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Interactive comment on "Spatial variability and hotspots of soil N_2O fluxes from intensively grazed grassland" *by* N. J. Cowan et al.

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Thank you for reviewing our manuscript. We have found your comments to be constructive and useful in amending sections of the original manuscript submission. Please find the reviewer's comments and the corresponding changes made to the manuscript below.

[Page 15344 L12: There are many publications on the relationship between soil properties and N2O fluxes that could be discussed before highlighting the need for more research and better measurement approaches.] We have added further references to address this. "Many studies have identified similar soil properties which affect the rate of N2O emissions from agricultural soils (Butterbach-Bahl et al., 2013; Dobbie and Smith, 2003): however, due to the multiple simultaneous microbial processes which

produce N2O it is difficult to identify a clear relationship between soil properties and flux. Relationships between N2O flux with temperature, WFPS % and nitrogen content in soils are often observed; yet a consistent method for predicting N2O from agricultural soils based on soil measurements still eludes researchers (Flechard et al., 2007; Smith et al., 2003). "

[Page 15344 L24: I understand that the confidence interval (table 3) for aggregated fluxes was derived from the range of N2O fluxes what would represent uncertainty if aggregated fluxes would be based on just one sample otherwise the uncertainty of aggregated fluxes would be smaller.] The reviewer is correct in their comment; however, propagation of the uncertainty in the cumulative flux estimate could be done several different ways. We have chosen to use the method used in IPCC reports which is to present the sum of the minimum and maximum of each source as in the IPCC 2007 and 2013 physical science basis sections.

[Page 15346 L25: It is mentioned that not covering the full variability of a field could cause an underestimation of derived emission factors and related N2O budgets. In fact, N2O emission budgets are derived from the amount of reactive N multiplied with an emission factor. So far, reactive nitrogen is uneven distributed at the test site and therefore also N2O fluxes are uneven distributed. However, it is not (clear enough) shown that the response of N2O fluxes on reactive N (nitrate) differ between measured features. The number of soil property measurements on soil features (shaded area, manure heap perimeter,..) is probably too small, but it could be interesting to see how the slope of N2O versus NO3 differs between soil features and grazed area and how this relationships can be explained by difference in wfps, soil porosity and ph between features and grazed grassland.] We agree with the reviewer that the different relationships between soil and flux measurements at different features would be interesting, however as the soil analysis was not done on a 1:1 ratio, we have too few points for further analysis of this data. Figure 6c does highlight the relationship between flux and nitrogen content to an extent. The linear regression in this plot is dominated by the re-

lationship between NO3- and N2O. There does not appear to be any bias in the plot in the relationship between the regression fitting and the samples taken from the features of the field, although the number of points is too few to be certain.

Interactive comment on Biogeosciences Discuss., 11, 15327, 2014.