

# **Climate changes in the Atlantic Sector of Antarctica over The Past 500 Years from Ice-Core and Other Evidence**

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## **Abstract**

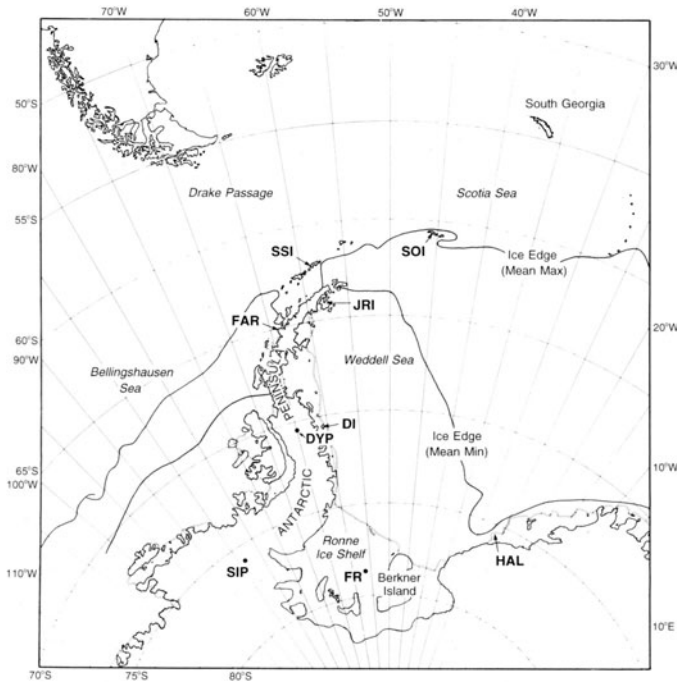
Evidence from ice cores, borehole temperatures, early expeditions and glacier margins is used to identify the major climate trends of the past 500 years in the Antarctic Peninsula region. Apparent conflicts between the different data sources are exposed and causes discussed. Ice-core records from areas influenced by the Weddell Sea appear to be strongly sensitive to ice-edge effects, which can be detected in the profiles of deuterium excess and methane sulphonic acid. The various data now appear to be consistent with a scenario where conditions during the mid-19th century to 1940's period was fairly cool until the onset of the recent extensive warming in the post-1940's period. The coldest period of the past 300 years appears to have occurred around 1760-1780, associated with strong disturbances in the atmospheric circulation in the Weddell Sea region. This may be contemporaneous with a rather stronger cold anomaly previously observed at Law Dome and suggested for ice cores recovered elsewhere in East Antarctica.

## **Introduction**

### *Climate Regime of the Atlantic Sector of Antarctica*

Instrumental temperature records for Antarctica show no significant correlation with records from the rest of the hemisphere (Jones et al. 1986). In part this reflects the strong zonal circulation around the continent. On the other hand, the vast and unconstrained sea-ice cover surrounding the continent provides an active thermodynamic and dynamic link to the ocean and atmosphere circulations of lower latitudes (Carleton, 1992).

In areas adjacent to the Weddell Sea, including the Antarctic Peninsula (Fig. 1), the climate is dominated by the Southern Hemisphere westerlies and by the distribution and extent of the Weddell Sea pack-ice zone (Schwerdtfeger, 1984). The mountain spine of the Antarctic Peninsula presents a topographic barrier to the westerly circulation, resulting in a strong east to west temperature gradient, with mild, maritime conditions on the west and a colder, more continental climate to the east where conditions are dominated by the advection of water and ice in the Weddell Sea.



**Figure 1:** The Antarctic Peninsula and Weddell Sea region showing the locations of the drilling sites and weather stations cited in the text. FAR: Faraday; SOI: South Orkney Island; DI: Dolleman Island; JRI: James Ross Island; FR: Filchner-Ronne; DYP: Dyer Plateau; SIP: Siple; SSI: South Shetland Island. The mean position of the annual maximum and minimum sea-ice edge is taken from US Naval Oceanography Command, 1985.

Thus temperatures in the Antarctic Peninsula region are subject to much greater interannual variability than elsewhere in Antarctica, and larger temperature trends during the last century have also been recorded in this region (Sansom, 1989; King, 1994). Finally, it should be noted that during the period of instrumental observations (mainly