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Interactive Comment

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.

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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

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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 N_2O fluxes as we had already gained from linear regressions.

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