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Biogeosciences Discussions

Interactive comment on "Soil-atmosphere exchange of nitrous oxide, methane and carbon dioxide in a gradient of elevation in the coastal Brazilian Atlantic forest" *by* E. Sousa Neto et al.

Anonymous Referee #1

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The authors measured greenhouse gases (GHGs) carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) fluxes in a gradient of elevation in the Brazilian Atlantic forest in a year. It is recognized that their efforts working in a harsh environment will contribute to our understanding of GHGs fluxes in remote areas, but there is room for improvement. I hope the provided comments will help the authors emphasise the innovative element of their study, formulate a testable hypothesis, and provide solid statistical evidence.

1. The effect of increasing temperature on CO2, CH4 and N2O fluxes

The authors suggest that increasing temperatures will result in a consequent increase in soil CO_2 and N_2O fluxes and CH_4 consumption. Considering the limitations of their observed data (i.e. once a month frequency and missing data) and provided statistical results (i.e. no clear correlation between soil temperature with N_2O and CH_4 fluxes through the gradient of elevation), the suggestion may not be robustly supported by the results of this study.

2. Estimate cumulative annual CO_2, CH_4 and N_2O fluxes for different altitudes

The authors provide annual mean flux of N_2O and CH_4 for different altitudes and statistical significance in the difference of fluxes by altitudes. The cumulative annual flux of N_2O and CH_4 could also be calculated by linear interpolation and numerical integration of observed fluxes between sampling times (i.e. area under the flux curves) and the authors can test the significance in differences of cumulative annual flux by altitudes. Additional efforts will provide clearer information. In the case of CO_2 flux, the Q10 model (relationship between soil temperature and CO_2 flux) can be developed with currently available soil temperature and CO_2 flux data and the authors can then estimate the missing CO_2 flux (Oct. 2006 to Dec. 2006) using the Q10 model with observed soil temperature (Oct. 2006 to Dec. 2006). After filling the gap of CO_2 flux, the authors can estimate cumulative annual CO_2 flux.

3. Add a rainfall figure and check possibility of peak N_2O emission caused by rewetting of dry soil

Beyond the significantly higher annual mean flux of N_2O in 100 m, two very high N_2O peak emissions occurred in Dec. 2006 and Jun. 2007 in 100 m. Since the soil temperatures of both months were not particularly high (Fig. 1), the peak emissions may not be caused by high soil microbial activity influenced by soil temperature. Looking at the WFPS figure (Fig. 2), there is an interesting common point: WFPS abruptly increased in both months. Considering the well-matched timing of N_2O peak emissions and WFPS changes, it is possible the peak emissions may be caused by rewetting events (rewetting of dry soils). Studies have reported increased soil N_2O emission

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following the wetting of dry soil in various ecosystems, including forest (e.g., Groffman Tiedje, 1988; Vitousek et al., 1989; Garcia-Mendez et al., 1991; Davidson et al., 1993; Nobre et al., 2001). If there are available rainfall data for the sites (i.e. from the nearest weather station) plot them with WFPS and check whether the changes of WFPS were associated with rainfall events. If they are well matched, further discussion related to N2O peak emissions and rewetting events will contribute to our understanding of N2O fluxes. It would be very interesting if the authors could discuss why high N2O peak emissions occurred only in the 100-m site.

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