2010 Sea Ice Outlook, June Report

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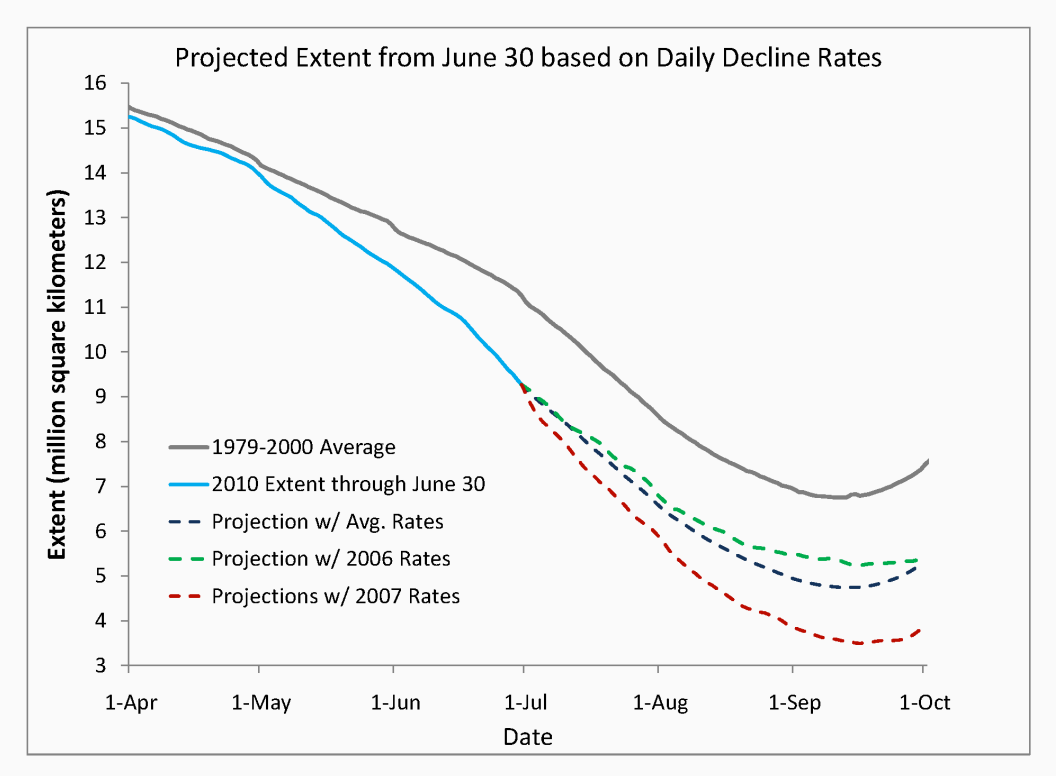
Summary

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 was also implement an alternative NSIDC method, by Meier, Stroeve, Serreze, and Scambos. This is based on daily decline rates from July 1 until the minimum extent is reached. Using average daily decline rates from 1979-2000, the minimum extent is estimated to be 4.74 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 July, August, and September was slower than normal, yields a minimum estimate of 5.23 million square kilometers. Using 2007 rates, when the summer decline was rapid, yields a minimum estimate of 3.49 million square kilometers. We note here that rates have slowed since the June 30 cutoff for data. Thus, at the time of submission (14 July) it is more likely that the final extent will be closer to 2006 and than to 2007.



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.

Details of Method

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.

Simply using **climatological daily rates** from 1979-2000, we obtain an estimate of **4.74 millions square kilometers**. Rates from different individual years can provide a range. Here we selected two recent years, 2006 and 2007, to provide a range around the climatological average. Both 2006 and 2007 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 summer loss was quite slow, while 2007 experienced the most rapid decline in the satellite record. In 2006, extent rarely declined by more than 100,000 square kilometers per day and even in early July, decline rates were around 50,000 square kilometers per day. However, in 2007, there were some days in early July where 200,000 square kilometers of ice was lost and rates remained at or near 100,000 square kilometers per day through most of July and into early August. Using **2006 rates**, we obtain a 2010 estimate of **5.23 million square kilometers**; for **2007 rates**, we obtain an estimate of **3.49 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 (June 30) 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 June 30, 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.

Addendum since June 30

We base our estimates here on data through June 30 as stipulated in the Sea Ice Outlook guidelines. However, we note that between the June 30 cut-off date and the submission date (July 14), the decline rate has slowed significantly, at least for the time being. Each day of slower than normal melt means that a lower minimum becomes less likely (because there is one less day of melt remaining and the extent hasn't decline much), because a few days of slow decline can substantially change projections.

The slowdown has been caused by a change in the sea level pressure, where high pressure that dominated over much of the Arctic through June has been replaced by a succession of low pressure systems. The low pressure systems bring more clouds, reducing solar insolation. Low pressure also results in divergence of the ice pack, opening up ice-free areas within the ice pack. These unconsolidated ice regions will be more prone to melt through the summer. Thus we expect decline rates to increase. However, with over a week already of slower rates, it seems a record minimum extent is unlikely, even if decline rates pick back up to 2007 levels. Much still depends on how the weather

plays out through the rest of the summer, but as sun begins to set, the end of the melt season is on the horizon and the potential range for minimum extent begins to narrow more and more.