

Sixty Years of Widespread Warming in the Southern Mid- and High-Latitudes (1957-2016)

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Two studies have documented cooling on the Antarctic Peninsula since the late 1990s, opposing the general longer-term warming trend previously reported for this region. Multi-decadal temperature trends in West Antarctica are more difficult to evaluate with Byrd as the only long-term station in the area, compared to many long-term staffed stations on the Peninsula. This study places temperature changes in the Antarctic Peninsula and West Antarctica into a larger spatial and temporal perspective, predominantly focusing on monthly station-based surface temperature observations since 1957 across the extratropical Southern Hemisphere. SST data and MSLP reanalysis data are also utilized to identify long-term patterns influencing surface temperatures. The results confirm statistically significant cooling in station observations and SST trends throughout the Antarctic Peninsula region over recent years (1999-2016). However, the full 60-year period shows statistically significant, widespread warming across most of the Southern Hemisphere mid- and high-latitudes. Positive SST trends broadly reflect these warming trends, especially in the mid-latitudes. Furthermore, the dominant influence of the Southern Annular Mode (SAM) on southern high-latitude climate variability, the positive SAM trend in recent decades, and the related cooling over East Antarctica are all confirmed. When the influence of the SAM is removed from the station temperature records, statistically significant background warming across all of the extratropical Southern Hemisphere is found, including East Antarctica. If future Antarctic stratospheric ozone recovery causes the SAM to trend more neutral, this background warming could become more evident and have greater implications for global climate.