Interdecadal Climate Variability over Antarctica and Linkages to the Tropics*

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* Manuscript will be available shortly
Interdecadal Climate Variability and Trend

Antarctic Climate

Atmospheric Bridge

Tropical SST

El Nino-Southern Oscillation
(e.g., Turner et al. 2004)

Pacific Decadal Oscillation
(e.g., Garreaud and Battisti 1999)

Antarctic Instrumental Data

Antarctic Ice Core Records

Year

1900 1957 2011
Analysis of Low-frequency Antarctic Climate Variability

Detrend &
Light Temporal Smoothing
Focus on time scales beyond ENSO

Ice Cores
$\delta^{18}O$ or $\delta D \propto$ Temp
Annual
1900~1981: 17 cores
1799~1981: 6 cores

Global Instrumental Data
Monthly → Annual
HadISST (1870-2010)
HadSLP2 (1850-2004)
Hulme Precip (1900-98)
One-Point Correlation Analysis

Individual Ice Core Record

Temporal Correlation 1900-1981

Global Sea Surface Temperature
Ice Core-Global SST One-Point Correlation Map (1900-1981)

Pacific Decadal Oscillation

Atlantic Multidecadal Oscillation

95% Significance

95% Significance
One-Point Correlation Analysis

Antarctic Ice Core  \( \rightarrow \)  Tropical Sea Surface Temperature

Objective Analysis

Singular Value Decomposition (SVD) Analysis

(Bretherton et al. 1992)
SVD Analysis of Ice Core and Tropical SST (1900-1981)

Correlation: Ice Core, Sea Surf Temp & Precipitation (Wet/Dry)

SVD Mode 1 (50%)
Pacific Decadal Oscillation

SVD Mode 2 (25%)
Atlantic Multidecadal Oscillation

ICE Tropical SST

H


r=0.72


r=0.75

ICE Tropical SST

H

Wet
Dry
Going Further Back in Time…

- Instrumental Sea Surface Temperature
  - 1799: 6 Records
  - 1900: 17 Records
  - 1981: 34 Records

- Ice Core
- Tropical Proxy (Coral, Ice Core, Tree Ring & Ocean Sediment)
- Wilson et al. (2010)

SVD Analysis
SVD Analysis of Ice Core and Tropical Proxy (1900-1981)

Correlation: Ice Core, Tropical Proxy & Sea Surf Temp

**SVD Mode 1 (30%)**
Pacific Decadal Oscillation

**SVD Mode 2 (22%)**
Atlantic Multidecadal Oscillation

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ICE Tropical Proxy

- Correlation: r=0.79

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ICE Tropical Proxy

- Correlation: r=0.71
SVD Analysis of Ice Core and Tropical Proxy (1799-1981)

Correlation: Ice Core, Tropical Proxy & Sea Surf Temp

SVD Mode 1 (52%)
Pacific Decadal Oscillation

SVD Mode 2 (13%)
Atlantic Multidecadal Oscillation?

ICE Tropical Proxy

1800 1900

1800 1900
Summary

- Antarctic climate is strongly linked to the sea surface temperature variations in the tropical Pacific and Atlantic on decadal-interdecadal time scales.

- The decadal changes in tropical sea surface temperature force atmospheric teleconnections and affect Antarctic temperature.