1. Names of Scientist(s) making the Outlook.

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2. Estimate of sea ice extent for the month of September 2008 (the value for September 2007 was 4.3 million square kilometers).

3.2 million sq. km

3. Principal method (numerical model, statistical model, comparison to 2007 weather and satellite data, etc.) Keep this short as it will go into a table.

Based on a survival statistics of sea ice ages/types derived from a simple Drift Age Model, and QuikSCAT retrievals.

4. A short several sentence summary of your primary physical reasoning behind the estimate provided in #2. We are primarily interested in how you may be using data from July.

This outlook emphasizes the importance of the initial ice conditions in developing a seasonal outlook. Our initial forecast was based on the estimated fractions of first-year and multi-year sea ice in March 2008, and the expected survival of these fractions through September based on data for each year from 1956 – 2007. We now show how these areas of FY/MY ice have drifted from April through July, and discuss how this may affect our initial outlook.

5. Any expanded information with figures which backs up #4.

Preconditioning of sea ice by prior winter AO and decadal changes in the age of sea ice.

As noted by Rigor et al. 2002, high Arctic Oscillation (AO, Figure 1) conditions during winter precondition summer sea ice for extensive retreats especially on the Eurasian sector of the Arctic Ocean. High AO conditions were observed during the winter of 2006/2007 preceding the current record minimum, and again this past winter of 2007/2008. The winds associated with these *conditions pushed the remaining multi-year (MY, or perennial) sea ice against the Canadian Archipelago and out through Fram Strait (Figure 2).*

The area of MY sea ice over the Arctic Ocean has dropped another 1 million sq. km. from March 2007 to March 2008 (Nghiem et al. 2008). As argued by [Rigor & Wallace (2004),](Rigor & Wallace (2004)) the age of sea ice explains over 50% of the variance in summer sea ice extent along the Alaskan and Eurasian coasts. This leaves a vast area of first-year (FY) sea ice that simply does not have enough mass to survive even a cold summer melt season. The expected minimum of 3.1 million sq. km. also agrees with typical survival rates of FY and MY ice from 1956 – 2007.

The variability in winds during the prior winter and summer are also important (Rigor 2005). During some years, the winds may pile FY ice up against a coast increasing its areal average thickness, and thus making these areas more resistant to sea ice retreat, or it may blow the ice away as it did during the summer of 2007. From late December 2007 to early January 2008, low AO conditions prevailed favoring strong easterly winds from the Canadian Archipelago. These winds fractured and blew the remnants of MY ice in the Eastern Beaufort across the Beaufort and Chukchi seas (Figure 3, more discussion and animations of this event may be viewed at http://www.ice.ec.gc.ca/app/WsvPageDsp.cfm?id=11892&Lang=eng). The extensive areas of FY ice that grew between the areas of MY ice are likely to melt earlier, quickly decreasing the concentration of sea ice, and as noted by Perovich et al. (2008), the extra sun light absorbed by the darker ocean may favor the rapid thinning of sea ice, and enhance the retreat of sea ice in the Beaufort and Chukchi seas.

Impact of Spring and Summer winds and ice drift

From April through July 2008, the AO exhibited primarily low to moderate conditions (mean = -0.5), which tended to blow the sea ice away from the Alaskan coast, which explains the dramatic decrease in ice extent in these areas (e.g. Rigor and Wallace, 2004), however, this ice was blown towards the East Siberian and Laptev Sea where ice extents remain high.

Given the distribution of FY and MY ice in July 2008 (Figure 4), and the survival rates of these ice types from July through August, we estimate that the summer minimum may be a little higher than our original projection of 3.1 million sq. km based on March 2008 data, and update our outlook to 3.2 million sq. km.

Figures

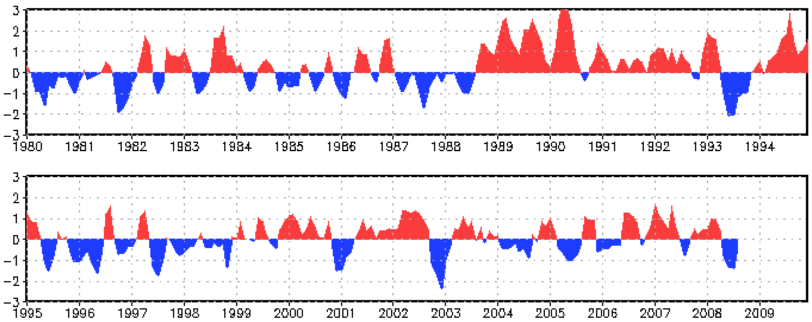

Figure 1. Standardized 3-month running mean Arctic Oscillation Index from 1980 through June 2009. Source www.cpc.ncep.noaa.gov.

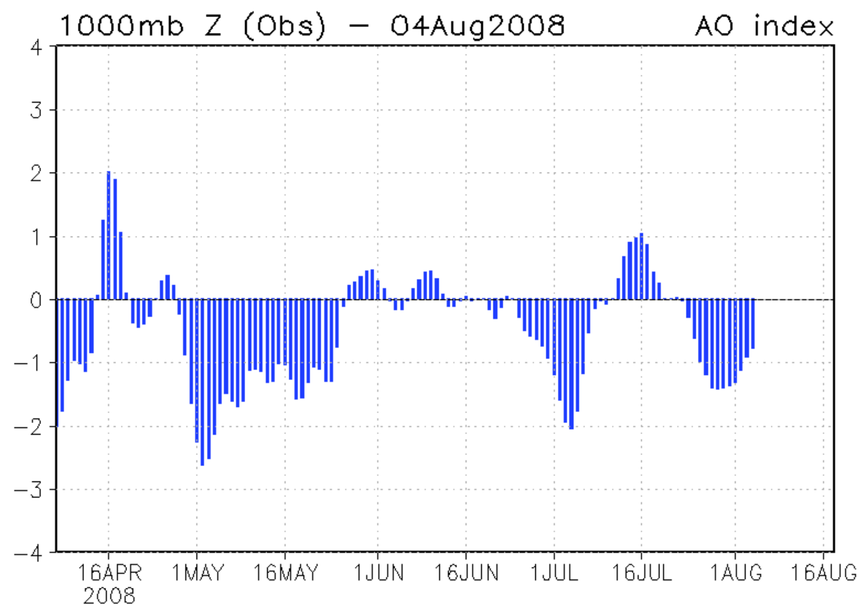

Figure 2. Standardized Daily AO index from April to August 2008. Source www.cpc.ncep.noaa.gov.

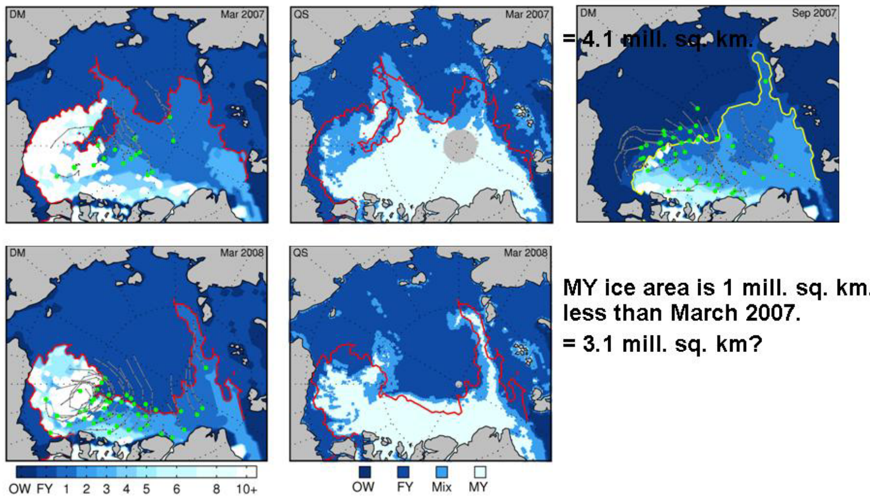

Figure 3. Age of sea ice from buoy drift model and QuikSCAT on March 2007 (top) & March 2008 (bottom), and the observed record minimum in September 2007. Adapted from Nghiem et al. 2008 and Nghiem et al. 2007. For animations of the age of sea ice visit http://seaice.apl.washington.edu/IceAge&Extent/.

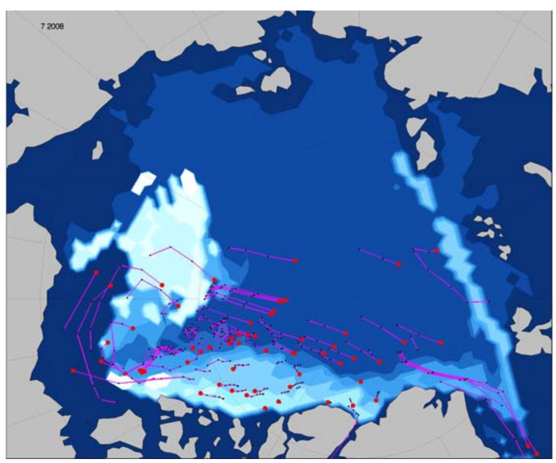

Figure 4. Age of sea ice from buoy drift model on July 2008. Same color bar as in Figure 3, right column.