September 2015 sea ice outlook (from July 1, 2015):
Pan-arctic and all Arctic regions

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Prediction type: Dynamic model: **P**an-Arctic **I**ce-**O**cean **M**odeling and **A**ssimilation **S**ystem (**PIOMAS**, Zhang and Rothrock, 2003), with coupled sea ice and ocean components.

Pan-arctic outlook: The September 2015 Arctic sea ice extent predicted from July 1, 2015 is **5.1 ± 0.6 million square kilometers**.

Outlook of all Arctic regions: The September 2015 Arctic sea ice thickness field and ice edge location are predicted and presented here (Figure 1).

Method: These results are obtained from a numerical ensemble seasonal forecasting system. The forecasting system is based on a synthesis of PIOMAS, the NCEP/NCAR reanalysis data, and satellite observations of ice concentration and sea surface temperature. 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 2008 NCEP/NCAR forcing, member 2 uses 2009 forcing …, and member 7 uses 2014 forcing. These seven years of the reanalysis atmospheric forcing fields are used to represent the climate variability expected for 2015. If the current or near future climate is close to any of the last seven years, it would be captured by the forecast system. Each ensemble prediction starts with the same initial ice–ocean conditions on 1 July 2015. To obtain the "best possible" initial ice-ocean conditions for the forecasts, we conducted a retrospective simulation that assimilates satellite ice concentration and sea surface temperature data through the end of May using reanalysis forcing data from this year. More details about the ensemble prediction procedure can be found in Zhang et al. (2008).

Uncertainty: The uncertainty of the predicted September 2015 Arctic sea ice extent is **± 0.6 million square kilometers** and the uncertainty of the predicted ice thickness field is reflected in the ensemble standard deviation (SD) of ice thickness field (Figure 1b). These uncertainties are derived from the 7 prediction ensemble members.

Executive summary: The seasonal prediction focuses not only on the total Arctic sea ice extent, but also on sea ice thickness field and ice edge location. We feel that, for all practical and scientific reasons, it is particularly important to improve our ability to predict ice thickness and ice edge location in various Arctic regions. Needless to say, this is a difficult goal. However, it is hoped that this effort would contribute to this goal.

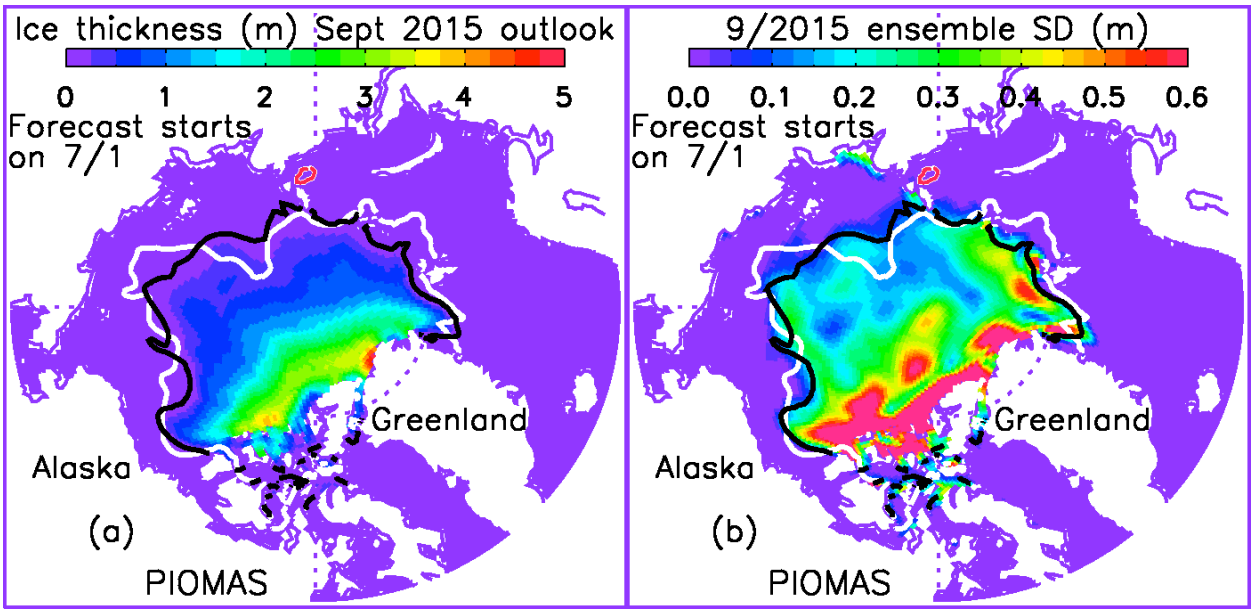

Figure 1. (a) Ensemble median prediction (outlook) of September 2015 mean sea ice thickness and edge location, and (b) ensemble standard deviation (SD) of ice thickness which shows the uncertainty of the prediction. The white line represents the satellite-observed mean September 2014 ice edge defined as the line of 0.15 ice concentration, while the black line is the model predicted September 2015 ice edge.

References:

Zhang, J., and D.A. Rothrock: Modeling global sea ice with a thickness and enthalpy distribution model in generalized curvilinear coordinates, *Mon. Wea. Rev.*, *131(5)*, 681–697, 2003.

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