Summer Arctic basin cyclone properties in the ERA-40 data set

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In the early part of the twentieth century the 'glacial anticyclone theory' of Arctic climate was generally accepted. However, these days it is known that the Arctic basin is host to a range of isobaric systems and intense cyclones year round. In this communication we present the structure of some key climatological characteristics of summer cyclonic systems in the Arctic basin.

We compile these climatologies using the ERA-40 re-analysis (Uppala et al. 2005) for summers (JJA) over the period 1958-2002. The cyclonic systems are identified and tracked with the Melbourne University cyclone tracking scheme (Simmonds and Murray 1999, Simmonds and Keay 2000a, b). The algorithm identifies both 'open and 'close' systems, and also computes a raft of characteristics for each identified cyclone, including Radius and Depth (see, e.g., Lim and Simmonds (2007) These statistics provide significantly more information than would be presented by cyclone counts alone.

The density of systems (the mean number per analysis found in a 10^3 (deg. lat.)^2 normalizing area) is presented in Fig. 1(a). A region of frequencies in excess of 3 is found in the central Arctic. There is known to be a winter centre of cyclonic activity off northwest Norway (see, e.g., Simmonds et al., 2008); in summer there is also a local maximum there but it is much more modest. It is of value to interpret this summer distribution in terms of the distribution of cyclogenesis. Fig. 1(b) shows the regions of greatest genesis to lie over the relatively warmer regions off Alaska and northern Norway.

The largest cyclones (greatest radius) are found in the central Arctic (Fig. 2(a)). The systems found in the basin are rather similar in size to those further south (Simmonds 2000) and exceed 5 deg. lat. over a significant portion of the domain. As to the net 'influence' of these summer cyclones, the greatest mean cyclone depths (in excess of 5 hPa) (Fig. 2(b)) are found in the broad region centered on the Pole.

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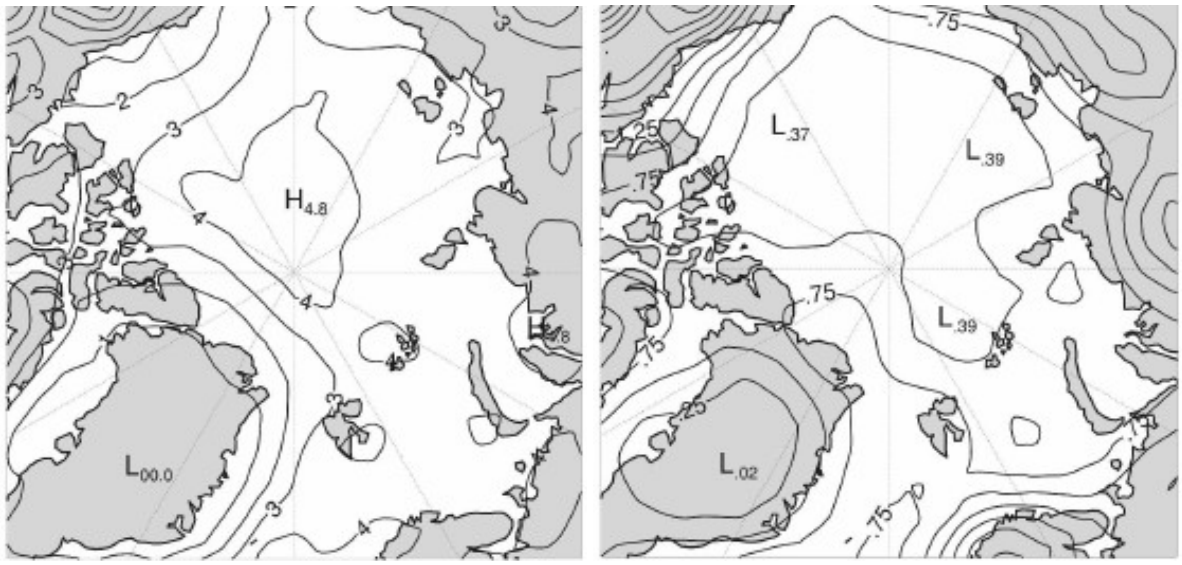

Figure 1: (a, left) System density (the mean number of cyclones found in a 10^3 (°lat)^2 area per analysis) and (b, right) density of the rate of cyclogenesis (systems formed in a 10^3 (°lat)^2 area per day. Both plots are for the summer season.

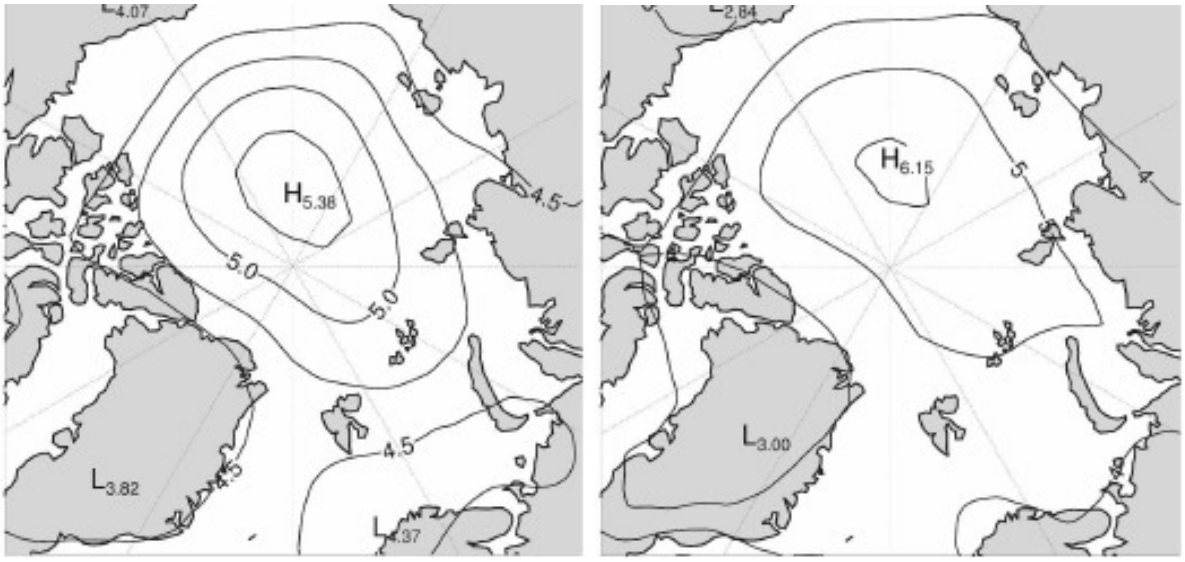

Figure 2: Mean summer distribution of the (a, left) Radius and (b, right) Depth of cyclones. The units are °lat and hPa, respectively.