

Interactive comment on “Annual CO₂ budget and seasonal CO₂ exchange signals at a High Arctic permafrost site on Spitsbergen, Svalbard archipelago” by J. Lüers et al.

F. J. W. Parmentier

frans-jan.parmenier@nateko.lu.se

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The manuscript by J. Lüers et al. represents a very interesting dataset which is certainly of interest to the wider flux measuring community. However, while reading it, I noticed something apart from the issues already raised by the reviewer (such as the Burba correction), which may be worth mentioning, too.

In the text, a CO₂ release from the snowpack is described following the passage of air depleted in CO₂. The measured flux is subsequently ascribed to this drop in CO₂. However, the presented concentrations are expressed in mmol/m³, and not in ppm, while temperature and pressure changes will lead to significant differences between

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concentrations in ppm and mmol/m³. This is especially true because a large change in temperature and pressure occurred at the same time the values in mmol/m³ changed.

As an example, I therefore extracted two datapoints from Figure 3, at the 15th of March and the 17th of March, both at 3 o'clock at night. Over that period, a large drop in CO₂ occurred as well as a large change in air pressure and temperature. Once the concentrations in mmol/m³ were converted to ppm, a CO₂ concentration of 368.5 ppm is derived in both cases.

There is some uncertainty in these numbers (since I had to read them from the figure), but it looks like there is no large change in concentration over this period, which negates the notion that the efflux of CO₂ was caused by the passage of air depleted in CO₂.

Then again, the paper rightfully points towards pressure effects, which may be more relevant than the CO₂ concentration. Pressure changes would stimulate efflux in and out of the snowpack, and it seems this represents a more classic storage problem, where there's a disconnect between the source and the measurement height. The underlying cause for the observed fluxes may therefore be sought in that direction instead.

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