Origins of northern Antarctic Peninsula air masses

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The Antarctic Peninsula (AP) has a number of characteristics which makes its weather and climate rather different from those of the rest of Antarctica. It is the most northerly part of the continent, and hence is the most subject to midlatitude influences and its north-south orientation influences transient weather systems in a variety of ways. The AP is of especial current interest because the rate at which the western side has warmed over recent decades (e.g., Doran et al., 2002) and also because it has experienced the disintegration over the last decade of a number of its ice shelves, including parts of the Larsen ice shelf. In February 2002 the northern section of the Larsen B shelf shattered and separated from the continent. A number of studies have quantified the roles of weather and climate in these breakups (e.g., Scambos et al., 2000).

The understanding of the atmospheric dynamics of this data-sparse part of the world has been aided by reanalysis products (e.g., Simmonds et al., 2003). We here make use of the NCEP/DOE reanalysis (Kanamitsu et al., 2002) available every 6 hrs over the period 1 January 1979 to 29 February 2000. The broad region to the west of the Peninsula is host to vigorous synoptic activity (Simmonds and Keay, 2000) and hence there is a rich variety of air trajectories which reach the AP. To quantify the variety of regional influences on the northern part of the Peninsula we have calculated the origin points of all 850 hPa four-day trajectories which reach 304.5^{o}E, 63.1^{o}S (near Esperanza on the northern tip of the AP) using the accurate technique described in Perrin and Simmonds (1995). The wide variety of origin points can best be conveyed by presenting their spatial frequency distribution. Fig. 1 shows that greatest frequency of summer (DJF) departure points is found some 40^{o} to the west of Esperanza, as one might have expected. However, the distribution function is quite broad; significant numbers of trajectories start from more than 90^{o} upstream of the AP, and a considerable proportion originate from the east. Many starting points are found as far north as 45^{o}S over South America. A similar, if a little more diffuse, plot for winter (JJA) is displayed in Fig. 2. The greater spread reflects even more active and varied circulations in that season.

Doran, P. T., and Coauthors, 2002: Antarctic climate cooling and terrestrial ecosystem response. *Nature,* **415,** 517-520.

Kanamitsu, M., and Coauthors, 2002: NCEP-DOE AMIP-II Reanalysis (R-2). *Bull. Amer. Meteor. Soc.,* **83,** 1631-1643.

Perrin, G., and I. Simmonds, 1995: The origin and characteristics of cold air outbreaks over Melbourne. *Aust. Meteor. Mag.,* **44,** 41-59.

Scambos, T. A., and Coauthors, 2000: The link between climate warming and break-up of ice shelves in the Antarctic Peninsula. *J. Glaciol.,* **46,** 516-530.

Simmonds, I., and K. Keay, 2000: Mean Southern Hemisphere extratropical cyclone behavior in the 40-year NCEP-NCAR reanalysis. *J. Climate,* **13,** 873-885.

Simmonds, I., K. Keay and E.-P. Lim, 2003: Synoptic activity in the seas around Antarctica. *Mon. Wea. Rev.,* **131,** 272-288.

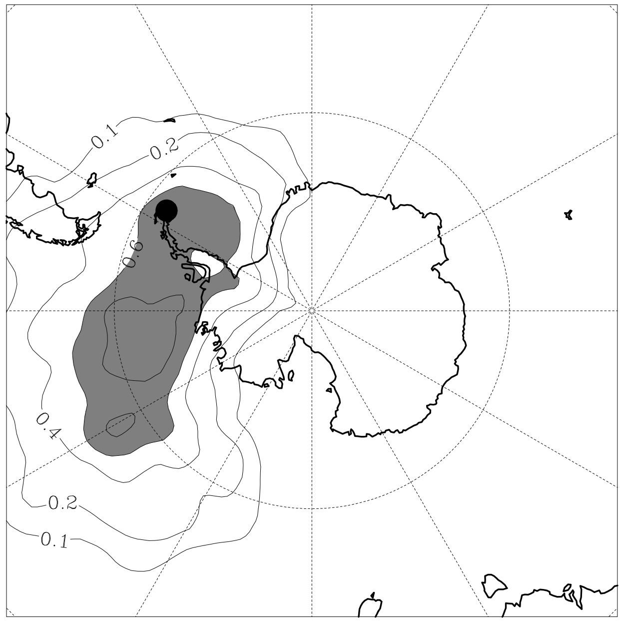

Figure 1: Frequency distribution of origin points of all summer (DJF) 4-day 850 hPa trajectories which terminate at 63.1°S, 304.5°E (indicated by a solid dot). The contour interval is 0.2 origin points per 1000 (deg. lat.)^2 per trajectory, and an extra contour has been added at 0.1.

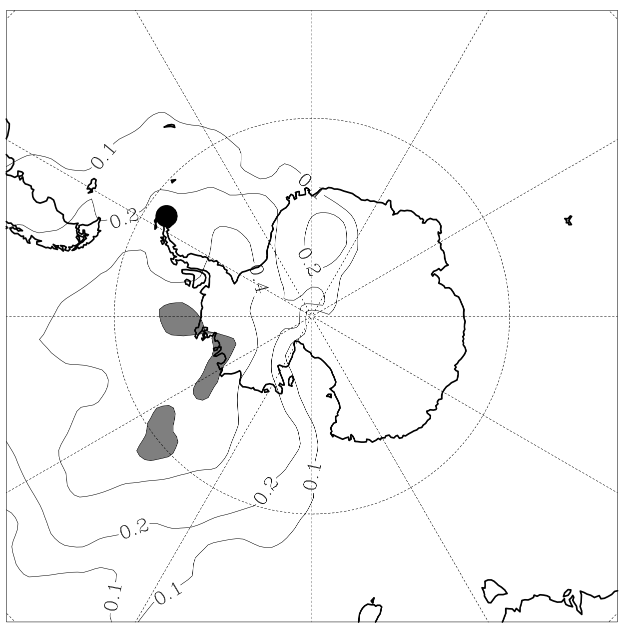

Figure 2: As Figure 1, but for winter (JJA).