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Ice Forecast for September 2008

Our forecast for the September mean ice extent is 4.5 ± 0.2 million sq km. This is just a little more than the record minimum last year, but still below the trend line. The prediction is made from an ice/ocean model estimate of the state of the system at the end of April 2008. The model field in April that is best correlated with the pan-Arctic ice extent in September over the last 20 years is the area of ice and water less than 2 m thick (what we call the G2 field). The predicted ice extent is 4.5 ± 0.3 million sq km. This field is correlated at a level of R2=0.86. The field of G2 for 2008 would predict a very low ice extent in September but the prediction is not as low as the prediction for 2007 and is much above the observed extent for 2007. The simulated G2 field shows very little ice 2 m thick in the Chukchi Sea, but near normal conditions elsewhere.

The method is based on a retrospective analysis of the state of the ice and ocean system created by a high resolution coupled ice/ocean model. The model uses the observed air temperature, wind, clouds, and precipitation to estimate maps of the ice motion, ice thickness distribution, and ocean temperatures and currents for past years, up to and including the most recent month. Statistical relationships between the model parameters in March (or any other month) and the ice extent in September are found from past years using a method developed by Dr. Drobot. This relationship is then used with the current March model output to predict the September ice extent. The method may be used to predict either the pan-Arctic ice extent or the ice extent in particular regions. It depends fundamentally on a stable relationship between the various components of the system, such as ice thickness in April compared to the ice extent in September.

Reference:
Lindsay, R. W., J. Zhang, A. J. Schweiger, and M. A. Steele, 2008: Seasonal predictions of ice extent in the Arctic Ocean, J. Geophys. Res., 113, C02023, doi:10.1029/2007JC004259.

Link:
http://psc.apl.washington.edu/lindsay/pdf_files/Lindsay_etal_JGR2008_seasonal_predictions.pdf

Also, see the web page at
http://psc.apl.washington.edu/lindsay/Prediction/seasonal%20ice%20prediction.html

The method seemed to work fairly well using historical data. However the summer of 2007 showed a tremendous loss of sea ice and the predictions were way too conservative. This has led me to think that the statistical relationships between the ice extent and the state of the ice and ocean are changing rapidly and the past relationships cannot be a reliable guide to the future.

Concerns about publicizing forecasts of ice conditions

Can we make accurate forecasts of the ice conditions months in advance? This is a challenging and interesting scientific problem, and I, among others, have certainly had a go at it.

But if we as a community want to publicize predictions it is perhaps wise to consider if it is in either the publics or our own best interest. We could do ourselves a disservice if the basis for the forecasts and the expected errors (and how they are calculated) are not clearly stated and if it appears like we, as a community, have not understood the nature of the predictability problem as it applies to sea ice.

What is to be forecast and why? Minimum total ice extent, September total ice extent, regional ice extents? In fact regional extents are probably the only forecasts that could make a difference in somebodies plans. Basin-wide projections make little difference to anybody, so maybe they are harmless. Error estimates for the forecasts are essential. Do the error estimates for the forecast depend on an assumption of stationary statistics? Is this a valid assumption? Is the error bar a 1-sigma (one standard deviation) of the expected error or something else? What constitutes a skillful forecast? Is it compared to persistence (the previous year) or to the trend? Or maybe a blend? A good or bad forecast for this particular year may not indicate that a method is good or bad…it takes a number of years of making forecasts (not withheld-data validations) with the same method to properly validate or invalidate a method.

A better service to the public, and probably for the science, may be to clearly outline the issues of predictability in the Arctic: initial conditions vs memory vs weather. How far in advance can skillful forecasts be made? How are the skills seasonally dependent?