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Open Access Earth System Science Data Discussions

Interactive comment on "CO_2-flux measurements above the Baltic Sea at two heights: flux gradients in the surface layer" *by* A. Lammert and F. Ament

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Summary

1.) **I consider the publication of the data to be very useful.**

2.) **More details and information are needed.**

3.) **Please publish the full HF-data.**

4.) **I challenge the conclusion and suggest something different.**

Specific comments

1) I consider the dataset to be very useful for the flux measurement community. These trace gas eddy flux data at two heights over the ocean and over a long period are pretty unique. I see a uniqueness in the fact that due to the homogeneity of the surface the footprints of the eddy measurements at both heights can be taken as being of identical condition, a fact that is very hard to fulfill with land based eddy towers.

2) The description of the data set lacks essential information. The main objective of a data publishing paper is a thorough description of the experimental setup, data processing procedures, measurement accuracy, etc. Here, the paper has serious deficits.

2.1) sensor alignment

How well have the sonic axes been aligned ? Did you apply any alignment correction ? This is often done by rotating the axes such that over a 30min period the mean vertical wind velocity vanishes.

In Fig. 2 vertical wind speed values of ± 0.1 m/s for daily averages are shown, translating to some 8km distance the air would have travelled vertically. This is clearly not possible at a height of 6.8 m above the ocean.

In p590,l23 you consider a possible annual cycle of the mean vertical wind speed. If there was any at 6.8 m above the ocean, you certainly will not be able to detect it by a sonic anemometer at a 9 m boom.

2.2) sensor separation

Missing is information on the separation between sonic and Licor. Do they have the identical distance at both heights ? And what effect does the sensor spacing have on the accuracy of the measurement, especially on the high frequency resolution ?

2.3) scale resolution, what sampling frequency ?

Information on the sampling frequency is also missing. Did you do any spectral analysis

to estimate possible high frequency losses ?

2.4) flow distortion due to platform

What effect does the structure of Fino 2 have on flow distortion ? Please give more information how you filtered the data with respect to influence of the mast.

2.5) effects of possible CO_2 sources

How is Fino 2 powered ? Does it have a generator that exhausts CO_2 ? May that have an effect on the measurements ?

Can it be excluded, that ships passing have an effect on CO_2 measurements ?

What about directional dependence of the CO_2 flux measurement ?

3) In Pangaea only 30 minute flux calculation and averages of scalars and vector components are published. It would be of great benefit if the full dataset, i.e. the high frequency values of the wind components and scalars are published. Pangaea should be able to handle that.

With the above mentioned points addressed, I recommend to limit the essd paper to the data presentation. essd is essentially a data publishing journal, you don't need to discuss physics.

4) I challenge the conclusion

The scales of transporting eddies increase with height. If your setup has the identical high-frequency loss at both heights, the relative error will be smaller at 13.8m than at 6.8m. Of an upward flux the lower instrument will miss more than the upper one, which may be misinterpreted as a positive flux gradient. Vice versa for a downward flux. Isn't it suspicious, that the gradients appear for those covariances only that compose of spaced sensors ? While no gradients appear for momentum and heat flux that

compose of measurement at the identical location ?

After all, where should the CO_2 and H_2O go or come from between 6.8 m and 13.8 m ? If there is a gradient, and I think we can exclude divergence or convergence, there also needs to be a source or sink.

If it turns out that your conclusions cannot be maintained after further accuracy analysis and possible high frequency corrections of the covariances you may actually consider to turn your point of view. Assume no gradient and identical footprints for both heights and use the data to derive a height dependent correction procedure for flux measurements in a separat (e.g. AMT) paper.

Interactive comment on Earth Syst. Sci. Data Discuss., 8, 587, 2015.