Lincoln Sea and Nares Strait

Preben Gudmandsen, Technical University of Denmark

The Lincoln Sea acts as a buffer between the Arctic Ocean and the Nares Strait with floes entering over the continental slope delimiting the Sea towards north. An impression of this in-flow of multiyear ice may be obtained from Figure 1 that shows the tracks of three floes that happened to be observed already on 27 August 2009 – the northern floes – and on 31 August 2009 – the western floe. The floes could be tracked until 13 June when their characteristics vanished due to summer melt that actually began in the Lincoln Sea on that day. Observations were made at irregular intervals partly determined by the acquisition of the Advanced Synthetic Aperture Radar (ASAR) on Envisat operated in its wide swath mode (AWS). Although widely separated it is noted that the overall movements of the floes are very similar, an observation that was also made in previous experiments with deployment of drifting buoys in the region.

In the period floes advected into the Nares Strait interrupted by ice barriers that formed just north of the entrance to the Strait. The first one formed in the period 11-13 January and lasted until 18 January 2010. A second one became solid by 5-7 March to break down slowly in the period 26 April to 2 May 2010. The presence of these barriers is reflected in the drift patterns of the three floes.

An additional impression of the overall situation in the Lincoln Sea may be obtained from Figure 2 that is an ASAR scene acquired on 4 April 2010 overlaid with two drift patterns showing vectors of floe movements. One pattern represents the 27-day period 4 to 31 January 2010 with in-flow from northwest and the other the 45-day period between 18 February and 4 April 2010. It is noted that the 100-km vectors passing the 65ºW meridian in the first period essentially are the sums of two shorter periods of four and one day only constituting the only major in-flow from northwest this past winter. The other vector pattern shows east-to-west (also) 100-km movements along the 85º and 86ºN latitude that is part of the prevailing large-scale clockwise circulation in the Arctic Ocean present this late winter. It is noted that the in-flow to the Lincoln Sea is only a fraction of the overall transport.

Figure 2 also shows the ice barrier referred to above. The composition of the barrier is different from many earlier barriers in that it includes a relatively large fraction of new ice between – and behind - multiyear ice floes. The mechanism of ice barriers is so far unknown but we would expect that a barrier with these characteristics would not last for so long a period (55 days). This may indicate that it has not been subject to strong northern winds.

With a great part of the Lincoln Sea covered by multiyear ice from the previous winter and additional ice advected into the Sea that has stayed for two months and more under the prevailing low-temperature regime we expect that floes have increased in thickness compensating for the melt processes the preceding summer – modified by the coming new melt season.

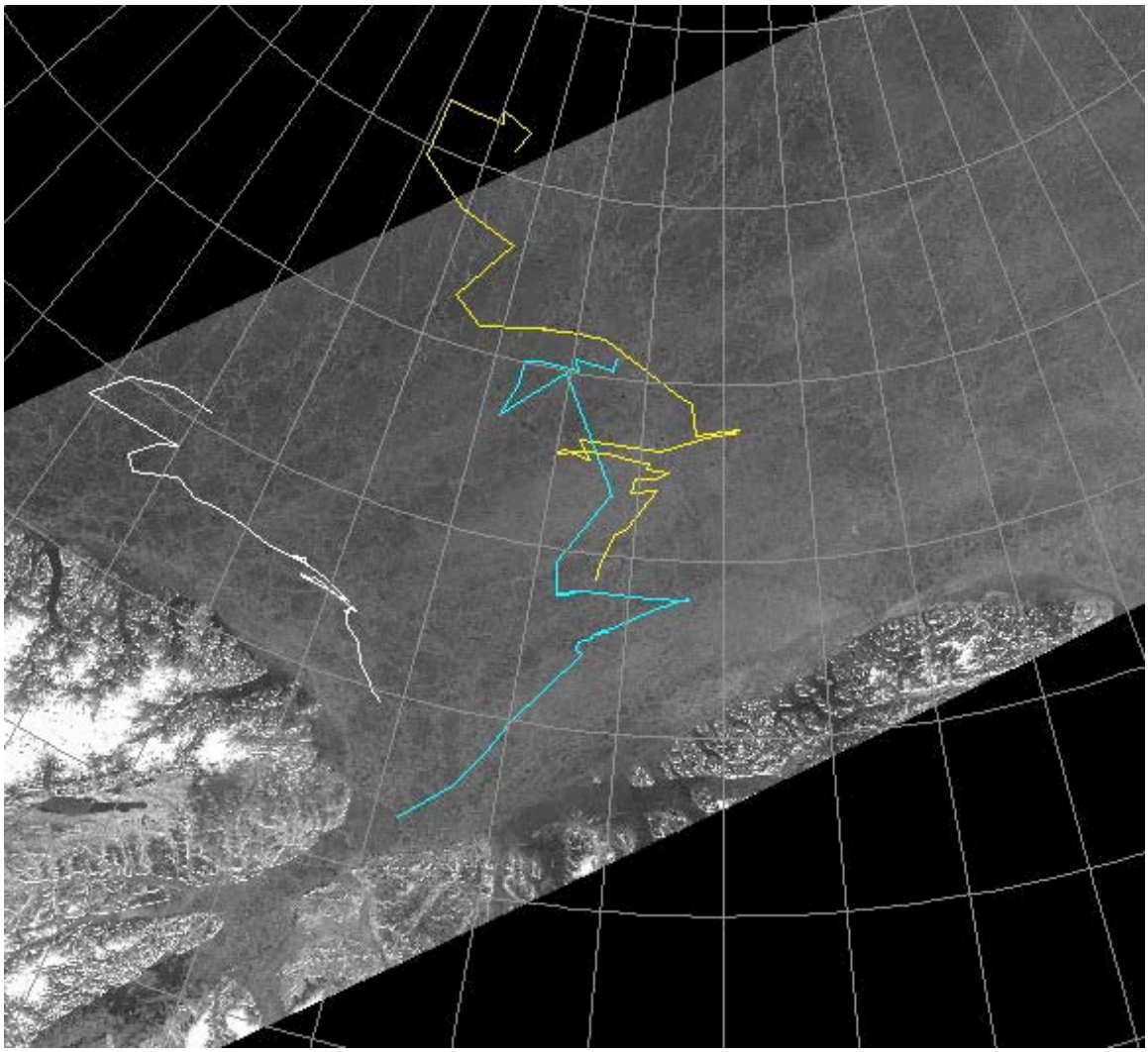

Figure 1.
Tracks of three floes in the period end August 2009 to 13 June 2010 plotted on an ASAR scene acquired by Envisat on the latter date. The dark surfaces indicate the beginning of the melt season.

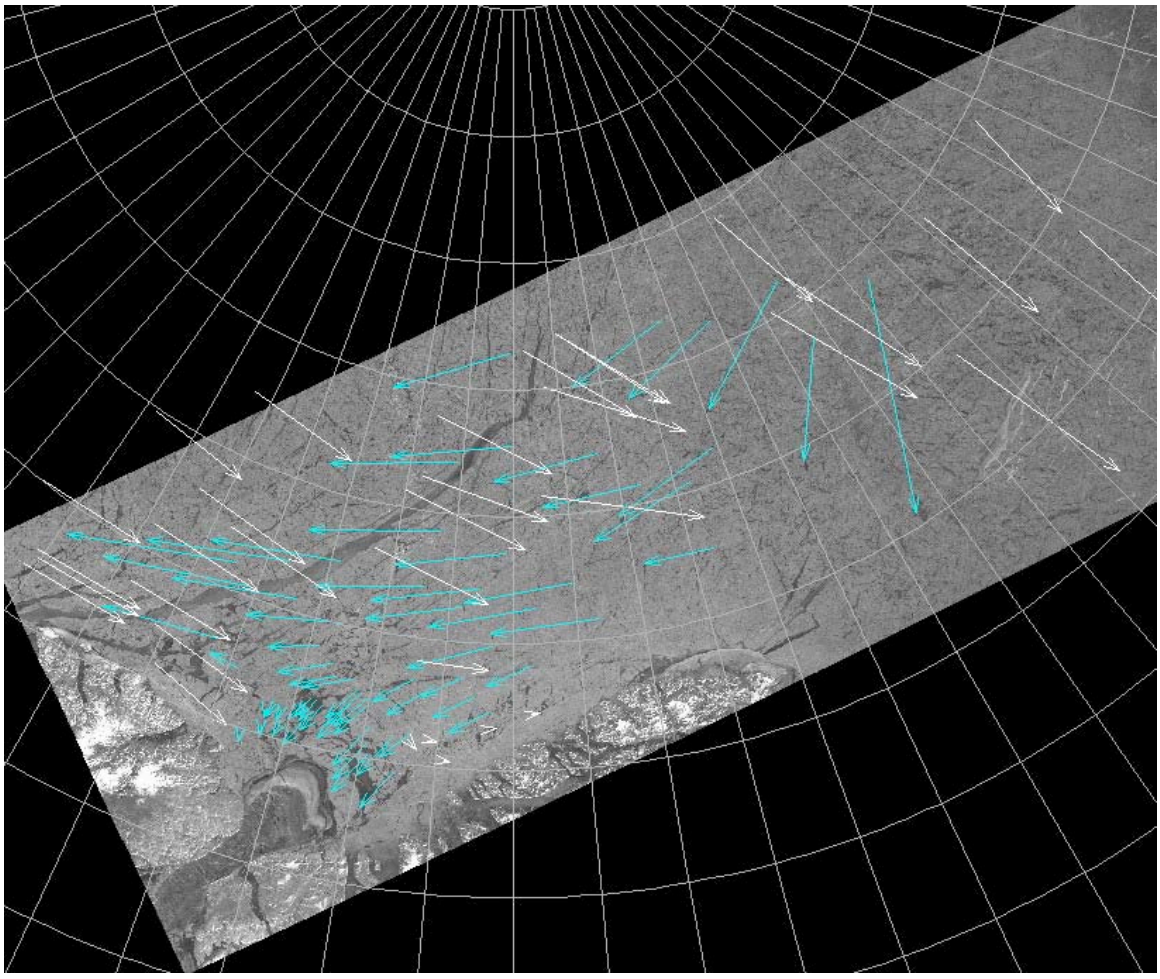

Figure 2.
Patterns of drift vectors obtained in two periods: 4 – 31 January (white) and 18 February to 4 April 2010 (cyan), plotted on an ASAR acquisition of 4 April 2010. The vectors are derived by way of an interactive program with observations of characteristic features in two consecutive radar scenes.