

Pan-Arctic Outlook for September 2012, Summary

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Todd E Arbetter

US Army Cold Regions Research & Engineering Laboratory, Hanover, NH

Executive Summary: The Arctic reached a record low minimum sea ice extent of 3.41 million square kilometers on September 16, 2012, as reported by NSIDC. This shattered the previous record of 4.17 million square kilometers set on September 18, 2007, and continues a downward trend in September minimums since the maximum value (of the satellite era) was recorded in 1996. Using a statistical regression model, seasonal forecasts were produced starting with May 1, June 1, July 1, and August 1 data. Corrected for model mask (e.g., Canadian Archipelago), all four forecasts overestimated the sea ice extent when compared to observations. The ice edge (defined by the 1/10 contour) was farther north than projected in all areas except the Greenland Sea, where the observed ice edge extended farther south; this is indicative of sea ice export through Fram Strait.

1) What are the reasons for the record-breaking minimum this year?

Sea ice extent in 2012 was generally similar to 2011 through June and July. In mid-August, a storm blew through the Arctic, resulting in an acceleration of ice loss; the sea ice extent fell below the 2007 minimum on August 26, 3 weeks before the 2012 minimum was reached. The summer was otherwise not remarkable in terms of surface air temperature. In previous years, such a storm would not have as much of an impact, but the physical makeup of the Arctic ice has changed. In the past, much of the ice was perennial (or multiyear), meaning it had survived one or more summers. Perennial ice is generally thicker than seasonal (or first-year) ice; it is also whiter (absorbs less heat). But changes in atmospheric circulation have resulted in perennial sea ice being exported through Fram Strait into the North Atlantic (where it quickly melts) rather than being recirculated into the Arctic via the Beaufort Gyre. The ice that forms in winter to replace it is first-year ice, which is thinner and more susceptible to melt. Not enough of this seasonal ice survives the summer to replace the perennial ice; the net effect is that the Arctic is transforming from a mainly perennial ice pack to a mainly seasonal ice pack. The storm in August broke up the existing (mostly seasonal) ice pack, leading to an acceleration of sea ice loss.

2) How would you characterize the success of Outlook predictions this year and any differences between methodologies?

In June, July, and August, the spread between predicted values was narrow; one way to think of that is all methods were in general agreement on what the minimum would be, regardless of method. But in fact, none of them were near the actual observed minimum (not taking in to account error bars, etc.) When given an opportunity to revise outlooks after the August storm, heuristic or statistic methods (other than mine) were the most successful.

3) What do you see as our main “lessons learned” form this year?

The response of the sea ice to the storm in mid-August illustrates that the sea ice is thinner and more vulnerable than previously thought, even when taking in to account the “new normal” that the ice pack is more seasonal than perennial. Physical models underestimated the melt, statistical methods could not extrapolate (at least on longer time scales) down to such a low ice extent, and other methods did not fare any better. Even those who predicted a record or near-record low were surprised by how early the previous record was broken and how low the minimum extent reached. The Arctic is changing at an alarming rate.

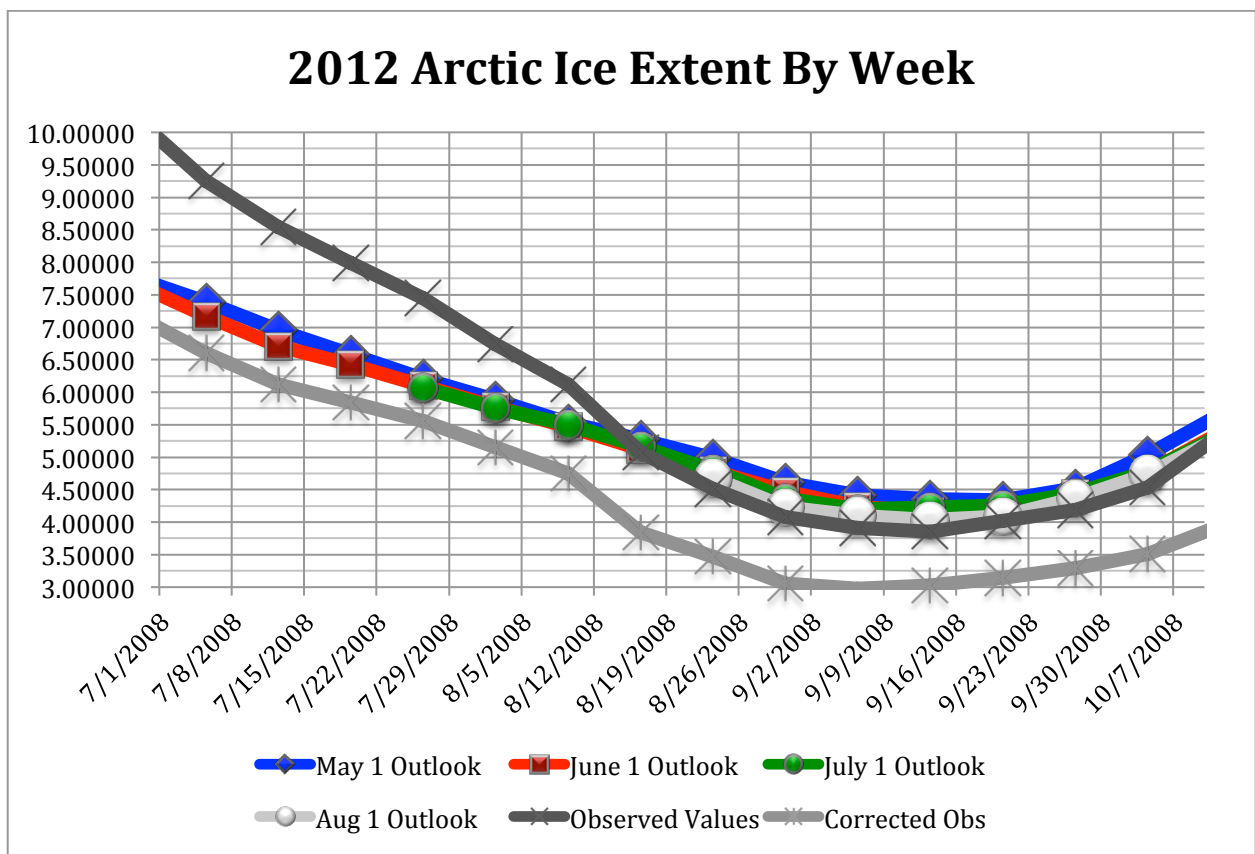


Figure 1: Projected 2012 sea ice extent by week, in millions of square kilometers. The total observed ice extent (SSM/I) and a corrected value (sea ice ice outside the forecast model domain has been removed) are also indicated.

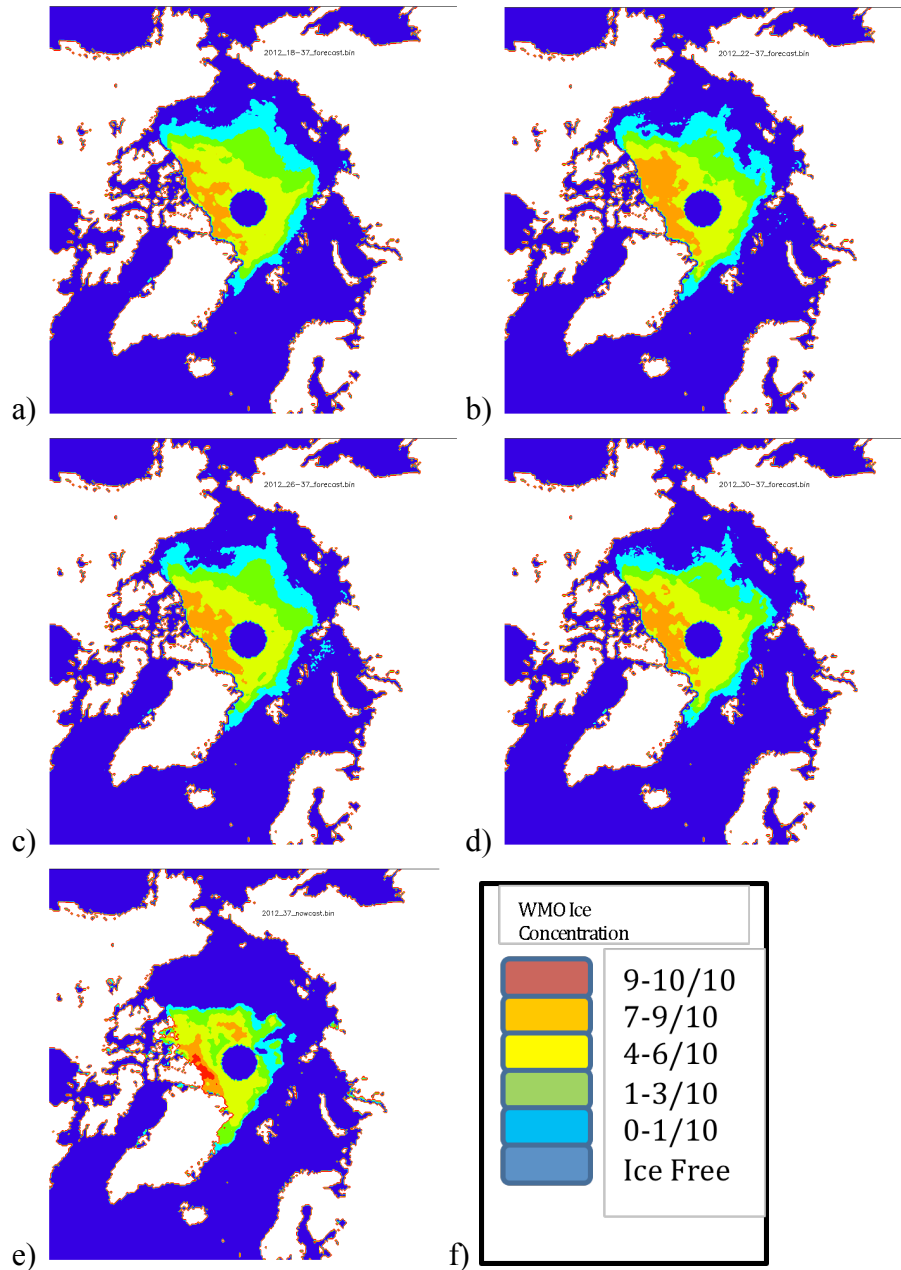


Figure 2: Seasonal outlooks for week 37 (Sep 14-21, 2012) using starting conditions from (a) May 1, (b) June 1, (c) July 1, (d) August 1, 2012. (e) Observed sea ice concentration from SSM/I for week 37. All charts use the WMO Ice Chart color code (f). The ice edge (and definition of ice extent) is the outer edge of the green-shaded area (1/10 concentration).

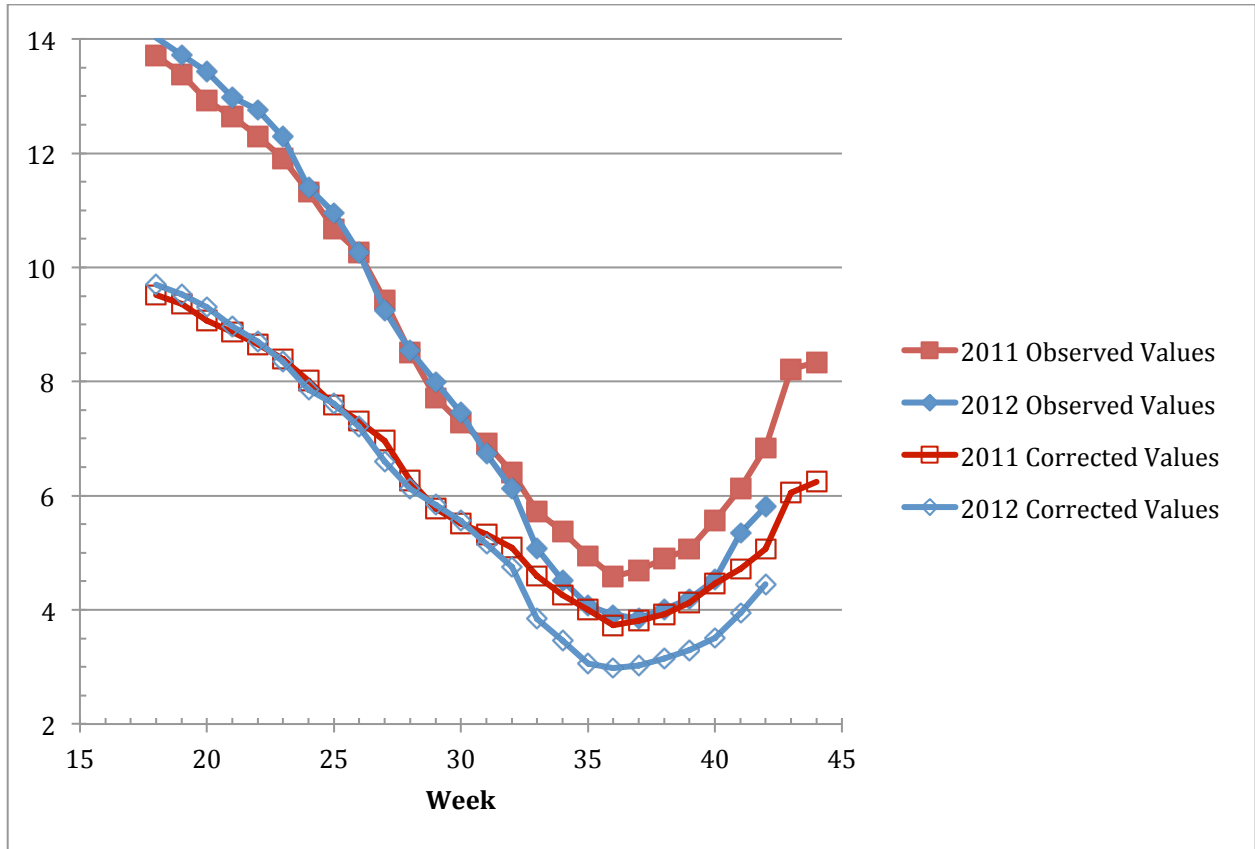


Figure 3: Observed ice extent (millions of square kilometers) as determined from SSM/I sea ice concentration for 2011 (red) and 2012 (blue). Corrected values indicated the sea ice extent within the forecast model domain.