Biogeosciences Discuss., 3, S279–S281, 2006
www.biogeosciences-discuss.net/3/S279/2006/

Biogeosciences Discussions

Interactive comment on "Nitrogen load and forest type determine the soil emission of nitrogen oxides (NO and N_2O)" *by* K. Pilegaard et al.

Anonymous Referee #2

Received and published: 30 June 2006

General comments:

This synthesis paper summarizes the data from one year of measurements of NO and N2O emissions at different forest sites in the NOFRETETE project. The authors attempt to relate the measured average emission rates (mean rate per hour) or annual emissions (amount per year) to site conditions such as N-deposition, soil C/N ratio, soil water content etc. using a stepwise multiple regression. This analysis results in statistical relationships for the pooled data. The authors find that some relationships, which commonly exist when using single-site data, no longer appear in the multi-site data; for instance, soil water content or soil temperature are not related to N2O, in contrast to what can be found in datasets with repeated measures at a single site.

The approach used here is typical for this type of project synthesis. In this case, it was done in spite of the fact that it is well documented, especially for N2O, that functional relationships between single factors and emission rates are lost in multi-site data analysis across regions (the authors refer to the paper by Groffman et al., 2000). So why try again? At single sites, relationships are established between factors and emissions only on the basis of the their temporal variation, whereas across multiple sites with annual data, relationships are established between factors, which vary in space. Clearly, these are two different stories. For N2O emissions, which are typically highly episodic and triggered by specific events such as rainfall or short-term high N-input, using annual emission rates together with, for instance, annual mean soil water content is very unlikely to produce significant relations using data from different sites. Hence, based on existing knowledge, it seems that the authors should have focussed only on those parameters, which determine the potential for N2O emissions. The analysis shows that C/N ratio is a key factor, which is not new, but the present analysis provides a good confirmation of that. The analysis of the relationship between emission rates and N deposition is interesting. However, the presentation is not straightforward. For instance, why use mean emissions rates in Fig. 2 and annual emissions in Fig. 5. Moreover, the difference between the two forest types is suggested to be related to differences in N-inputs, whereas N-inputs were almost equal (see lines 170/171). The relationship between N-input and NO emission is the interesting part of the story. But for the reasons given above, to try establishing a link to N2O emission seems a bit naive. Figure 3 clearly shows that the C/N ratio dominates the N2O emission potential, and other factors are - at best - of minor importance.

Finally, the presentation could be improved by combining Results and Discussion, by removing some of the very general points in the discussion, and by better focussing on the most important and innovative parts of the story.

Specific comments:

-The title does not reflect the contents of the paper. Nitrogen load and forest type is

BGD

3, S279–S281, 2006

Interactive Comment

only directly related to NO emissions, whereas N2O emission is related to C/N ratio. -Line 76: What results? -Line 89: Why is this important, given the negative experience in earlier studies of multi-site data? -Line 101: Mean rates (as in Fig. 2 for NO) are not annual emissions. It should also be clear, how individual measurements from chamber sampling were aggregated to yield annual rates. -Line 137: Was there any cross-calibration performed to make sure that data from different sites are in fact comparable? -Line 195: Which ratio? If NO/N2O, then the statement is in conflict with the next sentence. -Fig. 2: All points should be identified with site names. -Fig. 3: In my view, it would be more sound to use two separate linear regressions: one for the sites with C/N$<$20 and a separate one for sites with C/N$>$20. This would show that there is a relatively sharp threshold for C/N around 20, which would be in line with what is known from N-leaching. The regression line with log-transformed data does not mean much in terms of mechanisms (just improves the statistics). -Fig 5: Could be removed because the results from the statistical analysis clearly show that NO emission dominates the relationships, and this is displayed in Fig. 2.

Interactive comment on Biogeosciences Discuss., 3, 837, 2006.