Geosci. Model Dev. Discuss., 5, C556–C558, 2012
www.geosci-model-dev-discuss.net/5/C556/2012/

Geoscientific
Model Development
Discussions

Interactive comment on "Better constraints on the sea-ice state using global sea-ice data assimilation" *by* P. Mathiot et al.

L. Bertino (Referee)

laurent.bertino@nersc.no

Received and published: 15 August 2012

The manuscript by Mathiot and co-authors presents an ambitious data assimilation experiment in a coupled ice-ocean model, assimilating both ice concentration and ice thickness measurements. The study consists of a controlled experiment assimilating synthetic data plus a realistic experiment assimilating real satellite data. The exercise is of great interest both for operational forecast models and upcoming climate prediction systems. It is also timely in view of the upcoming availability of satellite ice thickness data from the CryoSAT mission. I believe this is the first time that a global system successfully assimilates real ice concentrations and freeboard observations simultaneously over several years.

The manuscript is generally good and well structured which only misses a few com-

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

plements of information to become a very good publication. The modelling and data assimilation methods used are both at the state of the art, and the results from the experiments are of direct practical interest for the community. There are however missing pieces of information, like the generation of the initial ensemble the magnitude of observation errors and other details of the setup (localization radius and inflation if any). Another missing element is the evidence that the EnKF is in good health: i.e. that the errors expected by the Kalman filter (forecast + observation errors) are commensurate to the actual innovations. This is particularly a critical point for the perturbed-observation EnKF used with a rather small ensemble size (25 members) and a high frequency of assimilation (once a day). I can imagine that in a coarse resolution model the numbers of degrees of freedom is probably small, but I still expect serious sampling errors, which may result in a shrinking of the ensemble spread.

In conclusion, I would like the authors to present some measure of the expected KF errors, in the form of time series or whiskers regularly spaced (once in summer, once in winter) along the existing time series (Fig. 3 or 5 for example), as well as some information about the initial error and measurement errors applied. Note that I would still find the paper worth publication in GMDD even in the eventuality that the ensemble spread would decrease all through the run.

Detailed comments: - P. 1635, L. 13. Performing the analysis in ensemble space prevents observation errors from being correlated, but localization does not. - Same place, please indicate localization radius. _ P. 1637, Section 3.2. Lisæter et al. (2007) recommend to perturb both the winds and heat fluxes for best efficiency, why not perturbing heat fluxes in your case? - P. 1638, l. 10. p has units of anomalies but is called "scale factor" with a value of 0.5, this seems like a small error. - P. 1638, l. 11. Assuming no temporal correlation between the perturbations effectively lets the model equations do the smoothing instead, which means that the perturbations may have a smaller effective standard deviation than the 0.5 scale factor specified. - P. 1640, l. 7. What is meant by "data with elevation varying..." varying in space or time? - Section 4.2, the errors

GMDD

5, C556–C558, 2012

on the measurements are omitted. - P. 1641, Section 5.2 has a little confusing logic, the discussion of the IC and FB experiments are done together instead of sequentially. - P. 1641, same paragraph, the last sentence about transforming multi-year sea ice into seasonal sea ice is also unclear. - P. 1643, l. 27. The too strong reduction is not obvious to me, is that in the Chukchi Sea? Please specify names of areas. - P. 1644, l. 17. This indicates that the correlations between ice concentration and thickness are negative in the marginal seas. This could be tracked back to model biases (for example too cold waters below the sea ice). - Fig. 4b) there are 5% of ice in almost the whole Arctic in the OSI-SAF obvervations, this looks strange to me. Could you double-check there is no error?

Typos: - "Sea ice" is usually spelled without dash. - P. 1642, l. 8. "accompanied" - P. 1643, l. 3. "As expected": I envy your optimism. - P. 1646, l. 16. "Simulates an ice..." - Fig. 3b), p. 1659. A little smoothing would make the plot more readable. - Fig. 9. Please remove the line "Free (EnKF)", it is only adding confusion.

Interactive comment on Geosci. Model Dev. Discuss., 5, 1627, 2012.

GMDD

5, C556–C558, 2012