NSIDC Sea Ice Outlook, August Update

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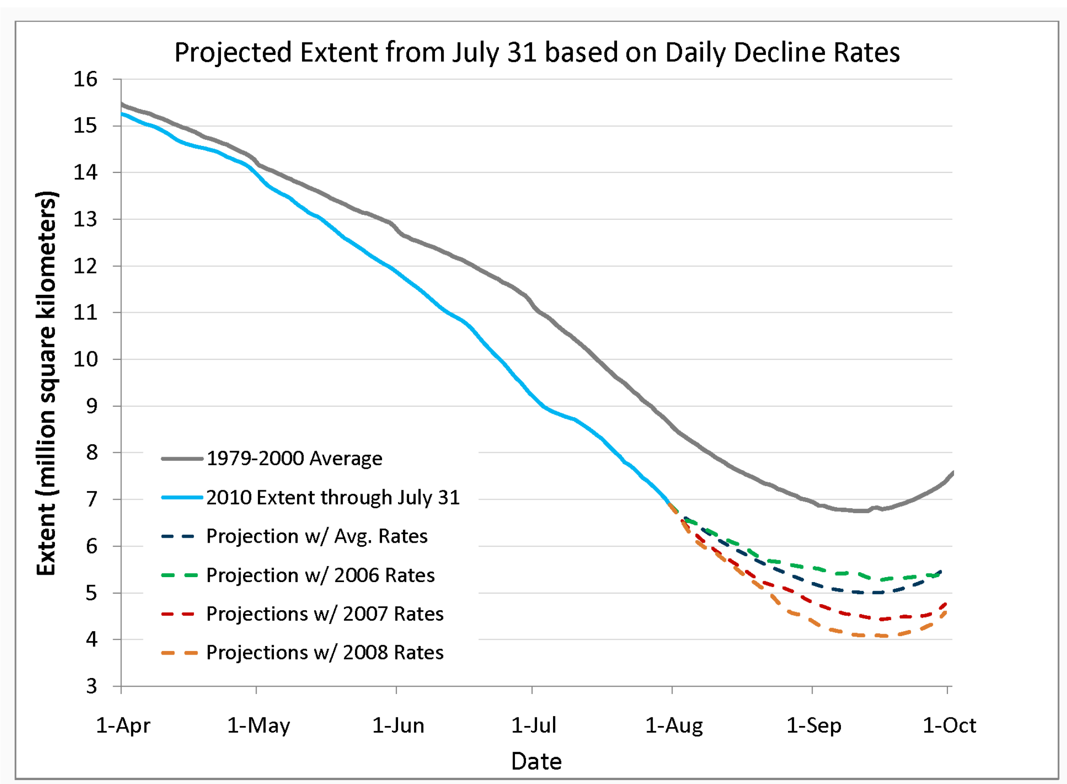
__*Projection:*__ 5.00 million square kilometers (range: 4.08 – 5.27 million square kilometers)

__*Summary*__

NSIDC's first outlook for May based on survival rates of different ice age classes from the end of March, designated as Stroeve et al. This yielded a range between 5.21 and 5.76 million square kilometers based on average survival rates for 2005-2009 and 2000-2009 respectively, with an average estimate of 5.5 million square kilometers. This estimate is unchanged. See the previous report for details of this method.

Here we update our alternative NSIDC method, by Meier, Stroeve, Serreze, and Scambos, used for the June Report. This is based on daily decline rates from August 1 until the minimum extent is reached. Using average daily decline rates from 1979-2000, the minimum extent is estimated to be 5.00 million square kilometers. To provide a range, we estimate the minimum based on decline rates for two recent years. Using 2006 rates, when the decline through August and September was slower than normal, yields a minimum estimate of 5.27 million square kilometers. Using 2008 rates, when the late summer decline was rapid, yields a minimum estimate of 4.09 million square kilometers.



Projected timeseries of extent starting July 1, 2010 through October 1, 2010 using decline rates from: (dark blue) 1979-2000 average, (green) 2006 rates, and (red) 2007 rates. The light blue line is the observed data through June 30. The gray line is the 1979-2000 average extent.

Methods/Techniques/Rationale

After the solstice, the melt rate and hence rate of extent loss starts to become more and more constrained as the incoming solar energy decreases. The extent loss rates from different years essentially represent the effect of weather variations during the remainder of the summer with the observations representing initial conditions. Our method projects a minimum daily extent by simply stepping forward day-by-day using a rate from a given year or average of years for each day. As we are now well past the solstice, the amount of available energy is rapidly decreasing. Surface melt basically ends during early to mid-August and the remaining ice loss is due to bottom and lateral melt or compaction of the pack through ice motion. Thus the window for extent loss is beginning to close and envelope of potential extent loss is narrowing. Here we use climatological rates for an "expected" minimum, bracketed by the extremes from recent years – a very slow August decline during 2006 and a rapid August decline during 2008.

Simply using **climatological daily rates** from 1979-2000, we obtain an estimate of **5.00 millions square kilometers**. Rates from different individual years can provide a range. Here we selected two recent years, 2006 and 2008, to provide a range around the climatological average. Both 2006 and 2008 both have relatively less multiyear ice than during the earlier part of the record and thus are more consistent with the initial thickness character of the ice in 2010. However, the evolution of the extent loss differed greatly between the two years due to different weather conditions. In 2006, the late summer loss was quite slow, while 2008 experienced the most rapid August decline in the satellite record. In 2006, extent declined by an average of 47,000 square kilometers per day (about 8000 kilometers per day slower than the 1979-2000 average). However, in 2008, the August average decline rate was 77,000 square kilometers per day, more than 50% higher than in 2006. Using **2006 rates**, the slowest August rates in recent years, we obtain a 2010 estimate of **5.27 million square kilometers**; for **2008 rates**, the fastest rate during August, we obtain an estimate of **4.08 million square kilometers**.

There are important issues to keep in mind. First, the weather may differ significantly from other years or the climatological average. In addition, the initial extent (July 31) for this year is different from other years or climatology on which the rates are determined. In other words, the rate of extent loss is a function not only of the weather conditions through the summer, but also the starting extent. Conditions exactly like 2006 would not necessarily result in the same daily decline rate if the starting extent was some other value than the July 31, 2006 extent. Not only the total extent, but the distribution of ice within the Arctic and, as mentioned above, the thickness distribution (e.g., multiyear vs. first-year), will also affect the decline rates.

One thing we note in terms of current conditions is that there is a large region in the Beaufort Sea of unconsolidated ice with low concentration, as indicated in higher resolution passive microwave data from the University of Bremen (http://www.iup.uni-bremen.de/seaice/amsr/) as well as high resolution visible imagery from the NASA MODIS Arctic Mosaic (http://rapidfire.sci.gsfc.nasa.gov/). Significant open water is seen in the higher-resolution imagery even though it is all considered "ice-covered" in our data. This region is prone to rapid melt resulting in a relatively fast August decline, similar to the situation during 2008. Winds will also play a role, depending on whether they help compact the ice (and thus lowering extent) or spread the ice over a larger region (at concentrations above 15%). If the rates match 2008 through the remainder of the melt season, there will be a new record minimum. However, such a rapid decline rate would require optimal conditions that are not likely. Thus, it seems more likely that the minimum extent will be closer to the high range of the estimates (e.g., close to the value using climatological decline rates).