Application of scatterometer data to the diagnosis of SH mesoscale cyclones

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The analysis of mesoscale synoptic systems in mid-to-high southern latitudes is has always been a difficult task. This is in part due to their small size and relatively short lifetimes. However, these small systems are known to exert significant influence (Yuan et al. 2009).

In the investigation outlined here, we have used the surface pressure fields derived from swath of QuikSAT surface wind vectors provided by Jerome Patoux at the University of Washington (Patoux et al. 2008), the 'UWQS pressure fields'. From these fields we have indentified and characterised (especially with respect to radius) the Southern Hemisphere mesoscale systems, using the approach detailed in Simmonds (2000) and Simmonds et al. (2008).

Over the period September 1999–November 2008 a total of 82,907 cyclonic systems were identified from the UWQS pressure fields (an average of 0.87 systems per field per swath). The radius of these systems ranged from 0.41° to 11.08° latitude (46–1230 km), where ° latitude refers to degrees of latitude, and their distribution is shown in Fig. 1. We here define mesoscale cyclones as having an upper radial bound of 4.5° latitude (500 km), the largest 15% were excluded, resulting in a set of 70,354 systems (0.74 per field). 46% of the mesoscale cyclones identified were classified as 'open' systems.

The mean geographical distribution of the mesocylone frequency for each season showed an arc of highest values located 5°–10° latitude north of the sea ice (or missing data) zone, extending from the south of Africa eastward to Drake Passage (Fig. 2). Maxima within this arc were most prominent over the Amundsen and Bellingshausen Seas during summer and autumn and off the coast of Wilkes Land, south of Australia, during winter. Climatological area-weighted average system density values calculated over the entire study domain revealed autumn as the most active season, with an average of 2.02×10^{-3} (° latitude)$^{-2}$. The average values for summer and winter were similar (1.70×10^{-3} (° latitude)$^{-2}$ and 1.75×10^{-3} (° latitude)$^{-2}$ respectively), while the lowest climatological area-weighted average system density was observed during spring (1.40×10^{-3} (° latitude)$^{-2}$). More detailed information on the structure and behavior of the identified mesoscale systems is presented in Irving et al. (2010).

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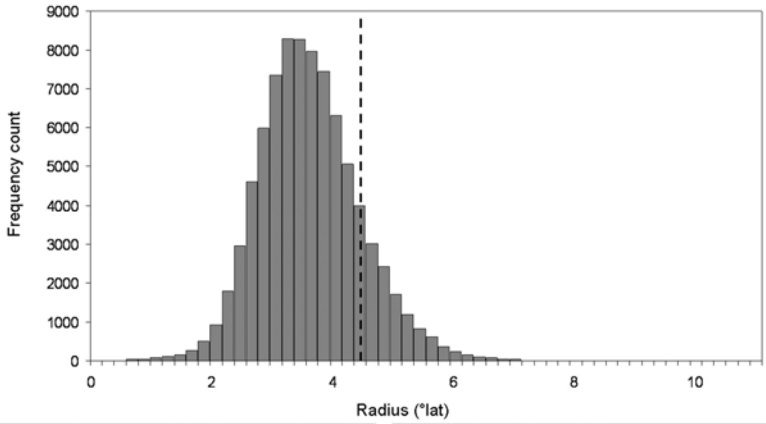

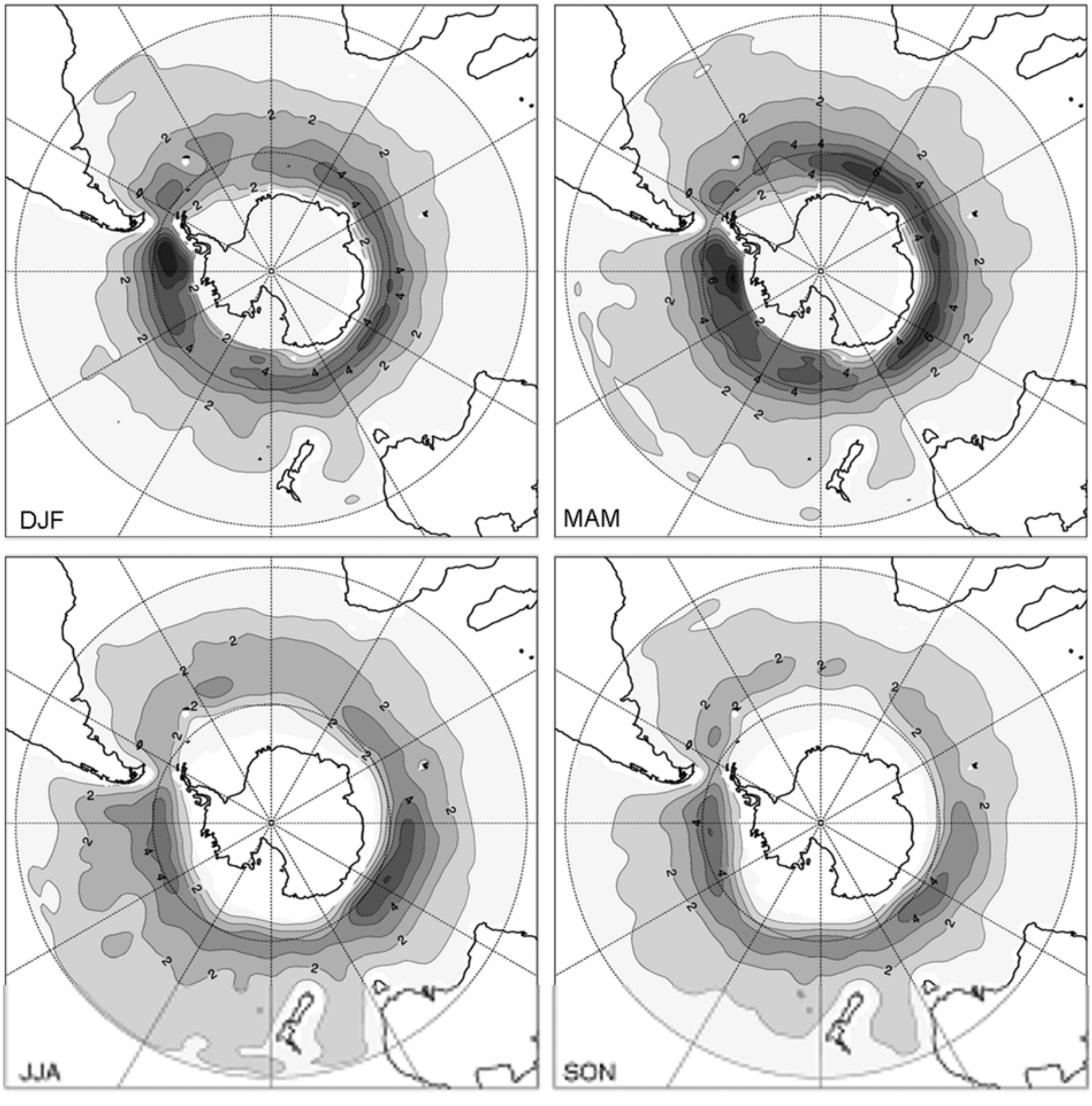

Fig. 1 (top): Number of systems identified per radius category. The dashed line indicates the upper radial limit (4.5° latitude) for a system to be included in the climatology.

Fig. 2 (bottom): Mean system density (number of mesoscale cyclones found in a 10^3 (° latitude)^2 area per analysis) for each season. The contour interval is 1×10^{-3} (° latitude)$^{-2}$.