increases so sharply with grid resolution, and how this might differ for other percentiles.

The section on model validation gives references with respect to deposition, but focuses mainly on validation of NO2 concentrations. This seems a bit odd as there is not attempt to compare with critical levels for NO2 concentrations. In fact there is an error in the title which should really be critical "loads" rather than "levels", as the paper is concerned with deposition and not concentrations.

The text is well written and clear but there are a few minor points: page 1, last line I suggest "emissions from farm animal wastes" page 2,line 5. Delete "Subsequent" and then "Atmospheric oxidation of NOx and chemical reaction can lead to...."