

## ***Interactive comment on “Parameterization of atmosphere–surface exchange of CO<sub>2</sub> over sea ice” by L. L. Sørensen et al.***

**L. L. Sørensen et al.**

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Received and published: 28 November 2013

I have additionally attached the response to all 3 reviews

Response to review 3: Page 3905, Lines 5-10: We will delete the details on the enclosure method. Page 3906, We have rewritten section and corrected the figure according to the comments. We have explained in more details how we calculated R<sub>b</sub> and redefined c<sub>s</sub> and c<sub>0</sub>. Page 3908, Eq. 10: z<sub>0c</sub> is the surface. That will be more clear in the rewritten manuscript. Page 3908, Eq. 11: Stanton number Bi is corrected. In the rewritten manuscript it is explained how R<sub>b</sub> was estimated and how the variables were determined. Page 3909, Eq.13: The mean vertical advection is normally neglected because the vertical velocity is considered to be negligible, by when measuring CO<sub>2</sub> flux this term needs to be included since the difference in density between upward

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and downward moving air result in a non-negligible vertical velocity. This can be done by correction of the calculated fluxes (Webb, 1989) or the high frequent fluctuations (the raw signal) can be corrected (Sahlée et al 2008). Here we use the approach by Sahlée since we then have a corrected time series, which is needed for spectral analysis. This is described in the rewritten manuscript. The instrumentation (a Licor 7500 and a metek sonic) is also described in the manuscript. Page 3910, L13-15: The fluxes are filtered based on a careful review of the co-spectrum and power spectrum of velocities and CO<sub>2</sub>. A more detailed description of the flux estimations using different spectral techniques (inertial dissipation and also co-spectra peak method) is provided in the new manuscript. We also include an error analysis based on the error analysis in Sørensen and Larsen (2010). Page 3910, L 24: We did not try to estimate the true surface pCO<sub>2</sub> based on a vertical gradient in the ice. This paper is meant to suggest a conceptual model for CO<sub>2</sub> air - ice exchange. However we will add that as a suggestion for future work in a more detailed study of air – ice exchange. Page 3914, L7-8: We have looked through our analysis again and based on a longer data set from our field site (Søgaard et al., 2013), we can conclude that the largest uncertainty in our study is the calculation of the pCO<sub>2</sub> in the ice. This is because the production and precipitation of CaCO<sub>3</sub> is not taken into account, when calculating the pCO<sub>2</sub>. This will be addressed in an updated manuscript. Page 3915, L14: We have removed the correlation between temperature and pCO<sub>2</sub> from the manuscript.

Please also note the supplement to this comment:

<http://www.the-cryosphere-discuss.net/7/C2566/2013/tcd-7-C2566-2013-supplement.pdf>

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Interactive comment on The Cryosphere Discuss., 7, 3899, 2013.

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