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Interactive comment on "Overestimation of closed chamber soil CO_2 effluxes at low atmospheric turbulence" *by* Andreas Brændholt et al.

Anonymous Referee #1

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In this study, authors use an automated soil CO2 flux chamber to measure soil CO2 flux for over a year in a temperate Danish beech forest. The main finding of this study reported in this paper is that, with the closed chamber method for measuring soil CO2 flux, the soil CO2 flux could be significantly overestimated at night during lower atmospheric turbulent conditions. This is because under low turbulent condition, respired CO2 could accumulate near the soil surface, which slows down the CO2 diffusion out of soil. As a result, the CO2 concentration in the soil profile gets elevated. During the chamber-based measurement, the chamber movement breaks down this CO2 gradient. Thus, the CO2 diffusion gradient across the soil surface is much steeper than outside the chamber under natural condition, which lead to measured soil CO2 flux overestimated. This result presented in this paper and the explanation all make very good sense to me. The result is also consistent with an early publication (Schneider, et

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Discussion paper

al., 2009. Overestimation of CO2 respiration fluxes by the closed chamber method in low-turbulence nighttime conditions, J. Geophys. Res. Biogeosciences, 114(3), 1–10, doi:10.1029/2008JG000909).

The research site is ideal for this study, as the diurnal soil temperature variation is almost non-exist. Otherwise the high daytime soil temperature could easily override the impact of low turbulent condition on measured soil CO2 flux. In the paper, authors also try to use a fan for promoting the turbulent condition around the soil chamber and hoping the diffusion process for respired CO2 is always under steady-state condition. Their field dataset does show that this approach is very promising. One concern I have with this approach is that it might be possible for some fresh air being pushed into the soil profile by the fan, leading horizontal advection of air movement in the soil around the chamber, which would cause loss of respired CO2. This might be another reason why authors see lower measured soil CO2 flux (Fig. 9) even under high turbulent condition when the fan is used. Nevertheless, this paper could serve a starting point in the research community to stimulate more studies so a reliable and robust method to create a steady-state condition around a soil CO2 flux chamber will be available soon. Overall this manuscript is well written with a high quality of dataset. Conclusions are drawn based on defensible data.

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