Recap of Predictions of September 2010 Arctic Sea Ice Extent

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Our method uses estimates of ice thickness from the PIOMAS coupled ice-ocean model as predictors for a statistical forecast of the Sea Ice Index mean ice extent in September. Fields of ice thickness (H), ice concentration (IC), area with less than 0.40 m thick ice (G0.4m), and area with less than 1.00 m thick ice (G1.0m) are the predictors considered in this forecast. The method is described in Lindsay et al (2008a). The model fields are collapsed to scalar time series by weighting each field with its correlation to the September ice extent (Drobot, 2006). A statistical model is then fit for the years 1988–2009. The performance of each predictor at each lead time from February through August is shown in Figure 1.

In retrospect the mean thickness H was the best predictor from almost all months, particularly early in the season, but the error standard deviation of the prediction equation using H in past years was larger than that for the G1.0m predictor. The G1.0m predictor was the best in terms of the minimum prediction error in the months of February through May and G0.4 was best in June, July, and August. This makes sense, since simplistically one might expect all the ice less than 1 m thick at the beginning of the season to melt out and only ice less than 0.4 m to melt out late in the season. The region with the greatest influence in determining the value of these two variables, that is where the correlation with the September ice extent is high and where there was a significant anomaly in the G1.0m or G0.4m parameter is in the Beaufort Sea. This region had both high values of the parameter and high correlations for it with the September ice extent. As shown in Figure 1, the observed September mean ice extent, 4.90 million sq km, was within the error bars of the predictions only for February, March, and April. The method worked poorly this year. One reason may be that the ice was very loose at the end of September. Figure 2 shows the compactness of the ice, which is the ratio area / extent, for the last 30 years. This September was a record low compactness in the modern era of very low ice extents. In the early 1980s the September compactness was also low, but the extent was high. When the pack is loose, the total extent is very dependent on the prevailing winds, which this year did not herd the ice to one side of the basin.

REFERENCES

Drobot, S. D., J. A. Maslanik, and C. F. Fowler (2006), A long-range forecast of Arctic summer sea-ice minimum extent, *Geophys. Res. Lett*., 33, L10501, doi:10.1029/2006GL026216

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

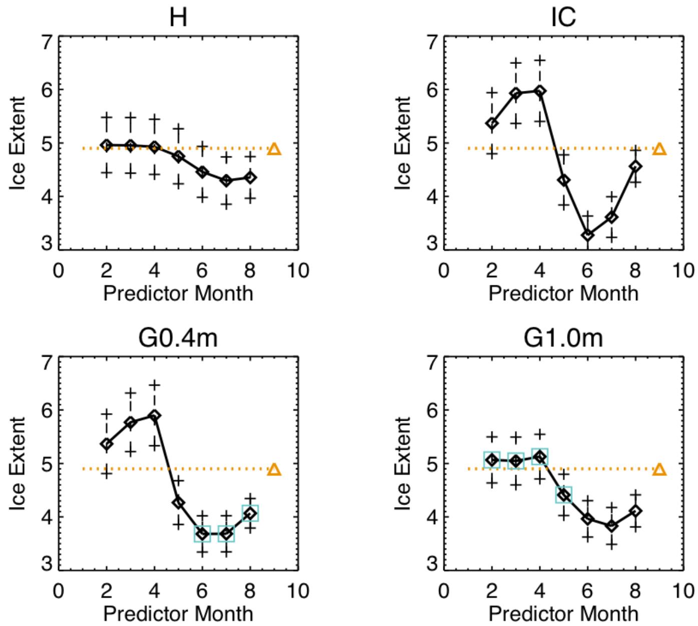

Figure 1. The performance of each predictor in 2010 in predicting the September minimum ice extent (in million sq km) using data through the end of each predictor month. The orange triangle and dotted line is the observed mean September ice extent (4.90 million sq km) from the NSIDC Sea Ice Index web site. The black lines show the prediction based on each of the four variables for each predictor month back to February. The dashed lines are the prediction uncertainties…the error standard deviations of the linear regression fit. The blue squares in the G1.0m and G0.4m plots show which variable of the four had the minimum prediction uncertainty in each month and hence was the basis of the value chosen for the prediction at the end of each month.

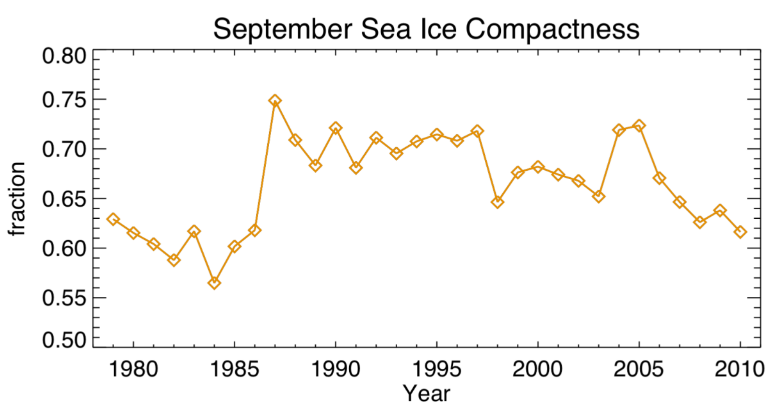

Figure 2. The ice compactness in September. The compactness is the ratio of the m,ean ice area to the mean ice extent.