

September 2009 Regional Sea Ice Outlook: July Report

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Region: Nares Strait, an outlet of the Arctic Ocean

Nares Strait is a narrow seaway between Ellesmere Island and northwest Greenland, which at places is only 30–50 km wide, see Figure 1. It carries substantial volumes of water and sea ice from the Arctic Ocean to Baffin Bay. Estimates of volumes of flux are 0.8 ± 0.3 Sv of water and 136 km^3 of sea ice have been presented, the latter number based on an estimated average ice thickness of 4 m (Münchow et al. 2006, Kwok, personal communication, 2009).

The southwards transport of sea ice is largely controlled by the ocean current and especially the wind, that is orographically confined to the narrow strait between mountains of 1500 m and 500 m on the Ellesmere and the Greenland sides, respectively (Samelson et. al. 2006). However, the transport is also controlled by formation of ice barriers that appear at places from the Lincoln Sea to southern Kane Basin and may last for periods of weeks and months. The ice bridge that with few exceptions forms every year in southern Kane Basin is a well-known feature. The importance of the barriers is demonstrated by the observation that the flux of ice was 2.5 times larger in the year 2006–2007 when no barrier formed at all than the average flux stated above (Kwok, 2009). Admittedly, different wind conditions might also have influenced the situation.

The present year is a special case in that on 16 January 2009, an ice barrier established in Lincoln Sea north of the entrance to Nares Strait (Robeson Channel) prevented transport of the multi-year ice in Lincoln Sea southwards. Figure 1, a recent MERIS observation shows this, as well as the almost ice-free Strait south of the barrier. In the course of time, large quantities of sea ice formed just south of the barrier and drifted southwards controlled by current and wind. The automatic weather station on Hans Island (Wilkinson, J, et al. 2009) measured an average air temperature of -24.3°C in the three-month period from 15 January to 15 April, when temperatures rose gradually to reach melting temperatures by the end of May.

During the same period the stagnant sea ice canopy in Lincoln Sea has increased in thickness. This is likely to have a bearing on the strength of the ice barrier that has practically not changed in position in the period. From changes of the signature of the sea ice surface it is concluded that surface melt began in Lincoln Sea by 17 June. An estimate of the time of breakdown is not possible, presently lacking important environmental parameters but also lacking a model describing the history of such barriers.

A previous case was encountered in the winter 2004–2005 when an ice barrier formed at almost the same place in Lincoln Sea at 14 November and broke down by 20 May 2005. With no information about the temperature, wind conditions, and ice properties in the period of breakdown, we may only conclude that the break-down is a result of increased warming that weakens the strength of the bridge.

However, the breakdown may have a bearing on the activities in the Strait in August this year. With a breakdown by late July, large quantities of sea ice will pass southwards in that month

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and hamper the activities that include recovery of moorings in southern Kennedy Channel, maintenance of weather stations in the region, and establishment of two new stations in addition to a number of oceanographic measurements.

References

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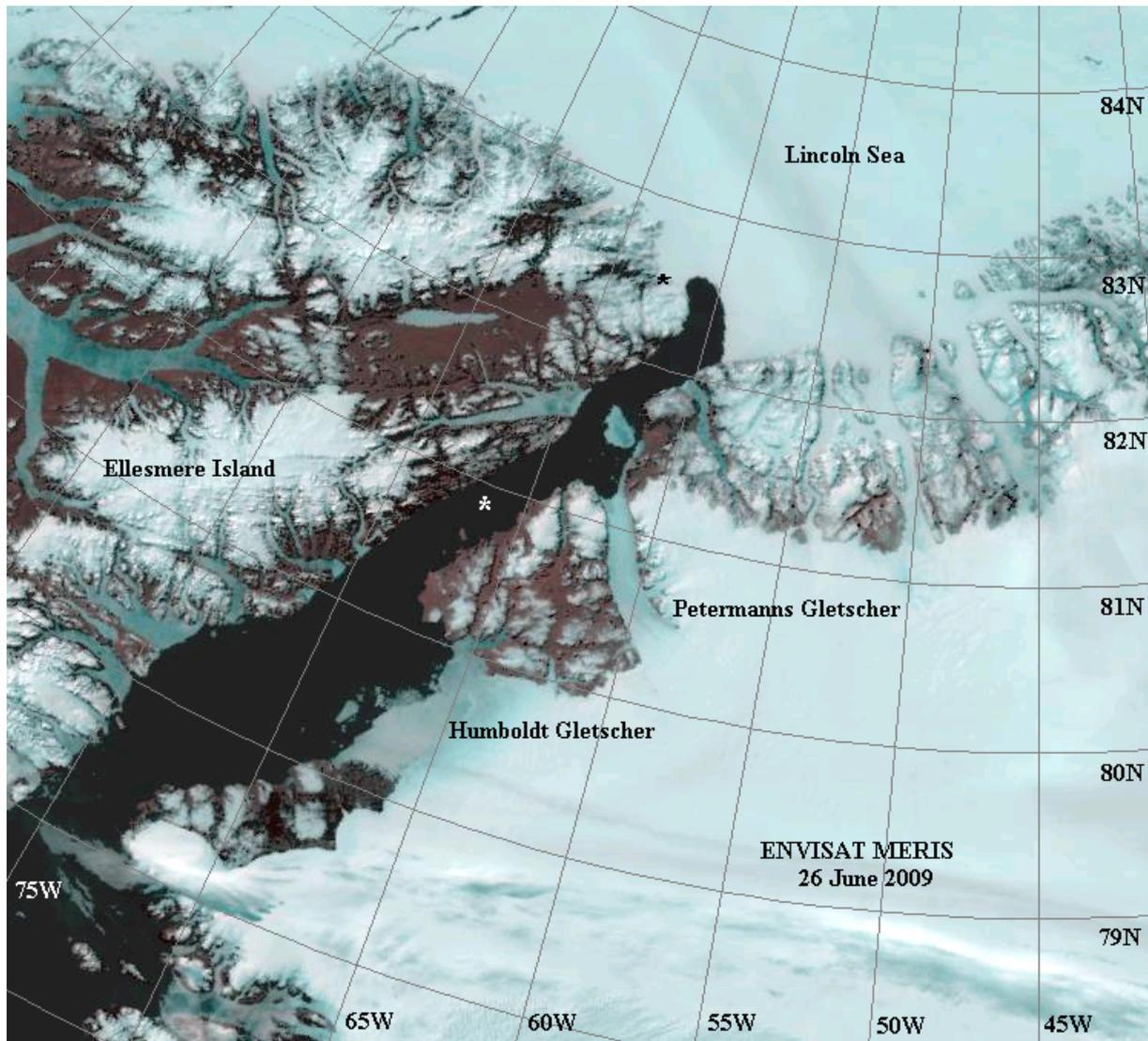


Figure 1. Region of Interest

Nares Strait between Ellesmere Island and northwest Greenland connecting the Arctic Ocean with Baffin Bay via Lincoln Sea.

The strait is divided in sections named after early explorers: from north to south, Robeson Channel, Hall Basin (with the large flow that broke off from the bay in front of Petermanns Gletscher two days before), Kennedy Channel with Franklin Island and Hans Island (asterisk), Kane Basin in front of Humboldt Gletscher and Smith Sound leading to North Water.

The black asterisk in northeast Ellesmere Island is the Canadian Station Alert.

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