Recent southern Semiannual Oscillation fluctuations in ERA-Interim

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The existence of a semiannual oscillation (SAO) in the southern extratropics pressure has been known for many years (van Loon 1967). It results from the different thermal inertias in the sea ice-Antarctic region and the Southern Ocean. This results in a semiannual variation in the meridional temperature gradient and the effects on the baroclinicity are also modulated by the seasonality of the vertical stability (Walland and Simmonds 1999). The magnitude of the SAO has been shown to undergo considerable interannual and decadal fluctuations, it being particularly strong in the mid 1970s and then progressively weakened up to about 1990 (Simmonds and Jones 1998 (SJ)). The behaviour of the SAO strongly influences sea ice-atmosphere interactions (Simmonds and King 2004, Yuan and Li 2008).

We have examined the recent behaviour of the SAO using the ERA-Interim reanalysis (1989-2008). We calculated (using the methods of SJ) the amplitude of the second harmonic of the zonally-averaged MSLP calculated from the three-year running means. Fig. 1 shows the time-latitude plot of the amplitude of this mode. It will be seen that the amplitude remained high for most of the 1990s, and then weakened for a few years about the turn of the century. About 2004 it regained its customary strength of about 2 hPa.

While MSLP is a valuable index of atmospheric behaviour its physical meaning over regions of significant topography (such as over the high southern latitudes) can be limited. In particular, any annual modes in the near-surface temperature used to extrapolate the surface pressure (SP) to MSLP could distort the MSLP SAO signal. For this reason it is also of value to undertaken the above analysis using SP, the time-latitude behaviour being shown in Fig.2. As would be expected, the plot is similar to Fig. 1, except to the south of 70°S where the role of topography become significant. The amplitude of SP SAO exceeds 3 hPa over the continent for the majority of the time, whereas that in the MSLP is considerably weaker.

The nature of the temporal SAO variability we observe in this updated analysis is consistent with that revealed in unforced and sensitivity experiments (e.g., boundary forcing) with climate models (Simmonds and Walland 1998, Walland and Simmonds 1998).

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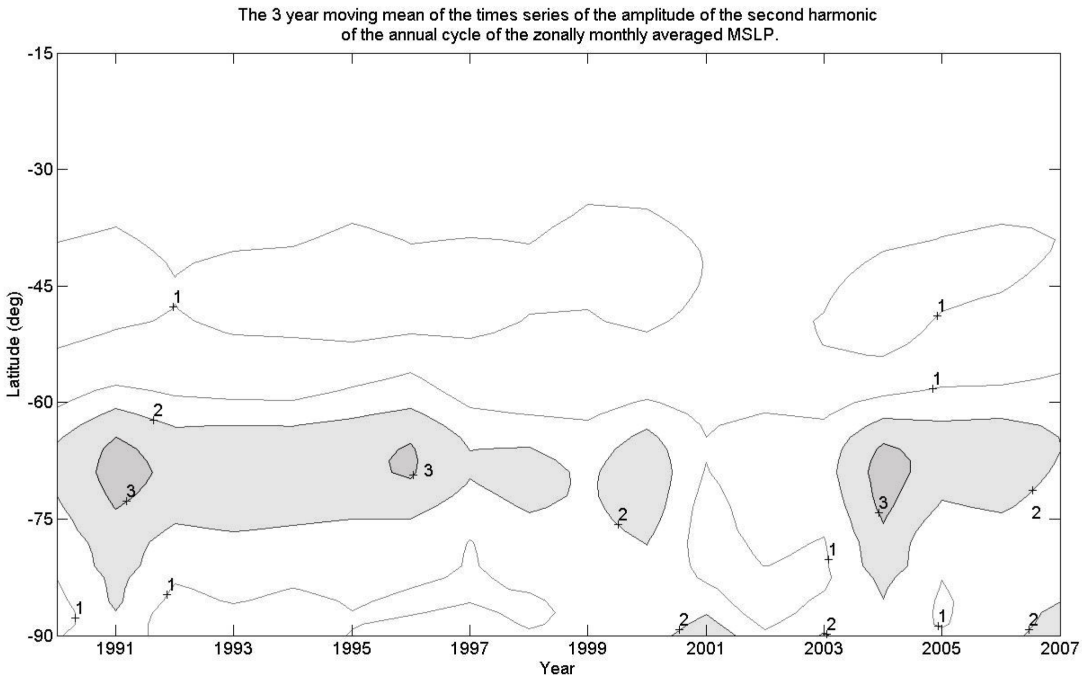

Figure 1: Time-latitude plot of the amplitude (hPa) of the semiannual oscillation in zonally-averaged MSLP in the ERA-Interim reanalysis. The semiannual mode is calculated from the mean annual cycle calculated over three consecutive years, and the amplitude plotted at the middle of those years.

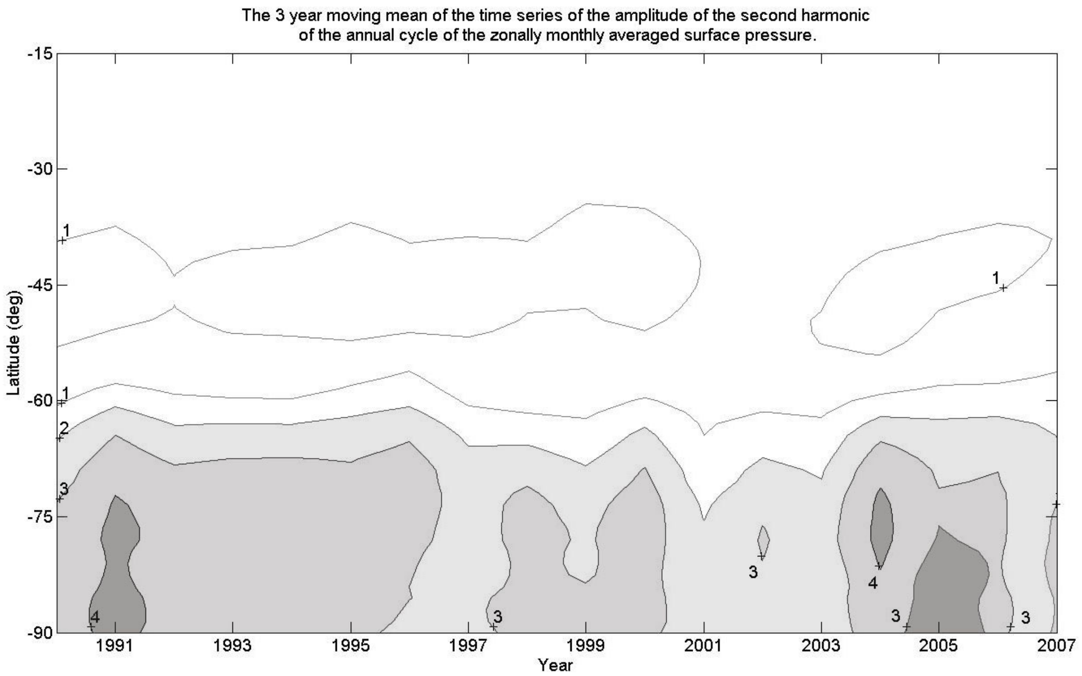

Figure 2: Time-latitude plot of the amplitude (hPa) of the semiannual oscillation in zonally-averaged SP in the ERA-Interim reanalysis. The semiannual mode is calculated from the mean annual cycle calculated over three consecutive years, and the amplitude plotted at the middle of those years.