Influences of the Pacific Decadal Oscillation on the Southern Hemisphere extratropical climate

Alexandre Bernardes Pezza and Ian Simmonds
School of Earth Sciences, The University of Melbourne, Victoria 3010, Australia
e-mail: apezza@unimelb.edu.au

The Southern Hemisphere (SH) climate is strongly associated with variability in the Pacific Ocean. The El Nino has been one of the most studied interannual modes of variability (Karoly 1989), but in the last decade the term Pacific Decadal Oscillation (PDO) was also introduced in connection to a long-lived ENSO-like pattern seen in the lower frequencies (Mantua et al 1997). The PDO is well documented for its impacts particularly over the extratropical Northern Hemisphere (Mantua et al 1997), but very little is known in the case of the SH. A recent assessment on the global rainfall variability at different time scales has stressed its importance at the decadal and interdecadal time scales, with enormous implications for agricultural management (Meinke et al 2005).

We are studying the association between the PDO and the cyclone/anticyclone behavior in the SH through an automatic procedure developed at Melbourne University (Simmonds et al 2003). The tracking scheme calculates each individual synoptic trajectory and summarizes the statistical properties from a climate perspective, either regionally or for the large scale. This technique has been applied in terms of Depth (DP), which is an objective measure of cyclone/anticyclone strength. Composites of this property and Mean Sea Level Pressure were calculated for the years when the PDO index was greater than the average plus one standard deviation (PDO^+) or lower than the average minus one deviation (PDO^-), using the ERA 40 reanalysis data set for the period 1958-2002.

The MSLP shows a strong annular structure related to the PDO, with lower pressure around Antarctica when the PDO index is positive, and higher pressure over much of the eastern hemisphere (Figure 1). The DP response presents a coherent pattern indicating greater values when the PDO is positive (Figure 2), indicating that more intense cyclones are found not only over the areas where the pressure is lower, but also spreading out further north around the SH. The DP anomalies are significant when compared to the climatology, and the most intense anomalous regions are statistically significant up to 99% according to the t-student test.

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Meinke, H, DeVoil, P, Hammer, GL, Power, S, et al., 2005: Rainfall variability at decadal and longer time scales: signal or noise? *Journal of Climate*, **18**, 89-96.

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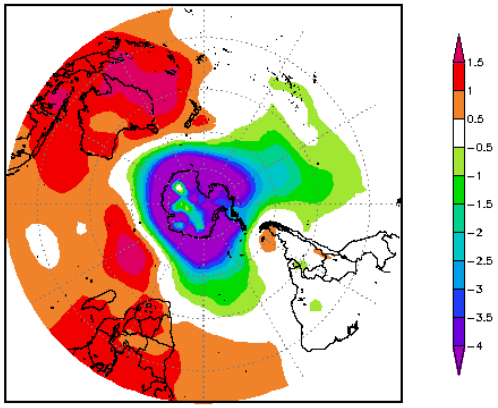

Figure 1: Annual mean sea level pressure anomalies for PDO^{+}- PDO^{-} for the period 1948 – 2004. Total number of years used in the composite: PDO^{+} 9 years, PDO^{-} 15 years.

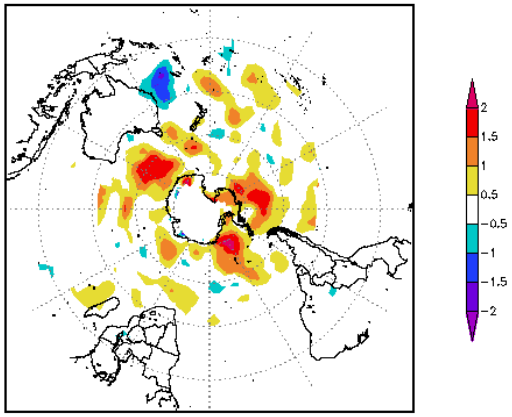

Figure 2: Cyclone Depth for the PDO^{+}- PDO^{-} during the 1958-2002 summer season (DJF). Total number of years used in the composite: PDO^{+} 8 years, PDO^{-} 9 years.