2008 Outlook for Arctic Sea Ice this Summer

A Collaborative Project between the Polar Science Center, National Ice Center and the NASA Jet Propulsion Lab.

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Introduction

The extent of arctic sea ice during summer has declined to record or near-record minima during the last few summers (Stroeve et al. 2008, e.g. Fig. 1). Can we predict future minima?

We have been working to improve our operational capability to predict the conditions of Arctic sea ice on weekly to seasonal time scales through a grant from the National Oceanic and Atmospheric Administration (NOAA) Transitions of Research Applications to Climate Services (TRACS). The forecasts provided by the National/Naval Ice Center help resources managers, navigators and hunters make better decisions regarding Arctic sea ice. Accurate sea ice information is important to naval operations, and increasing safety of life at sea.

Outlook

We expect that the minimum in summer sea ice extent in 2008 will break the record set during the summer of 2007 by about 1 million sq. km, and decrease from 4.1 million sq. km in September 2007 to 3.1 million sq. km in September 2008 (Fig. 1).

Rationale

As noted by Rigor et al. 2002, high Arctic Oscillation (AO) 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 (Fig. 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), 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 (Fig. 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.

Caveats and other Outlooks

Outlooks for summer sea ice are being produced by many researchers, and depending on methods, the outlooks range from a return to the trend line of 6 million sq. km, to as low as 2 million sq. km. (Fig. 1). This range of outlooks highlights the uncertainty in our ability to predict summer sea ice conditions this far in advance. Although we expect to break the record by 1 million sq. km., it may be worth noting that we have never broken the record 2 years in a row. And the effect of the summer winds is difficult to predict. If conditions similar to the summer of 2007 occur, then our outlook of 3.1 million sq. km. may be high.

Other outlooks for summer sea ice may be found at these links:

- Sheldon Drobot et al., http://ccar.colorado.edu/arifs/
- Ron Lindsay et al., http://psc.apl.washington.edu/lindsay/Prediction/seasonal%20ice%20prediction.html
- Jinlun Zhang et al., http://psc.apl.washington.edu/zhang/IDAO/seasonal_outlook.html

And more information on the latest condition of Arctic sea ice may be found at these links:

- National Snow and Ice Data Center (NSIDC), http://nsidc.org
- Cryosphere Today, http://arctic.atmos.uiuc.edu/cryosphere/

Figures

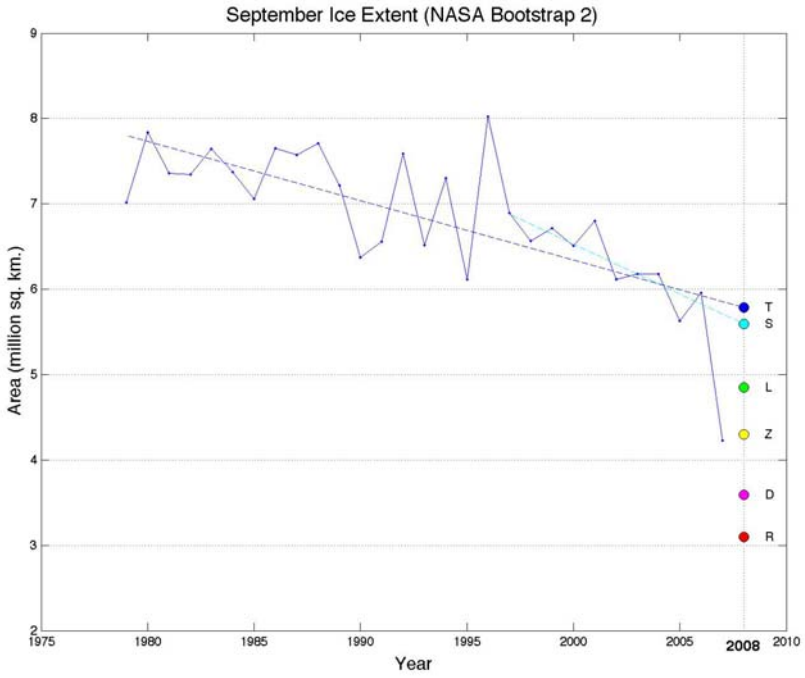

Figure 1. September average sea ice extent from 1979 – 2007 estimated from Bootstrap 2 (courtesy of Joey Comiso, NASA). We also show the expected minimum from various outlooks for this summer: T = 1979 – 2007 Trend Line; S = Stern et al., 1997 – 2006 Trend Line; L= Lindsay et al; Z = Zhang et al.; D = Drobot et al.; & R = Rigor et al.

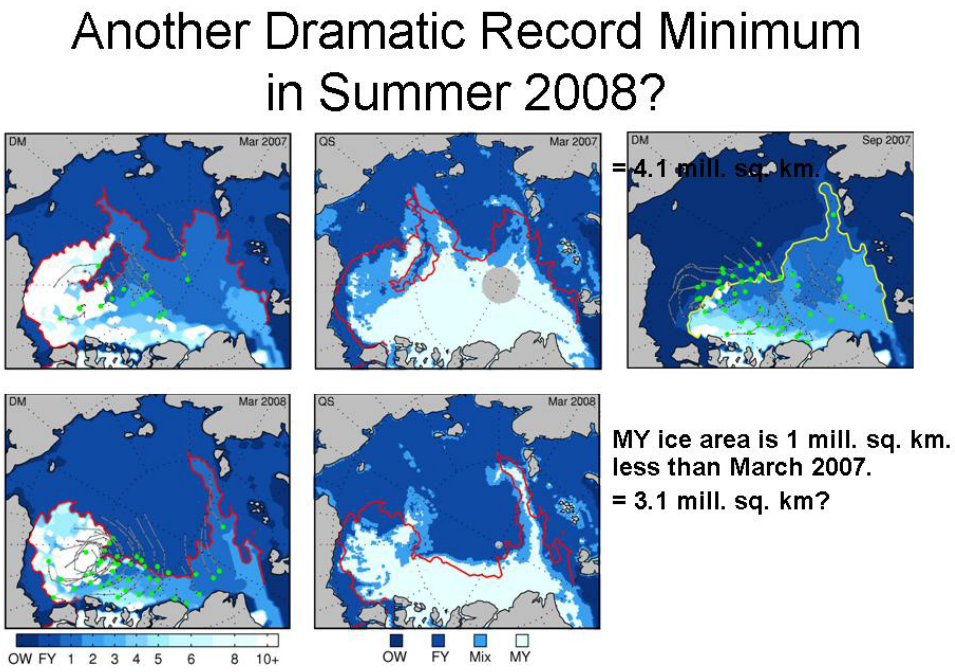

Figure 2. Age of sea ice from buoy drift model and QuikSCAT on March 2007 (top) & March 2008 (bottom), and the observed record minimum in September 2007. Adapted from Nghiem et al. 2008 and Nghiem et al. 2007. Animations of the age of sea ice may be obtained from http://seaice.apl.washington.edu/IceAge&Extent/.

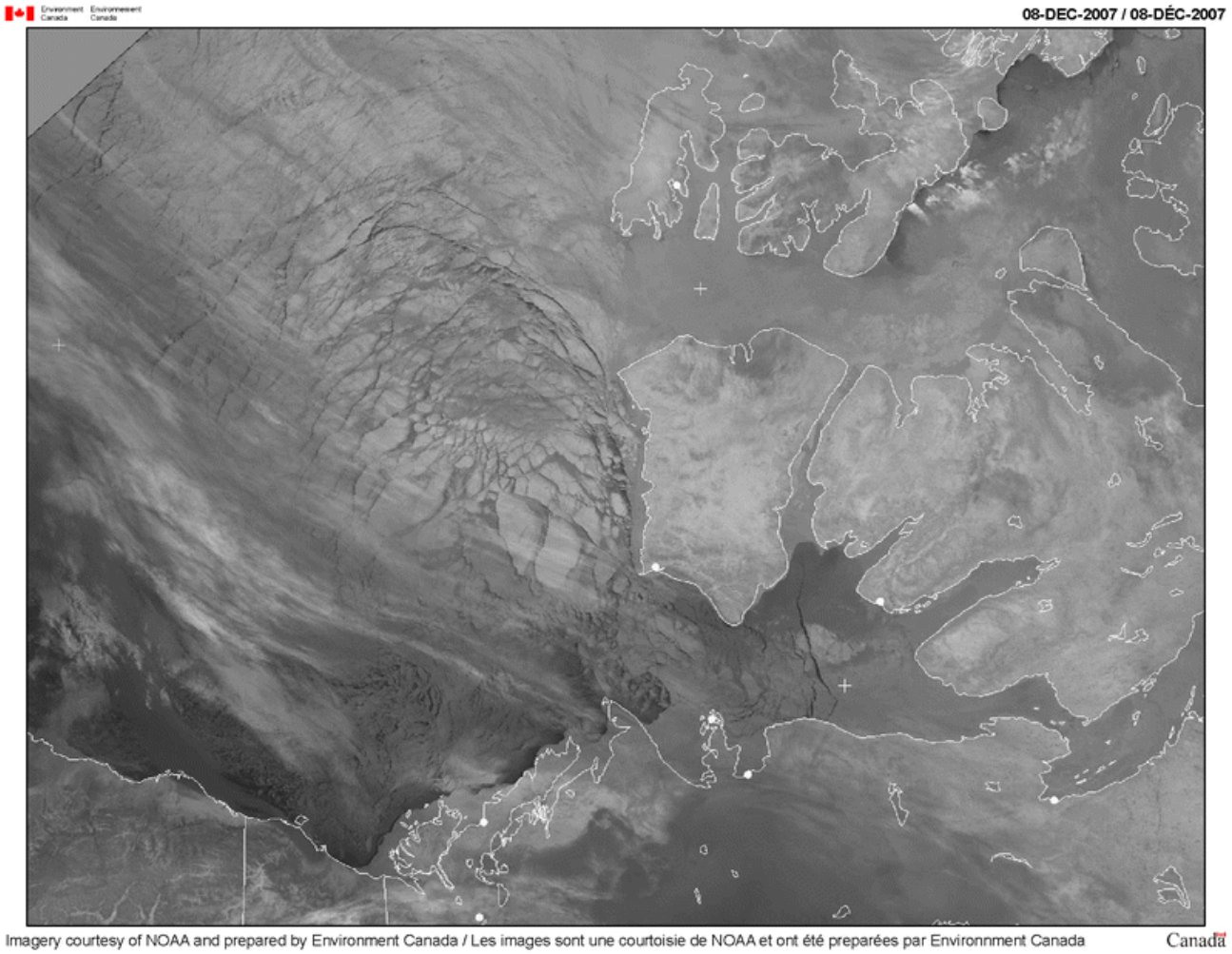

Figure 3. Fractured MY sea ice in the Beaufort and Chukchi seas. Animation was obtained from Environment Canada (http://www.ice.ec.gc.ca/app/WsvPageDsp.cfm?id=11892&Lang=eng), and uses imagery from NOAA.

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