Anonymous Referee #2

The manuscript describes the effects of air turbulence on gas fluxes measurements (CH4 and CO2) of an automatic closed dynamic chamber system in different contrasting sites in a peatland in Canada. Although this issue has been tackled in different papers, this is unique research with an impressive dataset and furthermore with an interesting discussion on how to solve under/overestimation gas fluxes values. This research is highly relevant as it looks at a big problem that soil scientist have in gas flux measurements and the reliability of these data. The information in this manuscript will be of great help for soil scientists to improve autochamber flux measurements analysis. The article is well written and structured (with the exception of the discussion) and includes latest references in the field. I would recommend publication after changes recommended as follows:

Abstract: Abstract well summarizes the main findings in the article.

Introduction: Introduction well summarizes current knowledge on gas flux measurements with autochamber system and give enough information to clearly understand the rest of the manuscript.

Methods. Well written and organized.

2.1 Site description Line 25, 1444 I would suggest, just for this paragraph, to add botanical authors initial to the plant names.

>> Authors' response: We will add botanical authors to the plant names and revise the sentence as follows: "The surface of this peatland is completely covered by *Sphagnum* moss (*Sphagnum magellanicum* Brid., *Sphagnum capillifolium* (Ehrh.) Hedw., *Sphagnum angustifolium* (C.E.O. Jensen ex Russow) C.E.O. Jensen, *Sphagnum fallax* (Klinggr.) Klinggr.,) and the vascular plant cover is dominated by low growing ericaceous evergreen shrubs (*Chamaedaphne calyculata* (L.) Moench, *Ledum groenlandicum* Oeder, *Kalmia angustifolia* L.), with an occasional mix of deciduous shrub (*Vaccinium myrtilloides* Michx.), sedge (*Eriophorum vaginatum* L.) and forb (*Maianthemum trifolium* (L.) Sloboda)."

2.2 Autochamber system line 13, 1446. Solenoid valves, which kind?

>> Authors' response: We will describe the kind of solenoid valves and revise the sentence as follows: "…connected to the gas inlet and outlet located at the top of chamber dome led to a sampling manifold controlled by solenoid valves (Model DDBA-1BA, MAC Valves, MI, USA).".

Line 0, 1447. "To estimate the effective volume of the chamber". Can u please specify more how and why you are doing this and why during those 2 hours at night.

>> Authors' response: To keep the paper concise, readers are invited to refer to the cited paper by Drewitt et al. (2002) for details regarding the estimation of chamber effective

volume. Briefly, this involves a standard addition at a known rate, and then the calculation of effective volume based on gas concentration change in the chamber headspace over time. The effective volume corrects for the loss of CO_2 from the headspace during flux measurements owing to gas adsorption on the chamber lid, diffusion through the vent tube, etc. The original programme pre-set this procedure to be done over 2400-0200h, as the system was intended for soil respiration measurements initially and it was expected that nighttime CO_2 effluxes would be low and the fluxes missed due to this procedure would not contribute most to the total CO_2 emissions from soils.

2.3 CO2 concentration profile system Line 27, 1447. How sure are you about the reliability of those data as you cut out big blocks of peat? That site was very disturbed indeed.

>> Authors' response: The peat blocks were carefully returned to the pits after installing the CO_2 sensors. As the surface peat column is very fibric, its structure remains intact after cutting and subsequent returning to its original location. Moreover, any disturbance effects have been minimized as the sensors had already been installed for a few years when the measurements were made in 2009. We will include a sentence to address this: "The sensors were installed a few years before the actual measurements made in 2009 to minimize any possible disturbance effects."

2.4 Ancillary field measurements Line 13, 1448. I would very briefly define what the shear stress is.

>> Authors' response: We will modify the statement to include a brief definition of shear stress: "Friction velocity (u_*) was computed every 30 minutes as $u_* = \left(\overline{u'w'}^2 + \overline{v'w'}^2\right)^{1/4}$ from 20 Hz measurements of wind velocity measured in three dimensions (u, v, and w) with a sonic anemometer (Model R3-50, Gill Instruments, UK) prior to rotation to a natural wind coordinate system [Foken, 2008]. Friction velocity is related to shear stress, the rate of transfer of momentum, and it varies with wind speed and stability for a given surface roughness [Oke, 1987]."

Line 19, 1448. Why did you install the anemometer at 3 m height? Wind turbulence at height might differ significantly near the ground. Please explain.

>> Authors' response: Wind speed is measured by the sonic anemometer, which is also part of the eddy covariance system used for determining peatland CO_2 exchange. The anemometer is installed at 3 m height to enable a sufficiently large footprint to be captured for CO_2 flux measurements at the ecosystem level. We will revise the sentence to address this issue as follows: "As part of the eddy covariance system for determining peatland CO_2 exchange, the sonic anemometer was mounted on an instrument tower at a height of 3 m and was also used to compute cup wind speed. Above the canopy, u_* does not change with height within the constant flux layer of the atmosphere [Oke, 1987]. Within the 30 cm shrub canopy, we did not directly assess wind speed but using the CO_2

concentration profile results in the text, we showed that in highly turbulent conditions, gusts appeared to penetrate the canopy and into the near surface peat."

Line 3, 1451 In fig 1 you show just the sedge site, did the others showed similar pattern? You did not include the others just for space reasons? How do they compare?

>> Authors' response: In Figure 2 we only include data at a sedge-dominated site as an example. Other sites show similar, negative relationships between friction velocity and CH_4 flux, although differences in the absolute magnitude of CH_4 flux are smaller in shrub-dominated sites as shown in Figure 1. We will modify the figure caption as follows: "Time series of half-hourly friction velocity and CH_4 flux between DOY 200 and 214 in 2009 using an autochamber at a sedge-dominated hollow as an example. Other sites showed similar patterns though the magnitude differed among sites."

Discussion Although the content of the discussion section is well written, I would recommend a more organized structure. There are many discussion points and comparisons in the section: carbon dioxide, methane, different sites, high and low turbulence issues. I would then recommend using some subheadings. I had to read the section quite a few times, as there is a large amount of highly detailed information that I feel like subheadings might provide some helpful organization.

>> Authors' response: We will add sub-headings in the paper to improve readability.

Conclusion I would avoid using references in this section; they should be just in the discussion.

>> Authors' response: We prefer to keep the three citations here as they only provide some examples of ecosystems that have similarly observed the ventilation effect, and do not involve any sophisticated arguments. We are not referring to their arguments but the data they showed in their studies, which were similar to ours.

Figures and tables presented are enough for a clear understanding. Figure 6. Legend missing.

>> Authors' response: We will revise the figure caption as follows to make this clear: "CH_4 flux (DOY 180) and nighttime CO_2 efflux (DOY 177–181) in 19 successive 1.5-min periods over 30 min of chamber deployment, from: (a, b) a sedge-dominated chamber, and (c, d) a shrub-dominated chamber. The different lines represent the replicate flux measurements made during the above said period."