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Arctic Report Card: *Update for 2010*

Tracking recent environmental changes

Sea Ice Cover

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***Monthly Sea Ice Outlook* from SEARCH/Arcus**

Highlights:

- September minimum sea ice extent is third lowest recorded
- Loss of thick multiyear ice in Beaufort Sea during summer

Sea ice extent

Sea ice extent is the primary parameter for summarizing the state of the Arctic sea ice cover. Microwave satellites have routinely and accurately monitored the extent since 1979. There are two periods that define the annual cycle and thus are of particular interest: March, at the end of winter when the ice is at its maximum extent, and September, when it reaches its annual minimum. Maps of ice coverage in March 2010 and September 2010 are presented in Figure I1, with the magenta line denoting the median ice extent for the period 1979–2000.

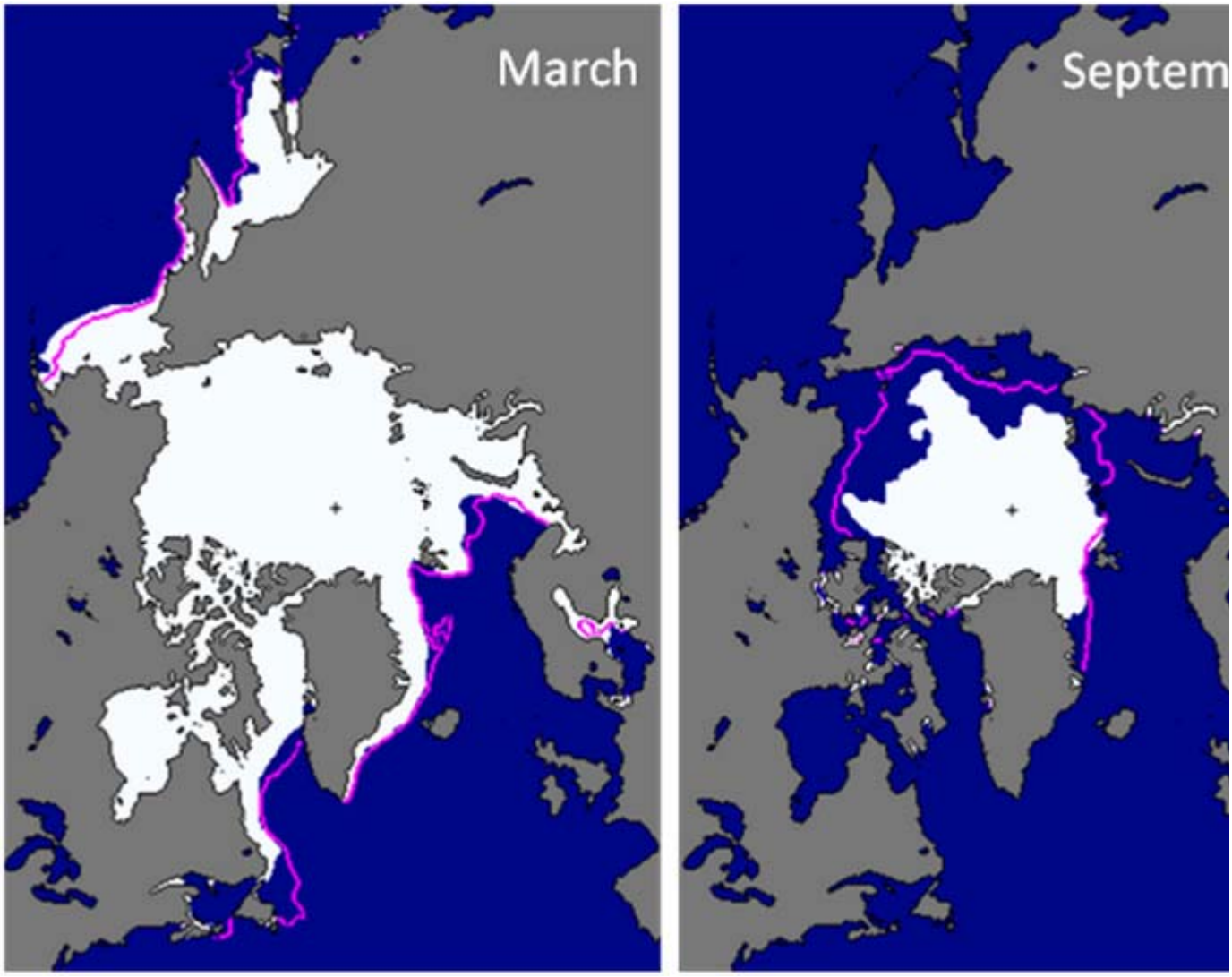

Figure I1. Sea ice extent in March 2010 (left) and September 2010 (right), illustrating the respective monthly winter maximum and summer minimum extents. The magenta line indicates the median maximum and minimum extent of the ice cover in the given month for the period 1979–2000. (Figures from the National Snow and Ice Data Center Sea Ice Index: nsidc.org/data/seaice_index.)

On September 19, 2010 sea ice extent reached a minimum for the year of 4.6 million km^2. The 2010 minimum is the third-lowest recorded since 1979, surpassed only by 2008 and the record low in 2007. Overall, the 2010 minimum was 31% (2.1 million km^2) lower than the 1979-2000 average. The last four summers have experienced the four lowest minimums in the satellite record, and eight of the ten lowest minimums have occurred during the last decade. Surface air temperatures through the 2010 summer were warmer than normal throughout the Arctic, though less extreme than in 2007. A strong atmospheric circulation pattern set up during June helped push the ice edge away from the coast. However, the pattern did not persist through the summer as it did in 2007 (see the Atmosphere Section for more details).

The March 2010 ice extent was 15.1 million km^2, about 4% less that the 1979–2000 average of 15.8 million km^2. Winter 2010 was characterized by a very strong atmospheric circulation pattern that led to warmer than normal temperatures. The yearly maximum sea ice extent occurred on March 31. This was the latest date for the maximum ice extent observed in the 30 year

satellite record and was due primarily to late ice growth in the Bering Sea, Barents Sea, and the Sea of Okhotsk.

The time series of the anomalies in sea ice extent in March and September for the period 1979–2010 are plotted in Figure I2. The anomalies are computed with respect to the average from 1979 to 2000. The large interannual variability in September ice extent is evident. Both winter and summer ice extent exhibit a negative trend, with values of -2.7 % per decade for March and -11.6% per decade for September over the period 1979-2010.

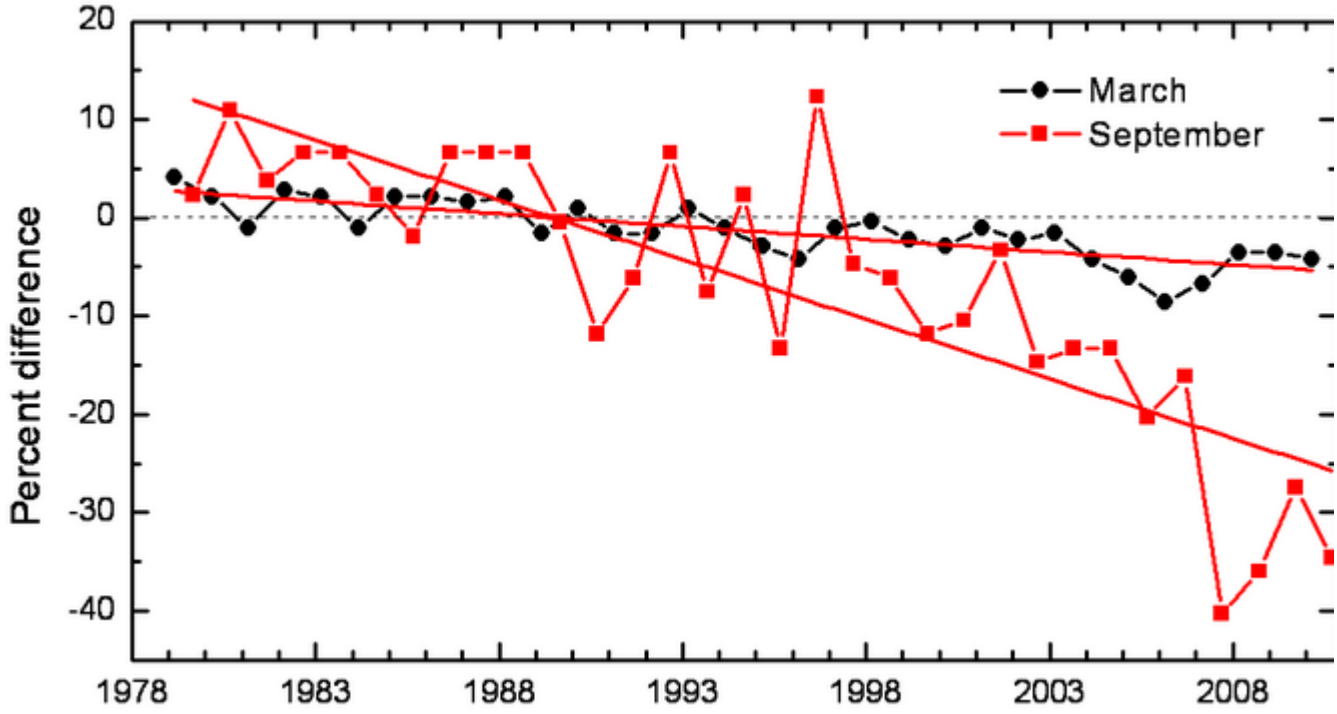

Figure I2. Time series of the percent difference in ice extent in March (the month of ice extent maximum) and September (the month of ice extent minimum) relative to the mean values for the period 1979–2000. Based on a least squares linear regression for the period 1979-2010, the rate of decrease for the March and September ice extents is –2.7% and –11.6% per decade, respectively.

Sea ice age

The age of the ice is another key descriptor of the state of the sea ice cover, since older ice tends to be thicker and more resilient than younger ice. Satellite observations can determine the age of the ice by tracking ice parcels over several years. This method has been used to provide a record of ice age since the early 1980s. Figure I3 shows sea ice age derived from tracking ice parcels for the first week of March 1988 (a), 2008 (b), 2009, (c) and 2010 (d). The panels illustrate the substantial loss in the oldest ice types within the Arctic Basin in recent years compared to the late 1980s.

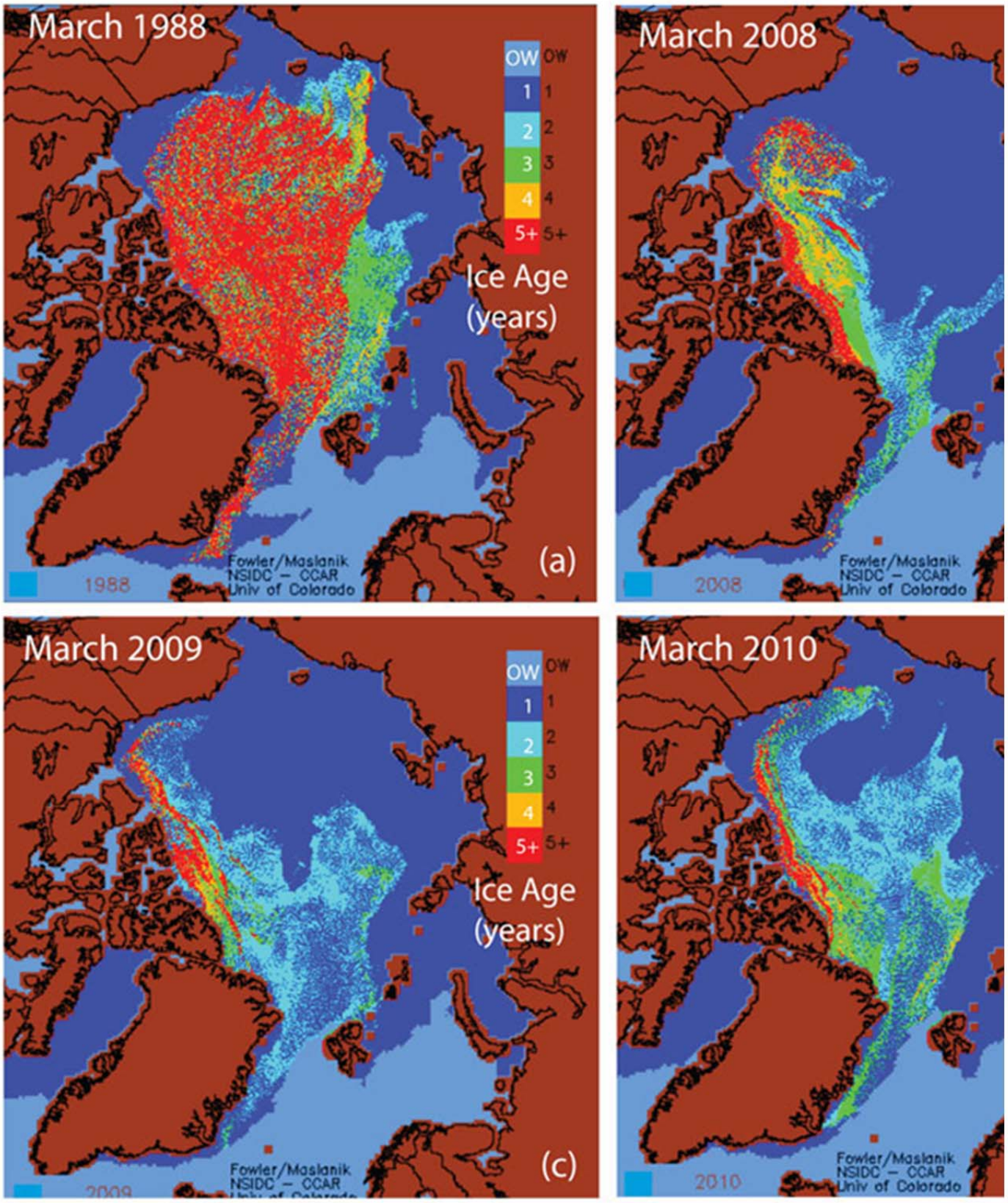

Figure I3. Sea ice age derived from drift tracking of ice floes for the first week of March in a) 1988, b) 2008, c), 2009, and d) 2010. The panels illustrate the substantial loss in the oldest ice types within the Arctic Basin in recent years compared to the late 1980s. (Figure courtesy of National Snow and Ice Data Center, J. Maslanik and C. Fowler).

Following the summer melt of 2007, there was a record low amount of multiyear ice (ice that has survived at least one summer

melt season) in March 2008. Since then there has been a modest increase in multiyear ice in 2009 and again in 2010. Even with this increase, 2010 had the third lowest March multiyear ice extent since 1980. A strong atmospheric circulation pattern during winter 2010 kept most of the 2-3 year old ice in the central Arctic. However, it also moved a lobe of older ice types from the region of old thick ice north of the Canadian Archipelago into the Beaufort Sea and the Chukchi Seas. Despite being old and presumably relatively thick, this area of ice did not survive the summer melt period (Figure I4).

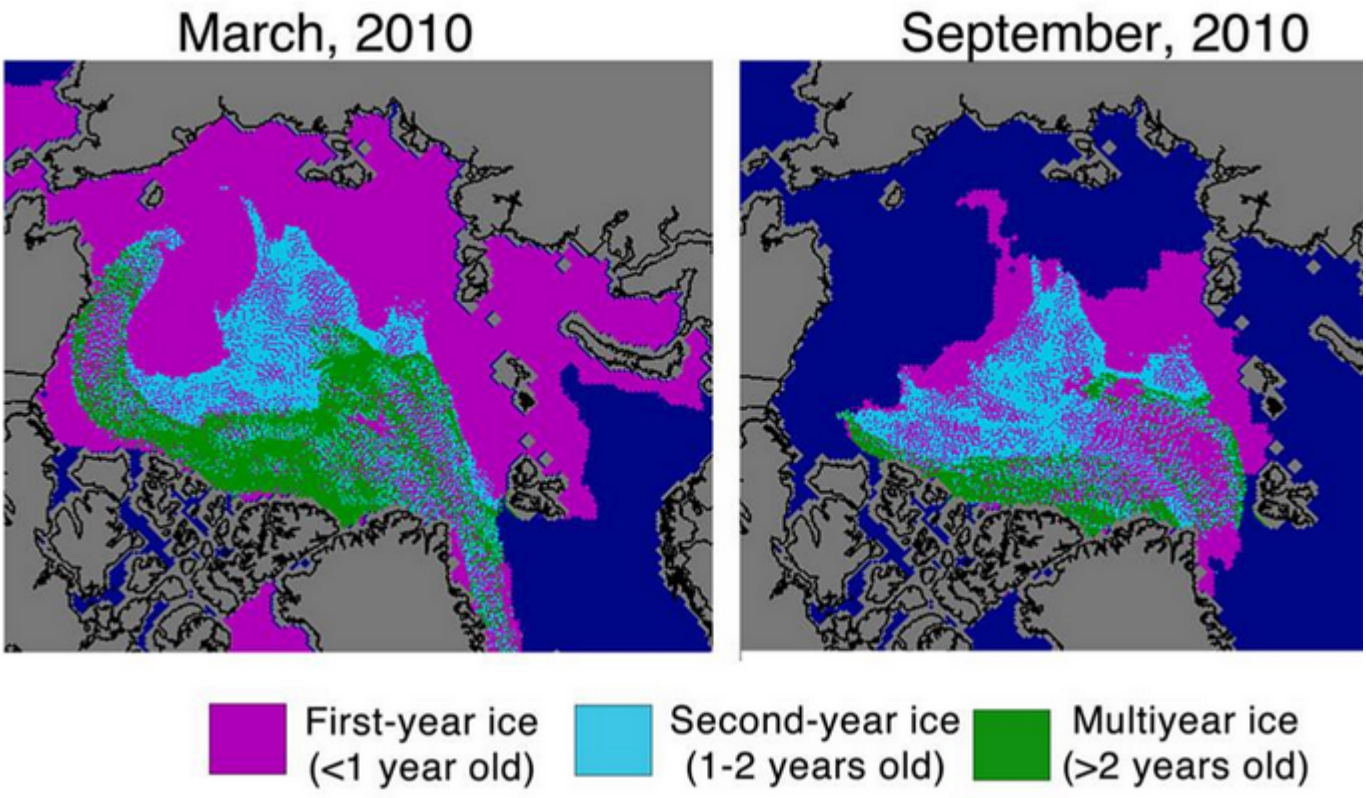

Figure I4. Map showing age of the sea ice in March and September 2010. Note the loss of multiyear ice in the Chukchi and Beaufort Seas in summer 2010. (Figure courtesy of National Snow and Ice Data Center, J. Maslanik and C. Fowler).

References

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