Canadian Ice Service Contribution

to the

## September 2012 Sea Ice Outlook: <u>August Update</u>

No Change from the CIS forecast issued in June.

Environment Canada's Canadian Ice Service (CIS) is predicting the minimum Arctic sea ice extent to again be less than 5 million square kilometres in September, 2012. A value similar to or slightly less than the average extents observed in September 2008, 2010 and 2011 is expected. This value (~**4.7 million square kilometres**) will make the Arctic sea ice extent in September, 2012, either the second or third lowest in the 1979-2012 record. This value still lies well below the average September extent for 1979-2011 of 6.5 million square kilometres based on the NSIDC sea ice index.

As with CIS contributions in June 2009, 2010 and 2011, the 2012 forecast was derived using a combination of three methods: 1) a qualitative heuristic method based on observed end-of-winter Arctic ice thicknesses and extents, as well as an examination of Surface Air Temperature (SAT), Sea Level Pressure (SLP) and vector wind anomaly patterns and trends; 2) an experimental Optimal Filtering Based (OFB) Model which uses an optimal linear data filter to extrapolate NSIDC's September Arctic Ice Extent time series into the future; and 3) an experimental Multiple Linear Regression (MLR) prediction system that tests ocean, atmosphere and sea ice predictors.

Based on winter sea ice extents and thicknesses, a September 2012 minimum ice extent value of **4.6 ≤ x ≤ 4.9 million square kilometres** is heuristically predicted. The CIS experimental OFB model predicts a September 2012 average ice extent of **4.3 million square kilometres**. The CIS experimental MLR forecast system predicts a September 2012 minimum sea ice extent of **5.2** (4 model runs with a range of 4.7 to 5.7) **million square kilometres**. The average forecast value of the two model predictions is **4.7 million square kilometres**, which is consistent with the heuristic forecast for the September 2012 pan-Arctic minimum sea ice extent. The average forecast value of the three methods combined is **<u>4.7 million square kilometres</u>**.

Statistical Method #2: MLR Prediction System Forecast:
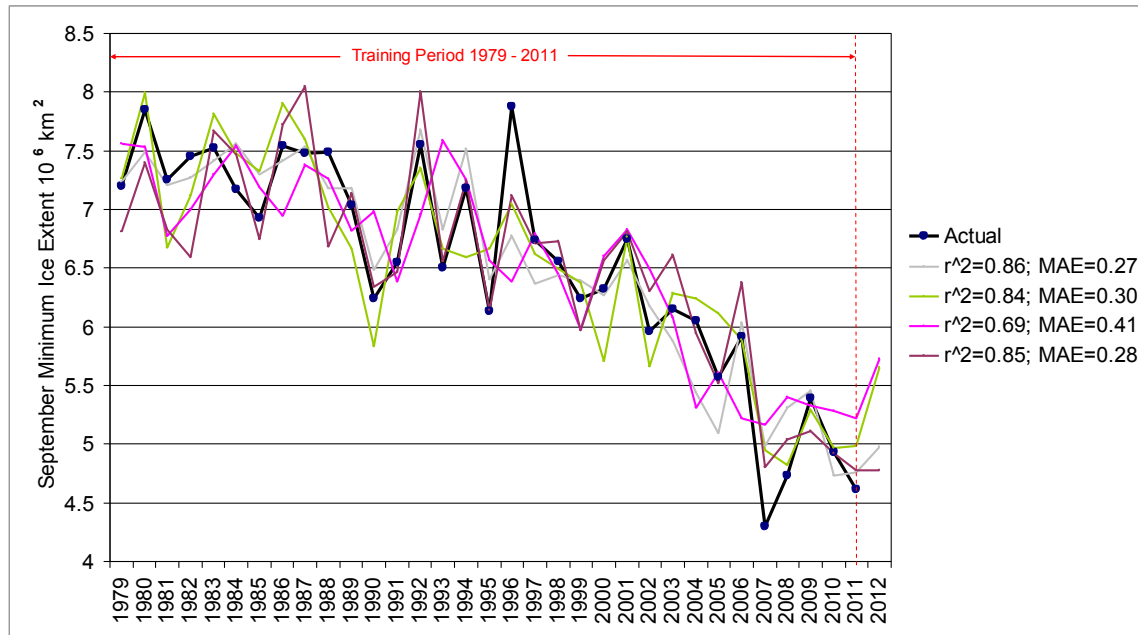
Figure 1. Regression based forecast for the 2012 September Ice Extent. The model is trained on the 33-year period from 1979-2011. The **2012 forecasts** from the 4 model runs range from 4.7 to 5.7 and average **5.2 *10^6 km^2**.

Model Details

The regression models are generated using an automated selection scheme (Tivy et al., 2007) based in part on step-wise regression and where the maximum number of predictors is restricted to two. Predictors in the original predictor pool included: pan-Arctic sea ice concentration, SLP and z500, near-global SST, and indices for ENSO, the PDO, the AO, NAO and other atmospheric teleconnections. Each predictor was tested at lags ranging from 5 to 18 months. After each model run the first predictor was removed from the predictor pool, this process was repeated until no models were generated. Four regression equations were generated for the September minimum, it is important to note that they are not necessarily independent. The pairs of predictors for the 4 models are: MJJ SST & AMJ z500, JJA SLP & F WP, MJJ MAT only, AMJ z500 & MAM PDO.

Reference:

Tivy, A., B. Alt, S.E.L. Howell, K. Wilson, and J.J Yackel. (2007). Long-range prediction of the shipping season in Hudson Bay: A statistical approach. Weather and Forecasting, 22, 1063–1075, doi:10.1175/WAF1038. WAF10