

#8—Jennifer Hutchings

June 2008 outlook for Arctic end of summer ice extent in 2008

Jennifer K. Hutchings

July 2, 2008

1. Introduction

I have not been working on a method for seasonal prediction of Arctic ice conditions. However, as I work in the Arctic and am researching which mechanisms control the end of summer sea ice minimum extent in the Beaufort Sea, I would like to provide some qualitative insight and a best-guess outlook. My research into the interplay between ice dynamics and sea ice mass balance is funded by the National Science Foundation.

2 Outlook

I expect 2008 minimum ice extent will be lower than the 2007 minimum ice extent. $3.6 + / - 0.5 \text{Mkm}^2$

3 Rational

As pointed out by several investigators in the batch of May Outlooks, the area of multi-year ice entering summer 2008 is reduced compared to 2007. The extension of this old ice into the coastal seas and marginal ice zone is as low this year as it was at the same time last year. Hence the presence of MY ice at southerly latitudes will not act to increase minimum sea ice extent from last years all time low.

The position of the ice edge, in regions other than the Beaufort Sea, will depend on summer ice drift and the rate of thermodynamic melt. Hence a longer, warmer summer than 2007 could push the 2008 minimum ice extent lower than last year. Also the presence of a younger ice pack in much of the central Arctic will act to increase melt out rate in this region. In the western Beaufort Sea, based on previous experience, and the fact that ice type distributions in this region are similar to a year ago (as shown by quickscat), I would not expect the ice edge to fall north of 77N. The distribution of ice types are similar to last year, and as it is unlikely the old ice tongue on the eastern edge of the Beaufort Sea will drift across the southern Beaufort, I expect Beaufort ice conditions at the end of summer 2008 will be similar to the 2007 minimum.

The vast area of first year ice that falls over the central Arctic will be very interesting to watch this summer. This area has expanded substantially over the winter, and hence will contain much thin ice that can melt out early in the summer. This will act to enhance solar heating of the upper ocean and further accelerate ice melt. In the region extending from the Laptev and East Siberian Seas across the Arctic we can expect a more northern ice edge compared to last year. I expect the final resting position of the ice edge at the end of summer will be determined by latitudinal variation in thermodynamic energy balance at the oceanic and atmospheric interfaces. If the central Arctic experiences an intrusion of warm air and low cloudiness similar to last summer, albedo feedback could lead to the loss of all the first year ice in the central Arctic. I do not know the likelihood of this happening. In the past the end of summer ice edge in this sector of the Arctic has typically followed the continental shelf break, with variability due to wind driven intrusions of old ice to lower latitudes and atmospheric circulation patterns. The end of summer

ice edge tends to follow the perennial ice pack edge, except in a few years when less extensive ice loss than average was experienced. The conditions at the start of summer 2007 and 2008 are unusual, due to the poleward transport of ice pack in the previous winters. Hence there is no observational basis for estimating the variability of a thermodynamically driven ice edge in the region with the new pack conditions.

A conservative viewpoint would take the 2007 event as an extreme melt back, given the anomalous weather patterns. However, the end of summer ice edge followed the edge of the perennial pack in 2007. Which means that the full potential maximum latitude of first year ice melt back was not realized.

Hence I estimate that the lower limit on 2008 minimum ice extent would be 3.1Mkm². We can expect the 2008 minimum ice extent to be lower than the 2007 minimum 4.1Mkm². So my best guess at the 2008 minimum ice extent is 3.6 \pm 0.5Mkm². Personally, I believe the 2008 minimum will fall at the lower range of this estimate - but that is just a hunch based on the understanding that the ice pack is set up for enhancement of this summer's albedo feedback.

4 Additional Information Required

Given the lack of observational information regarding the summer-time evolution of a seasonal ice pack that extends across the Arctic Basin, results from ensemble model runs could be of great importance in projecting this summer's ice conditions. Long-range and seasonal predictions of Arctic weather would help in assessing how we expect summer time ice drift and ice melt to vary from the norm.

5 Regional Prospective: The Beaufort Sea

At the time of writing the Beaufort melt season is underway in earnest. Ice loss in the eastern Beaufort is greater than the same day last year, or any previous year in the satellite record. As the spatial distribution of ice types matches last years in the Beaufort, I expect this year will once again have an open ice pack in the vicinity of Banks Island. The increased solar input to the ocean mixed layer could also act to extend the melt season in the southeastern Beaufort later in to 2008, as was experienced in 2007.

There is a thin zone of older ice along the Alaskan coast visible in quickscat imagery. This may persist far into the summer.