

## Trends in the behaviour of 850 hPa fronts in the southern extratropics

Ian Simmonds

School of Earth Sciences, The University of Melbourne, Victoria, 3010, Australia  
simmonds@unimelb.edu.au

There has been much research in recent times exploring the trends in extratropical cyclone behaviour in the SH (e.g., Simmonds and Keay 2000, Irving et al. 2010). However, very little attention has been paid to the more challenging task of diagnosing trends in frontal behaviour over the southern extratropics.

We report on some preliminary investigations into changes in frontal frequency, and well as trends in the length and intensity of fronts. The frontal identification and tracking package we have used here is that described by Simmonds et al. (2012). The scheme is applied at the 850 hPa level of the ERA–Interim reanalysis (Dee et al. 2011) over the 20-year period 1989–2008.

The top panel of Figure 1 shows the trends in the annual frequency distribution of the centroids of all identified frontal structures. Significant reductions in frontal numbers are diagnosed in the Southern Ocean to the south of Australia and New Zealand. By contrast the western Indian at about 50°S hosts an increase in frontal frequency. The middle panel of Figure 1 shows very little change in mean frontal length over our relatively short period of our analysis. By contrast the significant trends in mean frontal intensity (bottom panel of Figure 1) are predominantly positive, with notable increases in intensity in the Tasman Sea, to the southwest of Australia, and in the eastern Pacific at about 40°S.

Dee, D. P., et al., 2011: The ERA-Interim reanalysis: Configuration and performance of the data assimilation system. *Quart. J. Roy. Meteor. Soc.*, **137**, 553–597.

Irving, D., I. Simmonds and K. Keay, 2010: Mesoscale cyclone activity over the ice-free Southern Ocean: 1999–2008. *J. Climate*, **23**, 5404–5420.

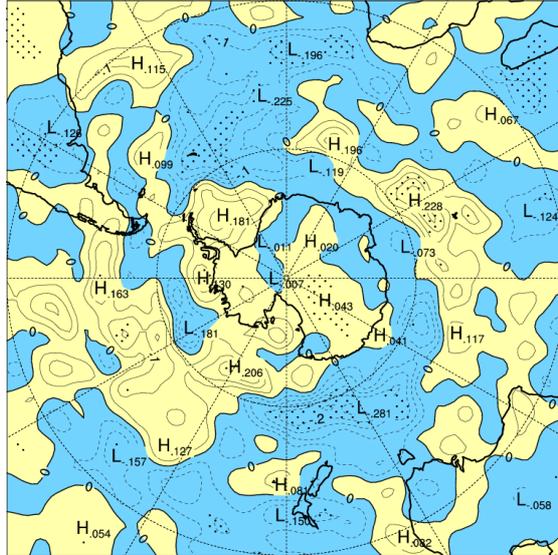
Simmonds, I., and K. Keay, 2000: Variability of Southern Hemisphere extratropical cyclone behavior 1958–97. *J. Climate*, **13**, 550–561.

Simmonds, I., K. Keay and J. A. T. Bye, 2012: Identification and climatology of Southern Hemisphere mobile fronts in a modern reanalysis. *J. Climate*, **25**, 1945–1962.

**Figure 1 (next page):** Annual mean trends (per decade) of 850 hPa frontal characteristics over 1989–2008. (top) frequency of frontal centroid positions, (middle) length, and (bottom) intensity. The units are counts per  $10^3$  (degrees of latitude)<sup>2</sup>, km, and  $\text{ms}^{-1}$  (1000 km), respectively. Stippling denotes where trends are significantly different from zero ( $p < 0.05$ ).

ERAIN 850hPa PM-LC SH ANN 1989 SD Fix

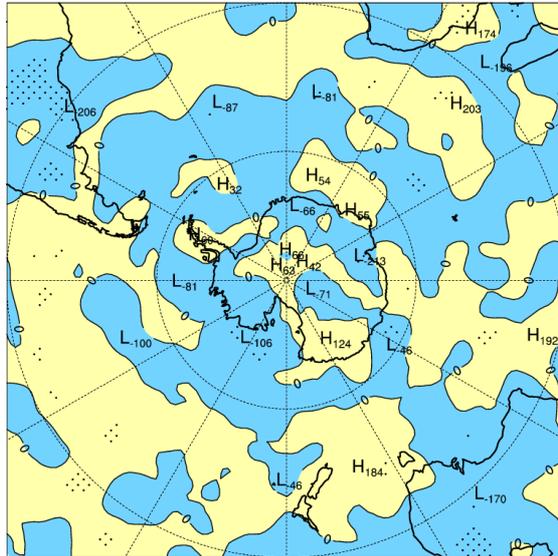
b values



CONTOUR FROM -.25 TO .25 BY .05

ERAIN 850hPa PM-LC SH ANN 1989 L Fix

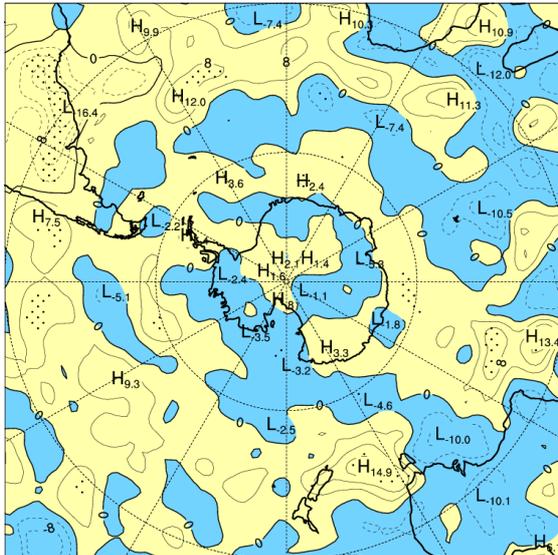
b values



CONTOUR FROM -800 TO 600 BY 200

ERAIN 850hPa PM-LC SH ANN 1989 I Fix

b values



CONTOUR FROM -16 TO 12 BY 4