

Summary for the outlook of 9/2010 Arctic sea ice

Jinlun Zhang

Polar Science Center, Applied Physics Lab, University of Washington

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Ensemble seasonal predictions were conducted for the community-wide Arctic Sea Ice Outlook for September 2010. The September 2010 mean sea ice extent was predicted to be 4.7, 4.8, and again 4.8 million square km when the ensemble prediction started on the first day of June, July, and August of 2010, respectively. The NSIDC reported that the September 2010 mean ice extent is 4.9 million square km, based on satellite observations.

Note however that the ensemble seasonal predictions are aimed at not only estimating the total sea ice extent, but also estimating ice thickness and ice edge locations. The predicted September mean sea ice thickness and ice edge locations are shown in Figure 1.

Summary

- (1) The pattern of surface winds in the first six months of 2010 tends to push ice into in the eastern Siberian and Laptev seas (Figure 2a), resulting in unusually thicker ice in that region (Figure 2i). This did not occur very often in the past 7 years (2003–2009) on which the ensemble atmospheric forcings are based. As a result, the model over-predicted September ice extent in that region when the prediction started on 6/1 or 7/1, (Figure 1, upper and middle panels). In July 2010, the pattern of surface winds tends to drive ice away from that region (Figure 2b). As a result, the model is able to better predict the September ice edge in that region when the prediction started on 8/1 (Figure 1, lower panels). This indicates the importance of atmospheric circulation in the accuracy of seasonal predictions. It also shows that as the prediction range decreases, the prediction of ice edge locations improves, as expected.
- (2) According to the NCEP/NCAR reanalysis surface air temperature, the Arctic Ocean in the first nine months of 2010 was generally warmer than the average of the past 7 years (Figures 2e–2h). This causes a reduction of summer ice thickness over most of the Arctic Ocean according to the model (Figures 2j–2l). In fact, the model indicates that the total September arctic sea ice volume in 2010 is the lowest over the period of 1978–2010. However, the pattern of summer 2010 winds does not resemble that of summer 2007 winds that drove much of the ice out of the Pacific sector of the Arctic Ocean. This is probably why the observed September 2010 ice extent is greater than the September 2007 ice extent.

Information about ensemble predictions:

The ensemble seasonal predictions are based on a synthesis of a model, NCEP/NCAR reanalysis data, and satellite ice concentration data. The model is the Pan-arctic Ice-Ocean Modeling and Assimilation System (PIOMAS), which is forced by NCEP/NCAR reanalysis data and assimilates satellite ice concentration data. The ensemble consists of seven members each of which uses a unique set of NCEP/NCAR atmospheric forcing fields from recent years,

representing recent climate, such that ensemble member 1 uses 2003 NCEP/NCAR forcing, member 2 uses 2004 forcing, ..., and member 7 uses 2009 forcing. Each ensemble prediction starts with the same initial ice–ocean conditions on the first day of a particular month in 2010. The initial ice-ocean conditions are obtained by a retrospective simulation that assimilates satellite ice concentration data. Of course, no data assimilation is performed during the predictions. More details about the prediction procedure can be found in Zhang et al. (2008). Additional information can be found on http://psc.apl.washington.edu/zhang/IDAO/seasonal_outlook.html.

Reference

Zhang, J., M. Steele, R.W. Lindsay, A. Schweiger, and J. Morison, Ensemble one-year predictions of arctic sea ice for the spring and summer of 2008. *Geophys. Res. Lett.*, 35, L08502, doi:10.1029/2008GL033244, 2008 (http://psc.apl.washington.edu/zhang/Pubs/Zhang_etal2008GL033244.pdf).

Two figures below

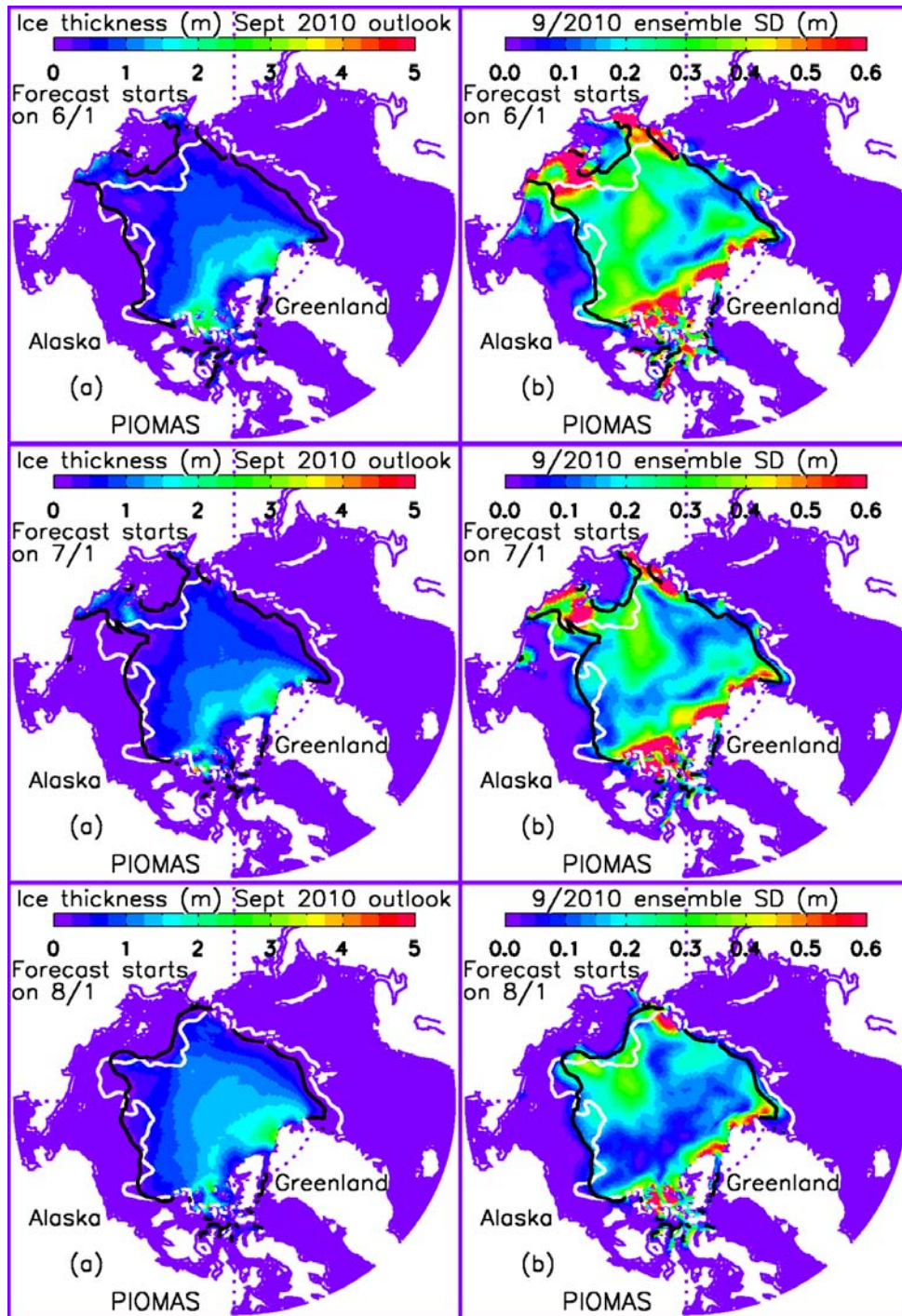


Figure 1. Ensemble prediction of September 2010 sea ice thickness (a) and ensemble standard deviation (SD) of ice thickness which shows the uncertainty of the prediction (b). The white line represents satellite observed September mean 2010 ice edge defined as 0.15 ice concentration, while the black line model predicted ice edge. The forecast started on the first day of June (upper), July (middle), and August (lower) of 2010.

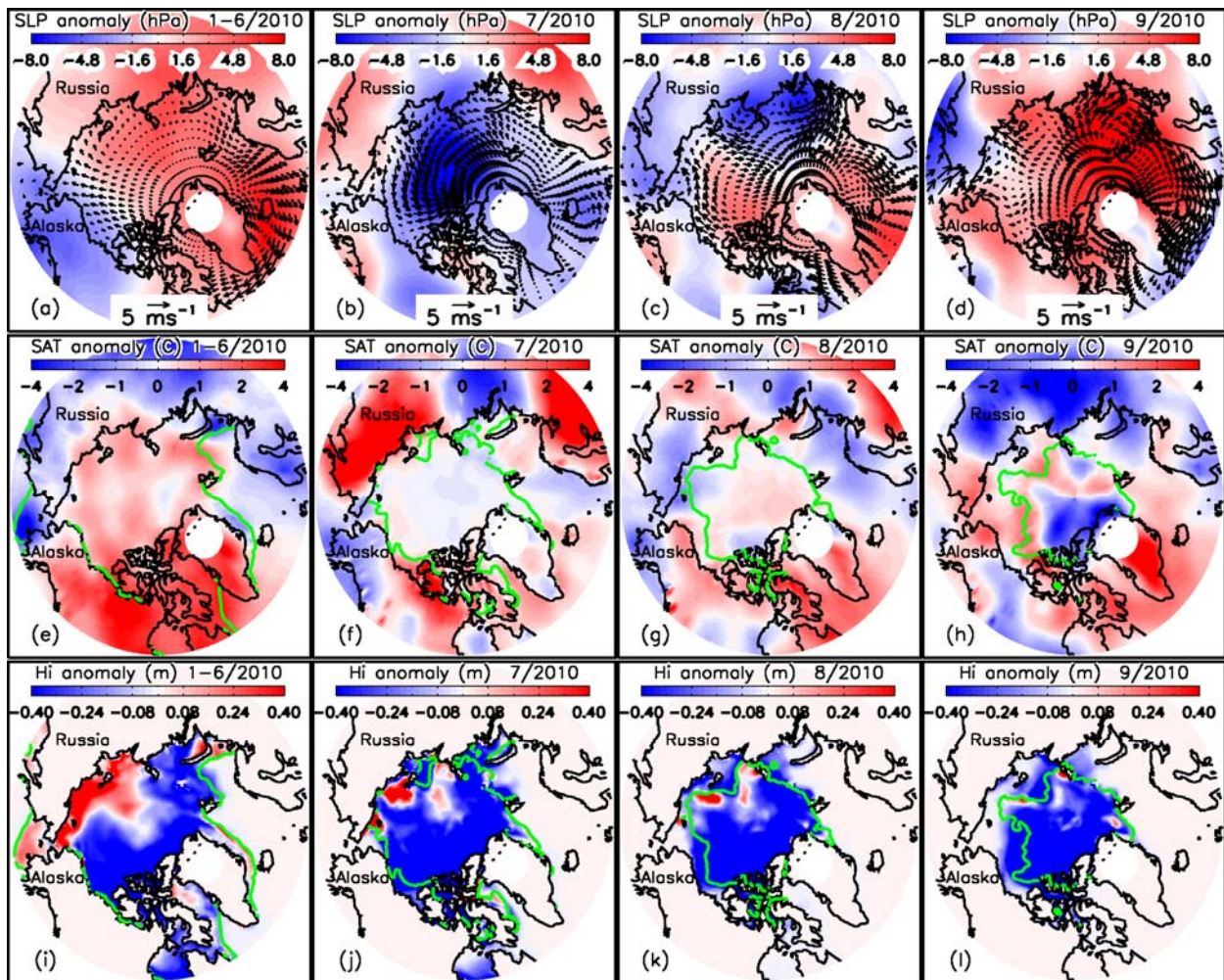


Figure 2. Anomalies of the NCEP/NCAR reanalysis sea level pressure (SLP) and surface wind (a–d) and surface air temperature (SAT) (e–h), and the model simulated sea ice thickness (Hi) (i–l). An anomaly is defined as the difference between the 2010 value and the 2003–2009 average. The green line in (e–l) represents corresponding satellite observed ice edge.