

Interactive comment on “Winter observations of CO₂ exchange between sea-ice and the atmosphere in a coastal fjord environment” by J. Sievers et al.

Anonymous Referee #1

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We thank the authors for their reply on this particular issue, which is important to address. It's also good to stress that a Licor-7500A was used, instead of the original model, which would reduce the heating problem. The authors refer to a paper by Burba et al. (2012) to support that point, but that particular paper is about the Licor-7200, not the Licor-7500A. The original Licor-7500 is mentioned once in that paper, while the Licor-7500A is not mentioned at all. A search for the claim that the Licor-7500A works well at -25 degrees only brings up a poster from Burba et al, which can be found at http://webmail.li-cor.com/env/pdf/eddy_covariance/minimize-surface-heating.pdf (perhaps the authors are able to find a more relevant peer-reviewed publication, which would be highly appreciated).

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This poster includes two days of simultaneous measurements with a Licor-7500, Licor-7500A and Licor-7200 with much higher fluxes than in authors' manuscript. Switching the sensor to the cold climate setting did show a large improvement, much closer to the Licor-7200, with ambient temperatures ranging from -22 to -13. However, some discrepancies remain, which in this short time-series reach as high as 50 mmol m⁻² d⁻¹. This is similar to the highest fluxes seen at the POLYI site, which implies that those numbers can still be artificial. Admittedly, the fluxes at DNB are larger than 50 mmol m⁻² d⁻¹ but the data from above-mentioned poster span just 36 hours with the cold-climate setting of the Licor. It's therefore hard to tell how large the difference with the Licor-7200 can be under varying conditions, especially since the solar load isn't shown in that poster. The problems with the Licor-7500 were not only related to the internal electronics, but also incoming solar radiation. In that light, it's striking that the net radiation was much higher at DNB than during the measurement campaigns at POLYI and ECEI.

However, even if we assume that the Licor-7500A does perform well enough at such low temperatures to measure these very small fluxes, correlations of 0.89 and 0.94 with a single environmental parameter are extremely high and not that common in micrometeorology. These numbers deserve high scrutiny for this reason alone. To illustrate, it's difficult enough to achieve an energy balance closure higher than 0.7 at many Fluxnet sites. Strong arguments are therefore needed to rule out the possibility of instrument interference, but when one instrument (the Licor-7200) does not show similarly high correlations, it becomes more likely that a difference between the instruments themselves plays a role. I therefore continue to recommend a much more thorough discussion and analysis of the effect of this problem on the fluxes. More focus on the Licor-7200 data can be used to evaluate which patterns and flux magnitudes are realistic. With that basis, perhaps it can be determined to what extent the data from the Licor-7500A can be relied upon.

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