Reconstructing Climate Change over Decadal Timescales
Decadal scale variability

Ruddiman, 2001
El Niño Year

Ruddiman, 2001
Southern Oscillation
Monthly Mean SST 2°S to 2°N Average
Galapagos Coral and Instrumental Record

Ruddiman, 2001
Reconstructed SST for Galapagos Region

Ruddiman, 2001
Qualitative Data:
Historical El Niño Records

Ruddiman, 2001
Laguna Pallcacocha, southern Ecuador

- Elev. 4,200m
- 0.5km Andean divide
- Steep headwall with loose debris

Image: Chris Moy
Laguna Pallcacocha

Moy et al., 2002
Teleconnection

• The term "teleconnection pattern" refers to a recurring and persistent, large-scale pattern of pressure and circulation anomalies that spans vast geographical areas.

• E.g. The most emblematic teleconnection is that linking sea-level pressure at Tahiti and Darwin, Australia, which defines the Southern Oscillation.
Fig. 1. Correlation coefficients computed between the winter SOI and selected moisture-sensitive tree-ring chronologies for the period 1900 to 1971 (the chronologies were not prewhitened, and four of the Mexican chronologies were indicated by sign only).

Fig. 5. Reconstructed winter SOI from 1699 to 1971. The solid line is the regression-based reconstruction, the symbols (defined in Fig. 3) represent years classified by the discriminant function as positive and negative winter SOI extremes. Note the asymmetry in the classified positive (23) and negative extremes (33) and the increased frequency of classified and regression-estimated SOI extremes after 1850.
Fire and ENSO

Fig. 1. Map of southwestern United States showing National Forest boundaries and locations of precipitation stations, fire scar, and tree growth chronologies used in the study.

Fig. 2. Time series of percentage of trees scarred and tree ring growth in Arizona and New Mexico. First differences [value (year $t$) − value (year $t-1$)] were computed to emphasize year-to-year changes and deemphasize trends in the data. Spearman rank correlation for the period 1700 to 1905 is 0.551 ($P < 0.001$).
FIGURE 10.27  Tree-ring anomalies across western North America associated with the high and low phases of the Southern Oscillation. The pattern on the left is associated with El Niños; teleconnections lead to heavier winter and spring rainfall in northern Mexico and the U.S. Southwest. By contrast, cold events in the Pacific (La Niñas) are associated with drier conditions and reduced tree growth in the same region (Lough, 1992).
Impacts of La Niña

S. California

Lake Mead

NASA

Glen MacDonald