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

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Dear Thomas Foken We thank you for showing an interest in the manuscript and for taking part in the discussion with helpful suggestions and comments. We provide the following response.

"It is a pity that no additional sonic anemometer was installed in the trunk space, which was recently urgently recommended (Thomas et al., 2013). Therefore you are unable to indicate if the atmosphere above the canopy (where you measured the friction velocity) is coupled with the trunk space (Thomas and Foken, 2007). Your daily and annual cycle of the friction velocity is probably slightly modified by the significant daily and annual cycle of coupling (Foken et al., 2012; Jocher et al., 2017). Perhaps you should include in your recommendations a second sonic anemometer, which would control the

turbulent mixing (friction velocity, standard deviation of the vertical wind velocity) in the vicinity of the soil chambers. This may reduce the proposed very high u*-threshold."

We agree that it could have been interesting to have a second anemometer closer to the ground to address the issues you mention. We will include a discussion of sonic anemometer height in section 4.5.

"The problem you addressed is not only related to the turbulent mixing or the friction velocity. Low friction velocities are often connected with stable stratification and the reason for very stable conditions near the surface is a cooling by a large longwave net radiation. In contrast to the natural condition, the longwave net radiation in a chamber is always nearly zero and therefore the stratification is always nearly neutral. This may also be a reason why a chamber under stable (night-time) conditions can overestimate the fluxes (Riederer et al., 2014). Our study was made above a meadow with much larger longwave net radiation than inside the canopy, but nevertheless the longwave radiation effect on chamber measurements should be discussed. Helpful would be four-component net radiometers above the forest and in the trunk space – perhaps a further recommendation for flux sites."

Thank you for pointing out another potential cause for stable conditions above the soil surface. We will include large longwave net radiation, as an explanation for stable stratification above the soil surface, alongside low turbulence in section 4.1.

"Finally, perhaps the following hypothesis could explain your findings: The chamber is like a "chimney", with nearly neutral stratification and high turbulent mixing. It is like a "convective hot spot" above the soil with stable stratification and nearly laminar flow in the surroundings. Because of the high carbon dioxide gas concentrations in the soil, a slight horizontal advection in the soil layer generates a high CO2 flux in the chamber. This can also explain your found hysteresis, because this horizontal advective flow is slow. In the case of the fans in the surroundings of the chamber, you destroyed the chimney effect, because the well-mixed and neutral stratified area is much larger."

We agree that a chamber is like a “convective hot spot”, as you phrase it, during stable stratification in the surroundings, and that using the fans destroy the chimney effect.

“I think the paper should be accepted with the discussion of the two additional influencing factors in Sect. 4, but the authors should repeat the experiment at their well-equipped site with the additional instrumentation recommended above.”

Thank you. It could indeed be very interesting to repeat the experiment with the additional instrumentation you recommend, and we hope we will get the chance to do so in the future.

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