Seasonal features of Arctic synoptic activity

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Cyclones are an integral part of the climate system in the Arctic basin, but have been little studied, partly because of the hostile environment and the limited data availability. We have used the Melbourne University cyclone tracking scheme (Simmonds and Keay 2000) to diagnose the winter (DJF) and summer (JJA) characteristics of Arctic cyclones in the 6-hourly NCEP reanalysis (Kalnay et al. 1996) for the period 1958-1997. Figure 1 shows the mean winter cyclone density (number per analysis found in a 10^3 (deg lat)^2 area) so-obtained. North of 60^oN system densities exceed 6 x 10^{-3} cyclones (deg lat)$^{-2}$ east of southern Greenland and in the Norwegian and Kara Seas. Densities between 2 and 4 x 10^{-3} cyclones (deg lat)$^{-2}$ are found for winter in the Arctic region include Baffin Bay, Davis Strait and south of Baffin Island. In summer (Figure 2) a much smoother distribution is evident for the Arctic region and there are no intense maxima. Local extrema of density in excess of 4 x 10^{-3} cyclones (deg lat)$^{-2}$ are positioned over Alaska, parts of northern Eurasia and south of Iceland.

The pictures presented here have similarities with those of Serreze et al. (1993), Serreze (1995), Brümmer et al. (2000) and Gulev et al. (2001). Having said that, we diagnose somewhat higher densities here, and we find winter cyclones to be more numerous than their summer counterpart. In part, these apparent discrepancies with the results of earlier work reflect the fact that our scheme also counts important (i.e., significant vorticity) 'open' depressions. We also do not consider cyclones identified in regions where the surface elevation exceeds 1 km.

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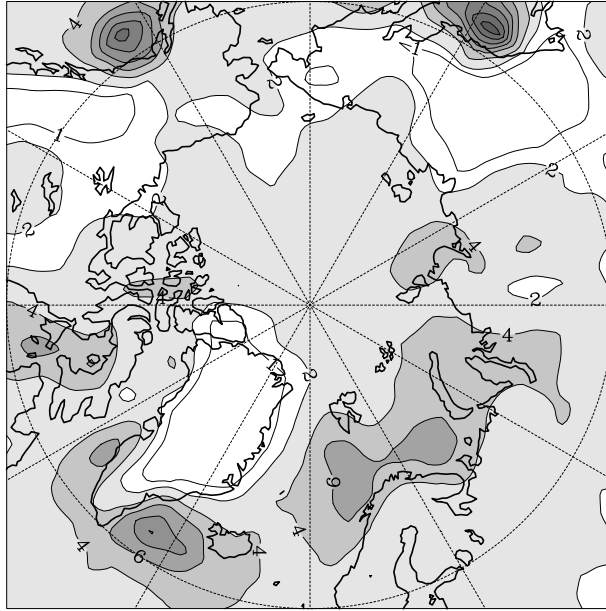
Figure 1: Mean system density (the mean number of cyclones found in a 10^3 (deg. lat.)$^{-2}$ area per analysis) in winter. Contour interval is 2 x 10^{-3} cyclones (deg. lat.)$^{-2}$.
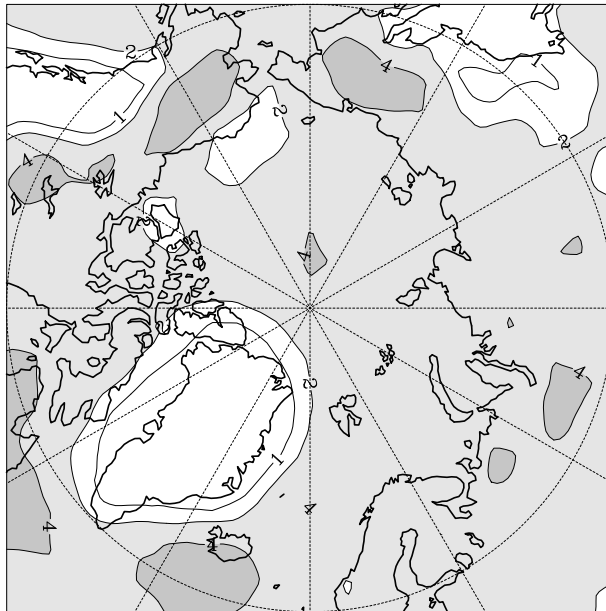

Figure 2: Mean system density (the mean number of cyclones found in a 10^3 (deg. lat.)$^{-2}$ area per analysis) in summer. Contour interval is 2 x 10^{-3} cyclones (deg. lat.)$^{-2}$.