

Interactive comment on “Influence of meltwater input on the skill of decadal forecast of sea ice in the Southern Ocean” by V. Zunz and H. Goosse

Anonymous Referee #1

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The authors assess the impact of an unspecified additional freshwater flux on the trend in simulated Southern Ocean sea ice extent and concentration using an 'ensemble' simulation with data assimilation for the period 1850–2009 as well as different hindcasts all initialized with assimilated data of 1980 and extending to 2009. For simulations with data assimilation and an additional freshwater flux the trend in sea ice extent and concentration from 1980 to 2009 improves the reconstruction. The hindcast simulations also have to be forced by an additional freshwater flux to avoid a model drift. Since the resulting trends in sea ice extent and concentration are in satisfying agreement with satellite observations, the authors are optimistic to have found an experimental design for sea ice predictions in the Southern Ocean. They also claim that the positive sea ice trend over the last 30 years is mainly determined by the ocean state in the late 1970's and does not need an increased meltwater flux from the Antarctic Ice

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Sheet as previously stated by others.

General comments:

The paper represents an interesting study especially with regard to recent claims relating the observed positive sea ice trend, although this has been questioned lately (Eisenman et al., 2014), to an increase in ice shelf basal melting. With this new view on the satellite measurements the authors might have to discuss their results from a slightly different perspective, i.e., the NODA and NOFWF simulations (Fig. 2) might be closer to reality than originally thought. However, their analysis provides additional evidence for the previous misinterpretation of the impact of ice shelf basal melting on the Southern Ocean sea ice extent.

Therefore, I urge the authors to consider this new finding thoroughly when analyzing the model results, but if done, I recommend publication in TC after consideration of the comments/corrections listed below.

Specific comments:

1. The authors consider an unspecified additional freshwater flux which can but does not need to be related to ice shelf basal melting. Therefore, I recommend to modify the title to 'Influence of freshwater input...'
2. The authors distribute the additional freshwater within the sector 0 ° to 170 °W. Although I understand the rationale behind, I question its applicability. The Filchner-Ronne and Ross ice shelves can be considered as 'low-melters', so why including the Weddell Sea and part of the Ross Sea? On the other hand, the coasts of East Antarctica are receiving most of today's precipitation, which will end up in marginal seas not included, and will be transported westward with the Antarctic Slope Current. The authors should show the difference with regard to sea ice extent for a circumpolar vs. sectoral distribution of the freshwater.
3. Several figures, in particular Figs. 2, 4, 5, and 7, are too small to read labels, annotations, etc.

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Technical corrections:

P 3571/L10: ...flux from the estimate of the

P3572/L06: ...,south of 70 °S (area....

P3572/L18: ...inherit the value...

P3573/L16: ...consist of weighted averages.

P3574/L24: ...(Fig. 2a and 3b),...

P3575/L16: ...(green solid lines in Fig. 4a and b).

P3575/L20: ...(Fig. 4c).

P3576/L09: ...increase in the eastern Weddell Sea,..

P3577/L13: ...Bellingshausen and....

P3581/L27: If the decrease in the western part of the Southern Ocean is considered to be too large, it should also be mentioned that the increases in the Weddell and Ross seas are too low.

References:

Eisenman, I., Meier, W. N., and Norris, J. R. (2014) A spurious jump in the satellite record: has Antarctic sea ice expansion been overestimated?, *The Cryosphere*, 8, 1289-1296, doi:10.5194/tc-8-1289-2014.

Interactive comment on *The Cryosphere Discuss.*, 8, 3563, 2014.