

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

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in soil CO₂ and N₂O fluxes and CH₄ 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 N₂O and CH₄ fluxes through the gradient of elevation), the suggestion may not be robustly supported by the results of this study.

2. Estimate cumulative annual CO₂, CH₄ and N₂O fluxes for different altitudes

The authors provide annual mean flux of N₂O and CH₄ for different altitudes and statistical significance in the difference of fluxes by altitudes. The cumulative annual flux of N₂O and CH₄ 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 CO₂ flux, the Q10 model (relationship between soil temperature and CO₂ flux) can be developed with currently available soil temperature and CO₂ flux data and the authors can then estimate the missing CO₂ flux (Oct. 2006 to Dec. 2006) using the Q10 model with observed soil temperature (Oct. 2006 to Dec. 2006). After filling the gap of CO₂ flux, the authors can estimate cumulative annual CO₂ flux.

3. Add a rainfall figure and check possibility of peak N₂O emission caused by rewetting of dry soil

Beyond the significantly higher annual mean flux of N₂O in 100 m, two very high N₂O 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 N₂O 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 N₂O 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.

References

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