Biogeosciences Discussions, 2, S345–S347, 2005
www.biogeosciences.net/bgd/2/S345/
European Geosciences Union

Biogeosciences Discussions

Interactive comment on "Nitrous oxide fluxes and nitrogen cycling along a pasture chronosequence in Central Amazonia, Brazil" *by* B. Wick et al.

B. Wick et al.

Received and published: 8 July 2005

Final author comment: We would like to thank the two referees for their insightful reviews and their considerate comments.

Author comment to RC S237: 'Statistical analysis', Anonymous Referee #2 The referee comments that we present data on CH4 fluxes but the title suggests that the discussion will be limited to N2O. - This is correct. In our paper we focus on N2O fluxes and N cycling; in our discussion we concentrate on factors that explain the variability of the N2O fluxes. In the results section we briefly introduce and present fluxes of CH4 because they are complementary to the fluxes of N2O. But the significance of CH4 in the context of this paper is rather marginal; therefore we do not include CH4 in the title.

The referee notes that Figures 7 and 8a to f show regression lines with rather low r2 values of 0.2 to 0.3, indicating a complete lack of correlation. - Figure 7 shows no regression line but litter C/N ratios from forest and pasture soils (see figure caption). -

The regressions are all significant at the 95% confidence level (a=0.05); the p values vary from 0.001 to 0.042. The level of significance, the regression equation and the number of samples (n) are given in the respective figure captions. The r2 values are similar to those reported from other studies in the Brazilian Amazon or from Costa Rica and Puerto Rico (e.g. Davidson et al. 2000. Testing a conceptual model of soil emissions of nitrous and nitric oxides. BioScience 50, 667-680).

The referee proposes the use of multiple regression analysis to give more insight into the combined effect of these factors. - The application of multiple regression analysis requires formal assumptions (no multi-collinearity of independent predictor variables and no interaction effects). In our study, in addition to soil-atmosphere fluxes of N2O we measured 27 soil chemical, soil microbiological and soil physical variables. One has to recognize that the identification or selection of a subset of predictor variables that constitute a "good" model in such a large data set is always a trade-off between bias and variance. By decreasing the number of parameters in the model, its predictive capability is enhanced (because the variance of the parameter estimates decreases). On the other hand, bias may increase because the "best fit model" may have a higher dimension [dimensionality of the submodel = how many variables to include]. In our exploratory phase of data analysis we applied multiple regression analysis to our data set and used backwards stepping to identify a good subset with predictor variables. Entry and removal criteria were based on statistics and diagnostics in the output as recommended in the SYSTAT Handbook Statistics I, 2002, pp. 379. For example, we applied a minimum tolerance value of 0.1 to measure and avoid multi-collinearity [where tolerance is defined as 1-r2]. We found serious problems with collinearity of the predictor variables. This is a troublesome situation because the estimates of the regression coefficients become unstable. Other strategies for identifying a good subset of predictor variables were forward and stepwise selection; we also changed the dimensionality of the model (how many variables and which variables to include) based on our knowledge, experience, and on existing data from the literature. However, as explained above we did not identify an acceptable or adequate submodel that (i) met the formal assumptions, and (ii) better reflected the cause-effect relationships of the variability of N2O fluxes as we had already gained from linear regressions.

Author comment to RC S245: 'review', Anonymous Referee #3 The referee suggests to more clearly define what we mean by open soil N cycle (page 511, 4.1. Changes of N transformation along the forest-to-pasture chronosequence). - Here we refer to studies by Vitousek et al. (1982; Ecological Monographs 52, 155-177) on potential nitrification and nitrate mobility in forest ecosystems; the conclusions were later corroborated by Davidson et al. (2000; BioScience 50, 667-680). The authors relate that nitrate accumulates and dominates the inorganic N pool when gross rates of nitrification exceed rates of nitrate uptake by plants and microorganisms. Nitrate accumulation and predominance over ammonium is therefore indicative of an open, leaky N-cycle that leaches nitrate, and may be indicative of gaseous N losses such as N2O. The authors conclude that although the nitrate pool does not provide a direct measure of N-flux in the soil, it indicates that excess nitrogen is flowing through the system relative to the ability of plants and microorganisms to assimilate nitrate. - We agree with the referee's suggestion and we will include a statement for clarification. The respective sentence on page 511, 4.1. Changes of N transformation along the forest-to-pasture chronosequence, line 8 to 10 will be changed as follows: While recognizing that nitrate pool sizes do not give information on N transformation rates, nitrate accumulation has been interpreted as an indication of an open, leaky soil N cycle, that leaches nitrate, and may be indicative of gaseous N losses such as N2O (Vitousek et al., 1982).

Interactive comment on Biogeosciences Discussions, 2, 499, 2005.