Pan-Arctic Outlook: Liljegren, The Blackboard

1. Extent Projection: 4.47 million square kilometers September NH sea ice extent minimum.

2. Method Technique: Statistical. Projection is based on a weighted set of selected regressions based on the most recent 7-day average JAXA and NASA-GSFC daily extent values , Cryosphere Today area, the difference in smothed extent and area values, the most recent PIOMAS volume report (July 31), the year and the recent rate of change in the 7-day average JAXA extent. Statistical fits were created using data from 1979 through 2010.

   Candidate regressions are created by fitting either the September Extent itself or the difference between September Extent and current JAXA 7 day average extent to a selected set of regressors. Each regression is assigned a probability based on its corrected Akaike criterion and fit coefficients are tested for statistical significance.   Regressions with fit coefficients that are not statistically significant to 95% and those with probabilities assessed as $1/20^{th}$ that of the most likely regression are excluded. The best estimate for the September ice extent is obtained from the weighted sum of the best estimates of the individual candidates. The standard error in the best estimate is computed from the square root of the sum of the weighted sum squares of the prediction intervals and the weighted variance of the best estimate from qualifying models. Uncertainties are reported based on an assumption the resulting probability distribution may be estimated as Gaussian.

   Using data available through August 30, the candidate regression selected and their weights were
   - NSDIC September Extent v. JAXA extent and area (58.4%).
   - Difference between NSDIC September Extent and current JAXA extent v. July 31 PIOMAS volume (6.4%).
   - Difference between NSDIC September Extent and most recent 7-day average JAXA extent v. most recent 7-day-average Cryosphere Today area. (35.2%)

3. Rational: Each regressor considered in the fit numbers among those with some possibly tenuous physical connection to the rate of decrease in ice extent of the ultimate minimum for the year. For example:
   - Current extent gives the initial point from which extent declines.
   - Area and volume provide measures of the total amount of ice available to melt, spread out, or compact.
   - The difference in extent and area provides a measure of dispersed ice especially vulnerable to compaction of rapid melting.

- The recent rate of change in extent provides a measure of current conditions as they impact change in extent.
- Time serves as a proxy for the effects of on going warming.

Each of these predictive variables is anticipated to correlate well to some physical phenomena with different ones providing a greater or lesser degree of predictive value at different times of the year. The current methodology is based on the possibility that some predictive ability can be obtained by using the Akaike criterion as a sieve to select which element provides the most predictive value at a particular time of the year.

4. Based on the notion that the selected regressors provide some predictive value, particularly in the late melt season, I computed the best linear fit between the regressand and single regressors, evaluated the corrected Akaike criteria (AICc) for each and followed this by computing the best linear fit to pairs of regressors and computed those AICc criterion. Models that failed the criteria were culled and weights computed. The weighted prediction is based on the remaining models.

5. Executive Summary: This projection is based on the observed correlation between JAXA extent on July 28, 2011 and September NH ice extent values since 2002.

6. Forecast Skill: ±95% uncertainty range 4.10 to 4.83 million square kilometers.

Outlook submission deadline: 30 August 2011. All Outlooks should be sent to: Helen Wiggins, ARCUS Email: helen@arcus.org.

Submitted by Lucia Liljegren

NSDIC Sept. Average Exent vs. Extent

y-axis: ice extent km^2 * 10^6

x-axis: Recent Extent 10^6
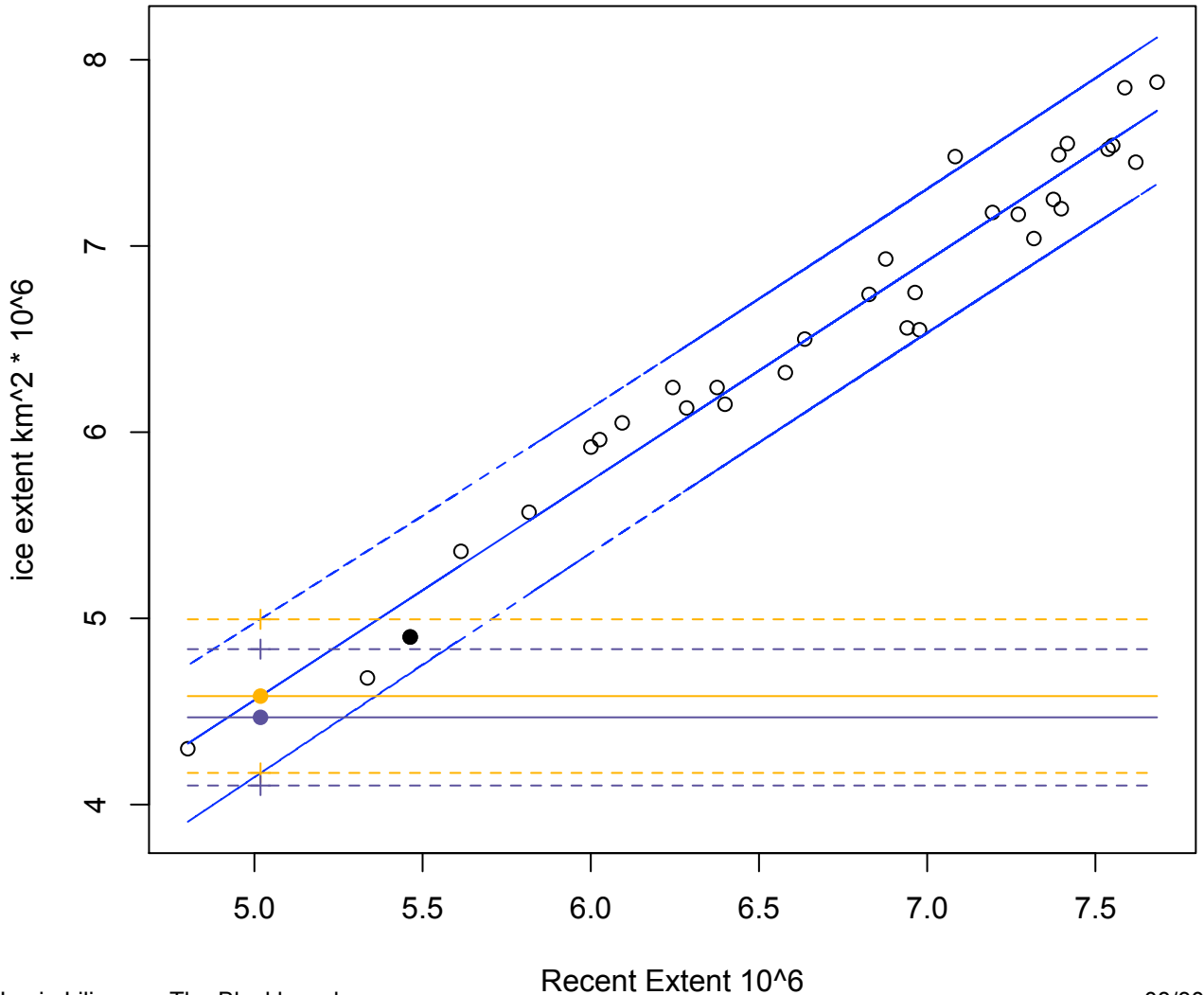
Lucia Liljegren: The Blackboard   08/30/ 2011
Extent:4.58km^2x10^6; range=[4.17,4.99] km^2x10^6   below min p=8.1%; above last year p=5.8%
Weighted:4.47km^2x10^6; range=[4.1,4.83] km^2x10^6   below min p=17.9%; above last year p=0.9%