A ferocious and extreme Arctic storm in a time of decreasing sea ice

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Summer Arctic sea-ice extent has exhibited a downward trend since comprehensive satellite data became available in 1979. The decline has been especially steep since 2002 (Stroeve et al. 2005) and a record low was set in September 2005. Ice extent from January through to the middle of July 2006 was well below 2005 conditions, and the August 2006 sea ice extent was only slightly greater than the 2005 record set for that month (NSIDC, http://www.nsidc.org).

Against this background, much public and media interest was attracted in connection with analyses of the remarkable Arctic ice conditions and severe storms in August 2006 (ESA, 2006). Data from ESA's Envisat's Advanced Synthetic Aperture Radar (ASAR) instrument showed that sea ice that had survived the melt season had been fragmented by fierce late summer storms, as a consequence of surface wind-forced ice drift divergence. We are exploring the complex relationships between Arctic cyclones and sea-ice distribution, a topic of particular concern during a period of dramatic sea-ice decrease.

We report here on a very powerful synoptic event which occurred in the central Arctic in August 2006. We have used MSLP fields from the NCEP/DOE reanalysis in conjunction with the Melbourne University cyclone tracking scheme (Murray and Simmonds 1995, Simmonds et al. 2003) to objectively locate and track all cyclones that occurred in the Arctic basin (70-90^{o}N) in the month August 2006. The cyclone of interest here was very intense and lasted a significant proportion of the month. Fig. 1 (left) shows the cyclone on 18 August 12UTC at which time it achieved its lowest central pressure of 983.8 hPa (which is within the second percentile of all August cyclones in the basin (1979-2006)). Even more dramatic was the system's Depth (17.2 hPa at 6UTC) and Laplacian (2.57 hPa (deg. lat.)$^{-2}$ at 19 August 0UTC). Both these values fall within the first half-percentile of their respective August climatological distributions (Fig. 2). This was indeed a ferocious and extreme event.

The Envisat satellite-derived ASAR image mosaics and daily tracked sea-ice drift reveal the response of sea-ice pack to this ferocious and extreme summer event (Fig. 1 (right)). Ice divergence results in significant reduction in sea-ice concentration, with the consequence of enhanced positive albedo feedback.

ESA, 2006: Arctic summer ice anomaly shocks scientists, Unpublished Web article http://www.esa.int/esaEO/SEM7ZF8LURE_index_0.html

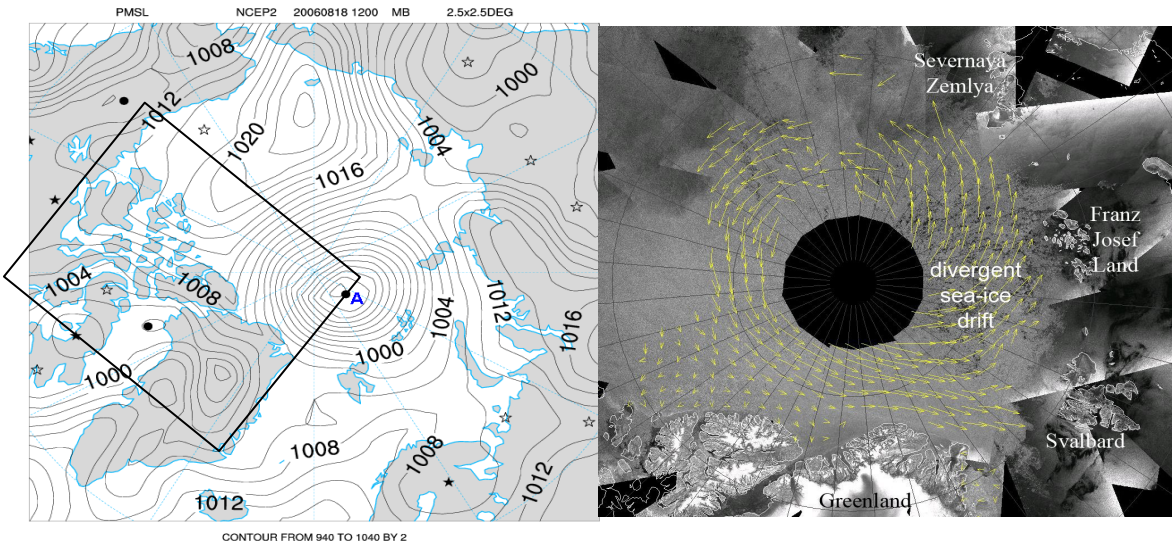
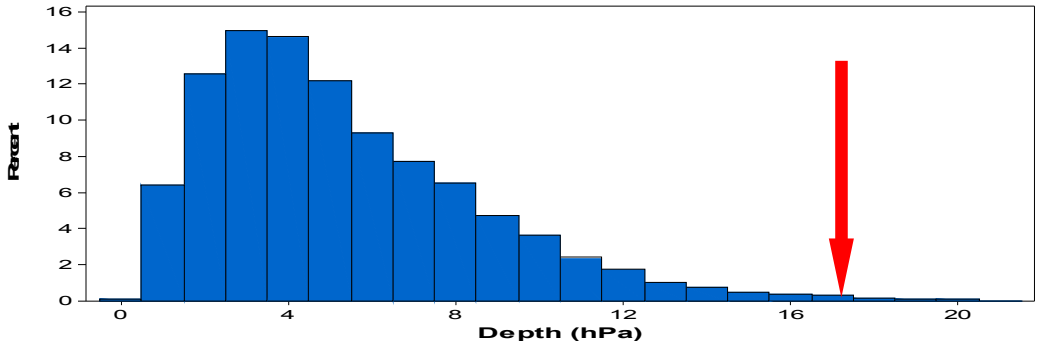


Fig. 1: (left) NCEP/DOE MSLP reanalysis at 18 August 2006 12UTC (contour interval 2 hPa). The intense cyclone of interest is marked with an 'A', and the box indicates the location of the satellite image mosaic in the right panel. Corresponding 30d mean daily ice drift vectors (right) for the month of August, superimposed on the 24 August Envisat ASAR Arctic image mosaic (courtesy Leif Toudal-Pedersen, PolarView consortium).



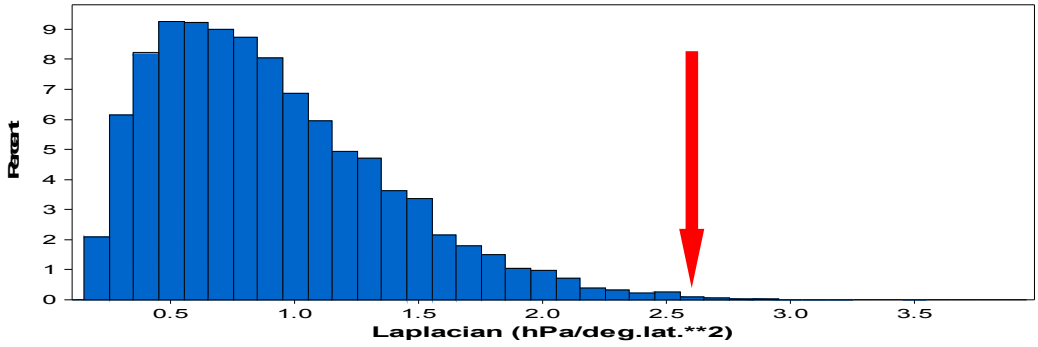


Fig. 2: Histograms of the distributions of (top) Depth and (bottom) Laplacian of MSLP of all August cyclones in the domain 70-90ºN (1979-2006). The red arrows indicate the values diagnosed for the 18/19 August 2006 event.