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Ocean Science
Discussions

Interactive comment on "Assimilation of sea-ice concentration in a global climate model – physical and statistical aspects" *by* S. Tietsche et al.

Anonymous Referee #2

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The paper describes Sea-Ice concentration assimilation experiments in the atmosphere-ocean global climate model ECHAM5/MPI-OM. The assimilation method consists in a Newtonian relaxation limited to the Northern-hemisphere sea ice and applied on the sea ice concentration and the mean ice thickness. Several decadal experiments have been performed in a twin experiment context or using realistic satellite observations of sea-ice concentration. Finally, various methods for the control of the mean ice thickness are explored and inter-compared and a specific solution is proposed and justified by convincing arguments and diagnostics.

General comments

The results are presented using figures of good quality. The paper is easy to read and is very well written even if the structure of the paper could be more classical (in

particular for the section 7). For instance, some assimilation concepts are presented at the end of the paper in the section 7, and it is not usual, but why not. Objectively, this paper is not too long but it could be shorter due to the presence of section 6 which is not very necessary. In addition, I am not sure that the appendix B is also necessary for the demonstration. Note that, despite this comments, I do not suggest to rewrite totally or remove these sections because they provide some relevant details improving the demonstration. Finally, I think that the topic is very interesting, and the paper could well fit into the Ocean Science journal. However, some very minor details or explanations are missing or weakly presented, and I would suggest a very moderate revision before submitting the paper for a second review.

Specific comments

S.3.3, P.2413 : "we adjust the salinity . . .that analysis update does not introduce artificial sources or skins of salt" . I understand that you have implemented a method "removing" the additional effect of the mean ice thickness correction. But is it totally equivalent to the case with no analysis update both for mean ice thickness and for the sea ice concentration? In particular for the CMT method, is it effective. Have you an adjustment taking into account the variation of the sea ice concentration (modifying consequently the exchange with the atmosphere like the precipitations)? Please, could the authors give more details about this specific adjustment for the sea surface salinity.

S.4.1, P.2414 : ".. we branch off a perturbed run P. . ." . It is not sufficiently clear for the reader. I understand that only the initial condition of the simulation is perturbed. Is it the case or have you also perturbed the model? Please, could the authors give more details.

S.5.2, P.2418-2419 : The CAT and CMT are not on the figure 5. Why? It could be interesting for the reader to have this comparison in order to better understand the specific behaviours in March. In particular, what are the values for the CMT method in March, we can imagine (or not) that the mean ice thickness are closer to the reference

run without assimilation and then are closer to the ICEsat observation. I don't know. I suggest to add the model average for these methods in the figure 5 or to justify why there are not in the figure.

Technical corrections

Equation 14 and 15: First, I think it will be clearer if the Sc and Sh notations are consistent with the equations 5 and 6. The nudging term is an additional terms and then not included in Sc or Sh. I suggest to modify these equations in order to separate explicitly these terms. Second, I think the presentation will be also clearer if the nudging term is similar to an analysis update term, i.e (y-Hxf). C0 is the observation so you have to write (C0-C) and not (C-C0). Third, I think that the two equations seem to be wrong; there is a mistake or I do not understand; a minus sign is missing or the mistake is linked to my second point or TR is negative or . . .?. Please correct.

Interactive comment on Ocean Sci. Discuss., 9, 2403, 2012.