# Trends in weather parameters at Australian Antarctic bases

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Climate conditions over coastal East Antarctica are being been explored using long time series of surface weather data from Australian manned weather stations, updating the work of Russell-Head and Simmonds (1993). The data used consist of 3 hourly observations (with some gaps) at Casey (1960-2002), Davis (1957-2002), and Mawson (1954-2002). The trends in the seasonal and annual means are presented in Table 1. It shows that no significant seasonal temperature trends are observed at any station over the periods. By contrast, significant annual mean pressure reductions are observed at each station (1% confidence level), with the largest occurring at Casey (1.61 hPa decade$^{-1}$). This station shows significant reductions in every season. The annual mean wind speed Casey and Davis show significant positive trends (0.30 and 0.28 ms$^{-1}$ decade $^{-1}$, respectively), and the upward seasonal tendencies are significant at at least the 5% level for all but Casey in summer. By contrast, none of the weak increases at Mawson can be said to be above the noise level. These trends are consistent with those seen in the Southern Annular Mode (Thompson *et al*. 2000).

| Parameter | Station | Summer | Autumn | Winter | Spring | Annual |
|---|---|---|---|---|---|---|
| Surface pressure | Casey | **-1.79** | **-1.41** | **-1.50** | **-1.14** | **-1.61** |
| | Davis | *-1.02* | *-0.93* | **-1.24** | -0.64 | **-0.96** |
| | Mawson | **-0.84** | -0.49 | *-0.74* | -0.24 | **-0.59** |
| Surface temperature | Casey | -0.11 | 0.01 | 0.36 | 0.10 | 0.02 |
| | Davis | 0.04 | -0.09 | 0.15 | 0.20 | 0.03 |
| | Mawson | -0.08 | -0.20 | 0.03 | -0.04 | -0.10 |
| Surface wind speed | Casey | 0.15 | **0.44** | **0.30** | **0.42** | **0.30** |
| | Davis | **0.29** | **0.27** | *0.21* | *0.26* | **0.28** |
| | Mawson | 0.17 | 0.11 | 0.12 | 0.08 | 0.06 |

**Table 1:** Mean seasonal and annual trends in surface pressure (hPa decade$^{-1}$), surface temperature ($^{o}$C decade$^{-1}$), and surface wind speed (ms$^{-1}$ decade$^{-1}$) at the three coastal Australian Antarctic stations. Trends which differ significantly from zero at the 1% and 5% confidence levels are indicated in **bold** and *italics*, respectively.

Another key aspect of variability identified in the high southern latitudes is the semiannual oscillation (SAO) in surface pressure (Simmonds 2003). Across the Southern Hemisphere in recent times this feature was strong during the 1970s, weakened towards the early 1980s and remained relatively weak into the early 1990s (Simmonds and Jones 1998, Meehl *et al*. 1998).

We here use our most recent station data to diagnose the SAO separately over the three or four decades to the end of 1999. Table 1 shows when diagnosed over the entire 1990s the SAO exhibited amplitudes close those of the 1970s (indeed slightly larger at Davis). Similarly, the percentage variance of the mean annual cycle explained by the SAO was large in the 1990s, and represents a significant recovery from the small values during the 1980s.

| Decade | Amplitude (hPa) | % variance |
|---|---|---|
| | **Casey** | |
| 1960-69 | 3.4 | 55.1 |
| 1970-79 | 3.7 | 63.1 |
| 1980-89 | 2.9 | 38.6 |
| 1990-99 | 3.5 | 62.6 |
| | **Davis** | |
| 1970-79 | 2.5 | 48.4 |
| 1980-89 | 2.0 | 24.1 |
| 1990-99 | 2.7 | 46.9 |
| | **Mawson** | |
| 1960-69 | 2.2 | 29.4 |
| 1970-79 | 2.1 | 32.6 |
| 1980-89 | 1.5 | 15.9 |
| 1990-99 | 2.1 | 31.4 |

**Table 2:** Decadal variations in the amplitude of the surface pressure amplitude of the SAO, and the percentage variance explained of the mean decadal annual cycle by the SAO at the three coastal Australian Antarctic stations.

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