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Interactive comment on “Parameterization of atmosphere–surface exchange of CO₂ over sea ice” by L. L. Sørensen et al.

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General comments

The paper “Parameterization of atmosphere-surface exchange of CO₂ over sea-ice” discusses a new application for parameterizing CO₂ fluxes over sea-ice. The paper addresses a potentially important and for the longest time ignored process of CO₂ exchange. Hardly any work has been done with respect to parameterizing this process and it is hence, a very timely study. The paper is generally well written and the methods described accurately. However, it seems to me that for the fact that the main content is to evaluate a parametrization based on resistance analogy as used over terrestrial surfaces, the actual analysis and discussion of the parametrization/comparison to measurements is rather short and unclear. I suggest that this component should

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be expanded to make clear how well the parametrization does perform and how large are the errors. This could then be tied in with the discussion/mention of the need for accurate estimations of surface pCO₂. The result should then also be mentioned in the conclusions.

Specific comments

Page 3902

Line 16 specify which TCO₂ (from the ocean, ice?)

Page 3903

This is to our knowledge...first attempt to parameterize air-sea-ice fluxes of CO₂

I think this sentence should be modified to include something like “via resistance theory” or similar, . . . Line 12

While it is correct that sea-ice does not change in response to wind as water does it is not immune. Maybe a note could be added that sea-ice surface might change via ice deformation, but on much longer timescales and is therefore not included in the study.

Page 3907/8

Equation 9 I am not sure what the sign convention is here, but from signage in equation 4 and 8, I would expect a minus sign on the right side of equation 9

similarly , I would expect equation 12 to contain $-R_a - R_b$ rather than $-R_a + R_b$

Please check, maybe an additional step in the equation conversions would help?

Page 3010 Line 1-2 It is not clear if “ showed good agreement” refers to the current study or the earlier Sorensen and Larsen Study, please clarify

Line 5-7 could this be further analyzed?

Page 3916 6-9, this sentence is somewhat confusing. This conclusion can probably be

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expanded for clarification. See also general comment.

Technical corrections

Page 3901

line 17 sea-ice, which have => sea-ice which has .. line 19 remove both (there are three...) line 26 reduced ice cover is expected to increase uptake=> temporarily increase uptake (???)

Page 3902

Line7 studies regarding => studies discussing (?) Line 11 across sea-ice => through sea-ice that the sea-ice => that sea-ice Line 27 more knowledge => better knowledge

Page 3914 Line 12: Clarify is this an increased surface flux into the ice?

Page 3903

Line 4-7 Reformulate in two sentences, maybe separate with “In addition “ in lieu of the “and”...

Page 3905

Page 25 physically => physical

Page 3914 Line 2 proper => properly Line 8 even can => can even Line 9 due to increase of difference in => due to an increase in the difference between Line 13 well to the => well with the Line 24 surface possibly => surface, possibly

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

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