REGIONAL OUTLOOK 2011 – Petrich, Druckenmiller, Eicken

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JUNE REPORT (using May data).

1. Region of Interest: *Beaufort-Chukchi Seas*

Landfast sea ice at the Chukchi Sea coast at Barrow, Alaska

2. Sea Ice Parameter

Parameter predicted: Date of break-up of landfast sea ice at Barrow, Alaska

Comparison with 2010: Landfast sea ice appears to be better grounded in 2011 than in 2010, rendering thermal break-up more likely to occur. In this case and unless June turns out to be extremely sunny, we expect break-up of landfast sea ice at Barrow to happen later than in 2010.

3. Outline of Methods/Techniques

An empirical model is used to forecast break-up of landfast sea ice, based on two parameters:
1. Mechanical stability of the landfast ice cover
2. Cumulative irradiance

Observations since 2000 indicate two modes of break-up: mechanical break-up, in which case km-size rafts of sea ice dislodge from the shore, and thermal break-up, in which case near-shore ice, confined by grounded pressure ridges, disintegrates in place and starts to drift along-shore prior to the dislodging of grounded pressure ridges. The present break-up forecast is valid only for the thermal break-up mode.

The mechanical stability of the landfast ice cover is largely determined by the extent of grounded pressure ridges at Barrow. While widespread grounding is difficult to assess reliably, we performed sea ice thickness measurements along trails built by members of the Barrow community and by the Department of Wildlife Management of the North Slope Borough, Alaska. The map in Figure 1 shows ice thickness along the trails measured with an electromagnetic induction instrument (EM 31). The thickness along the trails suggests that there is significant potential for the presence of grounded ice along the coast, making thermal break-up likely.

We expect to be able to predict thermal break-up in years with significantly grounded landfast ice. Prior experience showed that thermal break-up happens after the cumulative irradiance exceeds 700 MJ/m^2 since June 5, a representative date for the onset of widespread meltpond formation along the coast North of Barrow. The irradiance data for the break-up prediction are extracted from a GFS-driven 16-day WRF weather forecast by Zhang and Krieger (http://knik.iarc.uaf.edu/AtmGroup/ForcastGraphics.htm). Figure 2 shows the cumulative irradiance trajectories of the current and previous years until observed break-up. 2002, 2003, 2004, 2007, and 2010 did not experience thermal break-up and are therefore not expected to be predicted by the presented approach. At the time of publication, break-up is predicted to

happen more than 2 weeks into the future. The latest break-up forecast is available at http://seaice.alaska.edu/gi/observatories/barrow_breakup

4. Estimate of Forecast Skill

Break-up may happen earlier than predicted, as early as mid June, in years without grounded pressure ridges. While this case is outside the scope of the present break-up forecast, we have currently no quantitative measure for the groundedness or stability of the landfast sea ice cover that would help indicate the likelihood of observing mechanical break-up this year.

Based on the experience in previous years we expect to be able to gauge whether thermal break-up will happen comparatively early (July 4) or comparatively late (July 11) this year by the end of June. Complicating factors this year are potentially larger amounts of sediments entrained into the landfast ice, affecting absorption of solar heat and an early onset of surface melt around May 20.

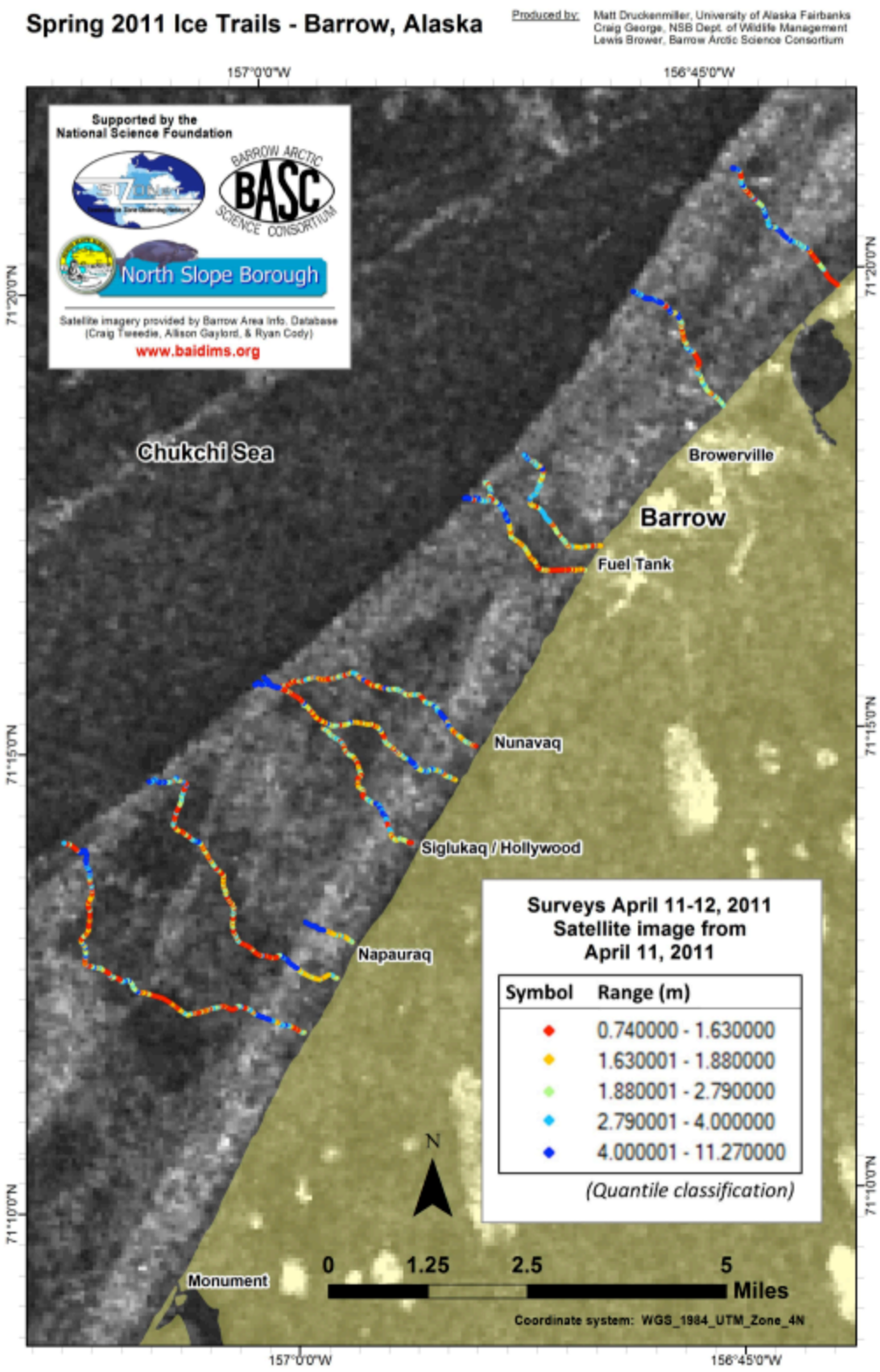

Figure 1: Ice thickness along the 2011 community trails on landfast ice at Barrow, superimposed on corresponding SAR image. Regions shown in dark blue are likely grounded.

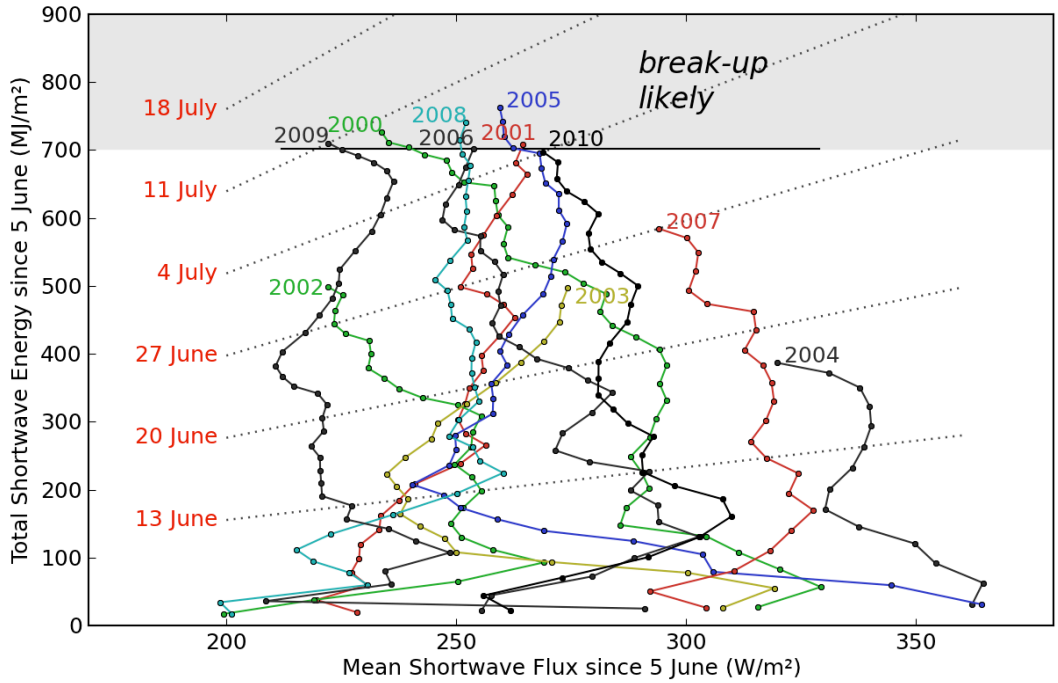

Figure 2: Irradiance trajectories until break-up in previous years with prediction based on current weather forecast. See http://seaice.alaska.edu/gi/observatories/barrow_breakup for the latest forecast.