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Biogeosciences Discussions

Interactive comment on "Estimating nitrogen fluxes at the European scale by upscaling INTEGRATOR model outputs from selected sites" *by* G. J. Reinds et al.

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Reply to reviewers on paper 'Estimating nitrogen fluxes at the European scale by upscaling Integrator model outputs from selected sites' by G.J. Reinds et al.

The authors would like to thank both reviewers for their comments and corrections; below we will answer their questions; our answers to the questions start with '...': Reviewer 1:

i)The INTEGRATOR model is partly based on MITERRA Europe which allows for different ways of applying manures and slurries affecting NH3 emissions etc. How are these allowed for in INTEGRATOR? . . .Integrator incorporates the Miterra model for

estimating N emissions from housing systems, arable land and managed grassland. Thus, Integrator adopts the way this is modelled in Miterra: a fraction of the N in applied manure is emitted; this fraction is dependent on the manure type (liquid/solid, cattle/poultry/pigs/ etc.) and the way the manure is applied (spreading or incorporation). We will add some short text to explain.

ii) INTEGRATOR estimates N deposition based on source0 receptor relationships from the EMEO model. But this seems to be missed out in the cluster analysis methods used in this paper? (See comments below re natural/ forest sites) . . .N deposition contributes only to a very limited extent to N emissions (NH3, N2O) from agriculture, were N input is dominated by inputs from fertilizer and manure, both include in the cluster analysis. We therefore decided not to include N deposition as a factor in the cluster analysis. For natural systems N deposition is more important, but even then it is not the main driving factor (see reply to questions V)

iii) A bit more explanation is required for the ,/(T+To) factor, where To=7 seems to be a rather arbitrary adjustment to avoid square roots of negative numbers. I presume T is annual average temperature in degrees centigrade? Similarly more explanation required for the form of equation 2. . . .T is indeed the annual temperature, the T0 is indeed just a scaling factor to avoid negative numbers. Some text is added to explain equation 2.

iv) The paper distinguishes arable,grassland and nature but in the statistical analysis "nature" seem to equate to "forest"? . . .The text is not consistent: with nature we mean forest, heather and moorland and sclerophyllous vegetation. We will explain in the text and be more consistent using 'nature' instead of 'forest'

v) The application of the model to nature/forest seems to be somewhat artificial in that the N deposition is not included despite being an important factor for natural ecosystems? Does this approach really tell us anything useful about these "natural" areas, and if they were just missed out what difference would it make to the totals estimated at

a EUROPEAN level? I can see you need to include representative sites for these areas for comparison of more detailed modelling that treats them more specifically, but is your cluster analysis suitable for selecting “nature sites” for more general use in model intercomparisons when it treats them in a very restricted way? . . . It must be noted that N deposition is implicitly included in the analysis simply through the random selection of NCU’s, as well as all other factors not included in the cluster analysis. Secondly, even though N deposition was not included in the cluster analysis, results show that the 150 plots give a very accurate estimate of N2O emissions on the European scale: average values for the 150 plots for N2O and N2 are identical to those for full areal support. The selection of plots was thus appropriate. Only for NH3 emissions a small deviation occurs. It should be noted that N deposition affects N emissions, but that wetness (included as rainfall in the cluster analysis), temperature (included in the cluster analysis also as an indicator for freezing/thawing events) and soil texture (also included) are as important, if not more important. We thus do not agree with the referee that the application is ‘somewhat artificial’ or ‘treats natural sites in a very restricted way’

Comments to referee 2:

(1) Specify in the abstract the No. of sites in the EU27 dataset. . . .We will do so

(2) What is an average size of NCU? . . .119 km2; we will add this in the text

(3) Where were loams put, to sands or to clays in your division? . . .Loams were added to clay as we think that the water regime and pH in loamy soils (important for emissions) show more resemblance to those of clayey soils than those of sandy soils; we will clarify this in the text.

(4)Is setting up the values of weights (p. 7, l. 17) arbitrary or based on an analysis? . . .This is expert judgement in which we tried to classify the factors based on existing knowledge of the importance of the factors for emissions processes.

(5) The number of clusters in each land use type was set equal (50; p. 8, l. 4). Wouldn’t

it be better to set the number relative to the total number of data in each type? . . .For reasons of consistency we chose to use the same number of clusters per land-use type. Using the number of ‘data’ to determine the number of clusters is not trivial: one can use number of NCU’s, total ecosystem area etc., but reducing the number of clusters may lead to large clusters containing NCU’s with (very) different properties, while expanding the number of clusters may lead to clusters with only very few NCU’s. We think that 50 clusters is a good compromise if we also use PAM clustering techniques.

(6) Grouping of Denmark to one cluster is not so apparent (p. 11, l. 30). It is clearer for example to the Czech Republic. This effect is probably caused also by low No. of sites in some countries. . . .The referee is correct: we should use the Czech Republic as an example of this phenomenon, not Denmark; we will change this accordingly.

(7) Why the results of grasslands are not discussed in chapter 3.2.1.? . . .For two reasons: (1) emissions from grassland in Integrator is computed with Miterra for managed grass and with the DNDC metamodel for unmanaged grass. Since both methods are used already for arable and nature for which the results are extensively described, adding grassland will not provide new insights in how well the method performs. (2) Since grassland consists of both managed and unmanaged grass results are not easily interpretable as a mix of models is used to obtain the results: this would require a complicated analysis and quite some text without much news (see (1)). We will add this consideration to the text.

(8) How are the clusters obtained by different methods ordered in fig. 1? Is there any correspondence between numbers of corresponding numbers, or are they random and independent? . . .We do not fully understand this question: clusters are obtained by the 3 methods described in section 2.2.6. The cluster techniques yield clusters with a varying number of NCU’s. This is a result of the cluster technique; different techiniques yield different numbers of NCU’s per cluster. There is no correspondence between the methods, or any ‘steering mechanism’ for the number of NCU’s per cluster

(9) What are the statistical parameters described in fig. 2, means or medians,....? . . .The figure shows the median values; we will add this in the figure caption

(10)How many countries are shown in graphs on fig. 6? . . .Results are displayed for 12 countries, we will add this in the figure caption

...We thank referee 2 for the technical corrections which we will process in the text.

Interactive comment on Biogeosciences Discuss., 9, 6335, 2012.