Sea Ice Outlook for September 2010 (Based on May Data)

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1. Extent Projection

   5.4 million sq. km. We estimate that the September 2010 mean sea ice extent will remain below the mean September sea ice extent (1979 – 2009).

2. Methods and Techniques

   This estimate is based on the prior winter AO conditions, and the spatial distribution of the sea ice of different ages as estimated from a Drift-age Model (DM), which combines buoy drift and retrievals of sea ice drift from satellites (Rigor and Wallace, 2004, updated). The DM model has been validated using independent estimates of ice type from QuikSCAT (e.g. Fig. 1 left; and Nghiem et al. 2007), and *in situ* observations of ice thickness from submarines, electromagnetic sensors, etc. (e.g. Haas et al. 2008; Rigor, 2005). For this analysis, we used the NCEP operational SIC analysis to determine which areas of sea ice survived in Sept. 2009, but the Bootstrap SIC analysis for previous years.

3. Rationale

   Figure 1 shows the estimated age of sea ice this spring. The average age of sea ice has been increasing since the record minimum ice extent in September 2007. There is more second year ice this spring, compared to last spring. This increase in the basin wide average age of sea ice was a result of extremely low Arctic Oscillation (AO) conditions during the winter of 2009/2010 (L'Heureux et al. 2010, and www.cpc.noaa.gov), which sequestered sea ice the larger Beaufort Gyre (e.g. Fig. 2; and Rigor et al. 2002), and compacted sea ice into the East Siberian Sea. However, these conditions are still far younger and thinner than the condition of sea ice prior to the 1990's, and it would take a few years of similar conditions to allow sea ice to recover (Rigor 2005).

   Regionally, we expect alternating areas of faster and slower retreats of sea ice due to the extreme low AO conditions during the past winter. Figure 2 shows the regression map of summer sea ice concentration and winter ice motion on the winter AO index. Note that the areas where sea ice extent is currently retreating (e.g. Banks Island, west of Barrow, and east coast of the Laptev Sea), are areas of much younger, thinner first-year ice where the low

AO conditions blew sea ice away during the past winter. We realize that the current sea ice extent is 0.5 million sq. km. below the pace of 2007, but we also note that much of these decreases are primarily in the lees of the coast and fast ice, where the younger, thinner sea ice simply does not have enough mass to survive the onset of summer. In the East Siberian Sea and east of Barrow, where sea ice has been packing into the coast we expect sea ice to hold out longer and thus slow the overall retreat of Arctic sea ice extent.

Figures

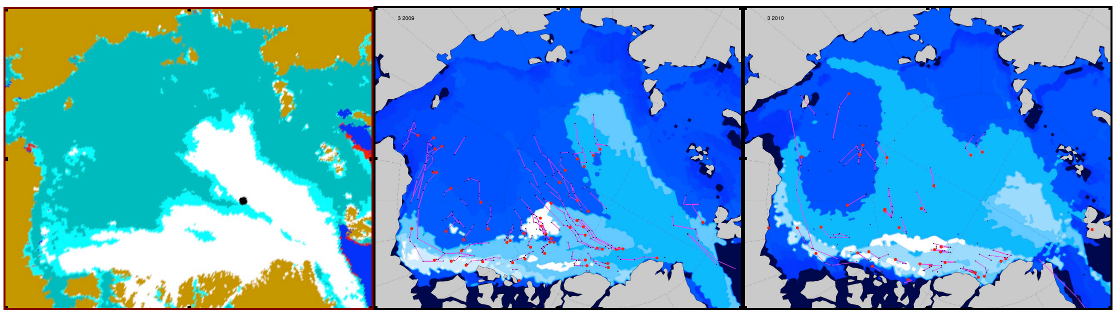

Figure 1. Maps of Arctic sea ice distribution based on QuikSCAT (QS) for March 2009 (left), and the age of sea ice based on the Drift-Age Model (DM) for each March 2009 and March 2010 (middle and right). The colors on the QS map shows perennial ice (white), mixed ice (aqua), seasonal ice (teal). The red dots on the DM maps show the current positions of buoys, while the black dots behind these show the positions of the buoys during the previous 6 months.

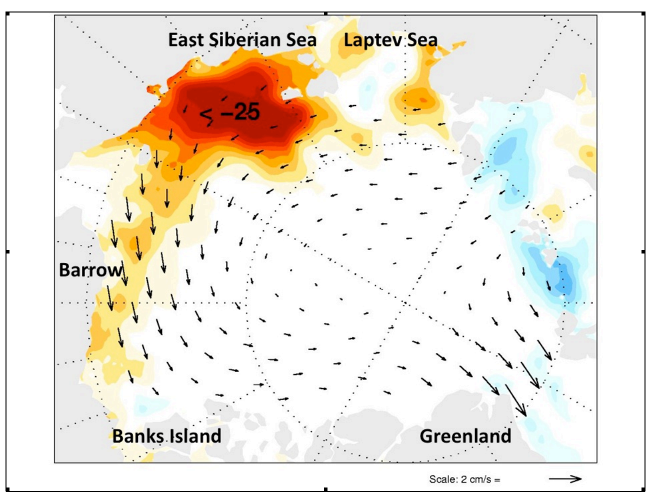

Figure 2. Regression map of summer sea ice concentration and prior winter sea ice motion on the prior winter Arctic Oscillation index. After low AO winters, the reds imply that sea ice concentrations should be higher I these areas, while blues imply lower that normal sea ice concentrations during the following summer. Based on Rigor et al. 2002.