Ensemble Predictions of September 2009 NWP Sea Ice Conditions (Summary)

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Ensemble predictions of September 2009 sea ice conditions in the Northwest Passage (NWP) region were conducted as a part of community-wide Arctic Regional Sea Ice Outlook. Here is a summary, followed by 4 figures:

(1) Satellite ice concentration data appear to show that sailing along NWP in September 2009 was possible without escort of ice breaker (Figure 1).
(2) With the starting date of prediction being 7/1, the model under-predicts sea ice in the NWP region (Figure 2 upper). It is not clear why. Maybe it is related to the under-prediction of ice extent in the Arctic Basin. With the starting date of prediction being 9/1, the predicted sea ice conditions appear to be quite closer to satellite observations (Figure 1 and Figure 2 lower). This is because as the prediction range becomes shorter, the initial prediction conditions, out of assimilation of satellite ice concentration data, approach to the actual September ice conditions. So obtaining right initial conditions are as important for the outlook of ice conditions in the NWP region as for that in the Arctic Basin.
(3) Except in a small area, most of the NWP region in September 2009 has less ice than the 2002-2008 September mean (Figure 3d). This may be attributed to the fact that it was warmer than usual in the NWP region in July and August (Figures 4b and 4c).
(4) Given that NWP in September was largely open and less ice was observed in most areas than the recent average and warmer SAT in July and August, we may deduce that the probability of a complete open NWP will increase in the future.

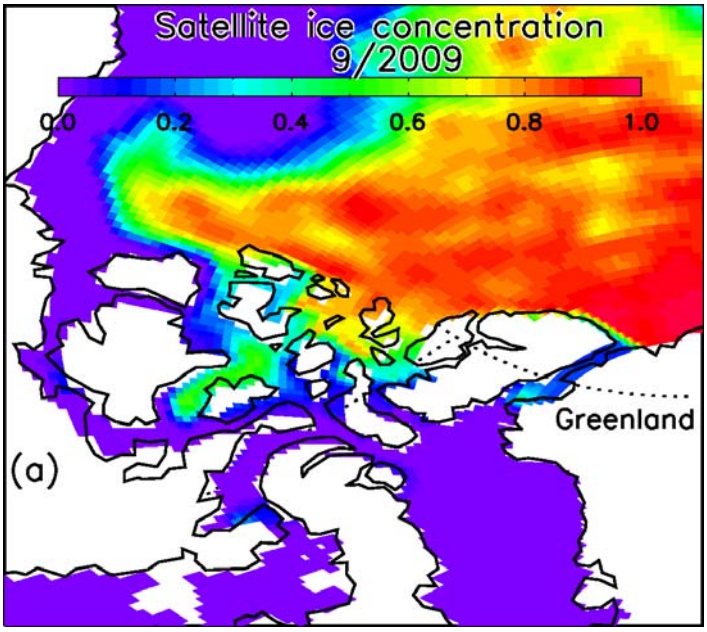

Figure 1. Satellite observed September 2009 sea ice concentration in the Northwest Passage region.

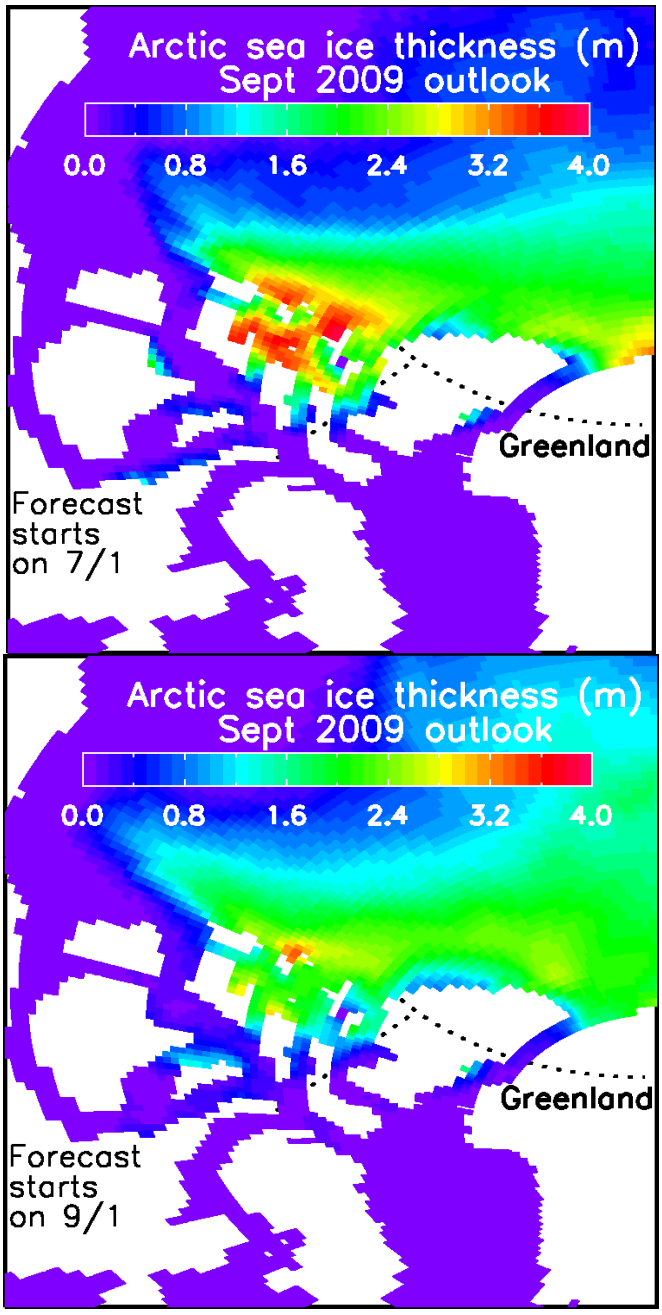

Figure 2. Ensemble predicted September 2009 sea ice thickness in the NWP region with two different starting dates of prediction (July 1 and September 1).

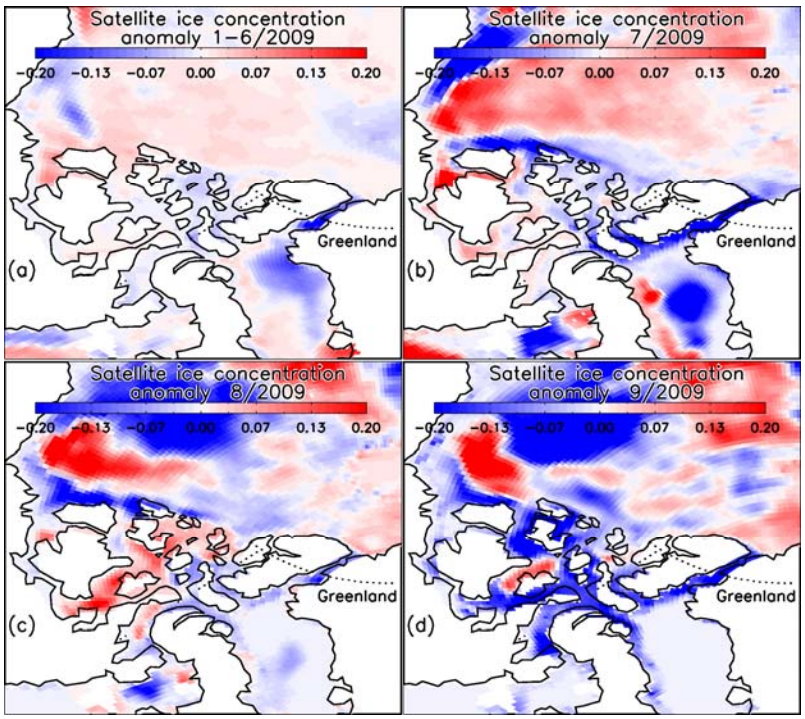

Figure 3. Anomalies of satellite observed sea ice concentration. An anomaly is defined as the difference between the 2009 value and the 2002–2008 average.

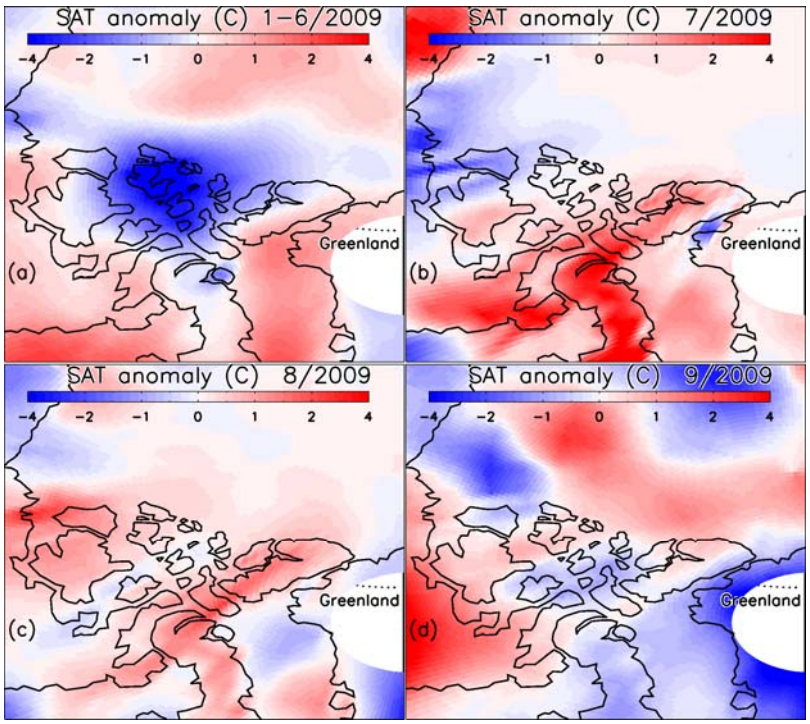

Figure 4. Anomalies of the NCEP/NCAR reanalysis surface air temperature (SAT). An anomaly is defined as the difference between the 2009 value and the 2002–2008 average.

Information about ensemble predictions:

The ensemble 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. It is able to assimilate 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 2002 NCEP/NCAR forcing, member 2 uses 2003 forcing, …, and member 7 uses 2008 forcing. Each ensemble prediction starts with the same initial ice–ocean conditions on the first day of a particular month in 2009. 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).

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)