

## ***Interactive comment on “Consistent biases in Antarctic sea ice concentration simulated by climate models” by Lettie A. Roach et al.***

### **Anonymous Referee #2**

Received and published: 23 September 2017

This paper was very interesting to read, and is certainly very well written. The result that all CMIP5 models show a too loose sea ice cover around Antarctica is novel and important, as it points to a consistent bias and potentially missing physics. The authors propose that this missing physics might be the treatment of lateral melt in sea ice models used in CMIP5. They perform experiments with one model to evaluate the impact of lateral melt choices. Overall, I think this study is very timely and should be published, after some revisions.

Page 2, Line 30: Why limit the analysis to 2000-2014, when longer observational and model timeseries are available? Longer time series would make the analysis more robust.

Page 2, line 32: Why is daily sea ice concentration used here? This should be ex-

plained, as many more models provide monthly than daily output, and it looks like the authors proceed to average the daily output to seasonal averages.

Page 3, Line 15-17: While I agree that one needs to consider the observational uncertainty, I am not convinced that averaging several products is the best way to do that. First of all, they could all have consistent biases, and hence their range still would not account for the observational uncertainty. Secondly, one of them might be a lot better than the others, and so the combined data might be further from the truth than the best one. So while I am not suggesting that the authors perform an evaluation of the three observations, which is best done by the creators of these data sets, I would encourage the authors to add a sentence or two here to highlight the potential shortcomings of this approach they are using.

Page 3, Line 19: Why was the sea ice output re-gridded, rather than analyzed on the model grids? This can introduce additional errors that have nothing to do with the physics of the model. So there needs to be a good reason to re-grid the model output, otherwise the analysis should be re-done on the original grids. And if the authors have a good reason to do the re-gridding, please include information on how exactly the re-gridding was done, so it can be replicated by others.

Page 3, Line 27: Why are concentrations below 10% not included? Others included them, so please explain why you would not. For loose sea ice, wouldn't it be important to look at below 10%?

Page 8, line 15, Table 1: Since the authors have the information on whether and how lateral melt is included in the CMIP5 models, do they find any difference between models that include it or not? That would provide an important argument for the hypothesis of the authors that the too loose sea ice concentration is a result of deficiencies in lateral melt.

Page 10, line 24-28: Please remove this entire paragraph. It is pure speculation what modeling centers look at during model development, and this speculation does not add

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anything to the arguments or results presented in the paper.

Page 10, Line 29: The observational range is not necessarily fully counted for, as discussed earlier. This should be reflected here.

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-131>, 2017.

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