

PAN-ARCTIC OUTLOOK

June 2015

1. James Morison

2. Summary

My estimate of 4.8 million square km is based on prior year's ice and Arctic Oscillation index plus in situ observations of ice in April and June.

3. Methods/Techniques

Heuristic

4. Extent Projection

4.8 million km²

5. Method

Short explanation: Estimate is based on prior year's ice and AO index plus observations of ice in April and June.

Detailed Outlook

My June projection of average September, 2015 Arctic sea ice extent is 4.8 million square kilometers. My estimate this year, as in past years working with Norbert Untersteiner, is an impression based on comparison of a few variables over the last few years.

A) Our observations during the 2015 North Pole Environmental Observatory (NPEO) deployment were suggest that the snow cover is a little thicker in the central Arctic Ocean. This is a factor that tends to decrease September ice extent by inhibiting sea ice growth in winter and reducing melt pond formation and associated melt in summer. The NPEO web cameras suggest that as of early June there was no early formation of melt ponds and much of the snow remains. In act it has gotten a little thicker in the last couple of weeks. This is suggests we may have extensive melt ponding and associated ice melt later in the summer, a negative factor.

B) A new wrinkle is the accumulation of ice off the Canadian Archipelago and associate average thickening of the ice cover (Kwok, personal communication). This was associated with a clockwise shift in the axis of the Transpolar Drift measured in Spring 2013, probably related to a strongly negative AO, reducing ice export. The ice drift in the winter-spring 2014-2015 showed drift orientation in spite of a positive AO the previous winter. The number of observations is limited, but ice in the North Pole region in April 2015 was slightly thicker than seen in the previous few springs. These are positive factors.

C) The high AO last winter (NDJFMA) was virtually the same as for 2013-2014, about one standard deviation above the 1950-1989 average. High winter AO should negatively correlate with AO [Rigor et al., 2002]. I notice that for recent peak AO winters, the ice extent the following September is between 0.8 and 1.7 million square km less that the

previous winter, making me think the atmospheric forcing associated with a peak AO will knock on the order of one million square kilometers off the previous years accumulation. In 2014, the Sept average was 5.28 million. One million off of that is 4.28 million.

A) and B) suggest positive and negative factors should average out and produce a September similar to last year 5.28 million. Splitting the difference between 4.28 and 5.28 yields 4.78 million. Supporting this, so far the extent seems to be tracking the 2 Sigma extent and looks similar to 2006 in other ways, suggesting and Sept average of 4.6 million. I like the feel of the increasing ice thickness and think that will retard really big losses in the late summer. I estimate the Sept 2015 average ice extent at 4.8 million square kilometers.

6) Uncertainty

1 million square kilometers

7) Uncertainty Method

Experience

Reference

Rigor, I. G., J. M. Wallace, and R. L. Colony (2002), Response of sea ice to the Arctic oscillation, *Journal of Climate*, 15(18), 2648-2663.