

Interdecadal Climate Variability over Antarctica and Linkages to the Tropics: Analysis of Ice Core, Instrumental, and Tropical Proxy Data for the 19-20th Centuries

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The Antarctic continent holds most of the global ice and plays an important role in a changing climate. The nature and cause of Antarctic climate variability is, however, poorly understood beyond interannual time scales due to the paucity of long, reliable meteorological observations. The present study analyzes low-frequency climate variability over Antarctica using a network of annually-resolved ice core records and various instrumental and proxy data for the 19-20th centuries. During the 20th century, Antarctic ice core records indicate strong linkages to sea surface temperature (SST) variations in the tropical Pacific and Atlantic on decadal-interdecadal time scales. Antarctic surface temperature anomalies inferred from the ice cores are consistent with the associated changes in atmospheric circulation and thermal advection. A set of atmospheric general circulation model experiments supports the idea that the low-frequency SST variations in the tropics force atmospheric teleconnections that affect Antarctic surface temperatures. When coral records are used as proxies of tropical SSTs, similar Antarctic-tropical linkages are identified for the past two centuries. Over the past 50 years, a change in the phase of Pacific and Atlantic interdecadal variations may have contributed to the rapid warming of the Antarctic Peninsula and West Antarctica.