Keep Your Eye on the Puck!

Proxy records and their role in estimating climate change.
Hockey Sticks

- **Surface Temp Reconstructions**
  - Medieval Climate Anomaly (MCA)
  - Little Ice Age (LIA)
  - Northern Hemisphere (NH) Mean
  - Atlantic Multi-decadal Oscillation (AMO) Region

![Map showing the AMO Region](AMO_Region.png)

Mann 2009
Hockey Sticks

- MCA and LIA
- Important Niño3 Region
  - Notice how small it is
  - Can cause drought in the Western US

PDO Region

Niño3 Region

Mann 2009
What are proxy records?

- **Tree Ring/MXD**
  - Timescale <2,000 yr locally
  - Other environmental factors?

- **Ice Core**
  - Timescale ~500 kyr locally
  - $\delta^{18}O$ ratios
  - Ice age vs. air age discrepancy
    - E.g. Vostok core = 7,000 yr

![CROSS SECTION of a CONIFER](http://www.noaanews.noaa.gov/stories/images/treeringsections.jpg)

![Proxy Records](http://images.aad.gov.au/img.py/547f.jpg)
What are proxy records?

- Coral³ ~350 yr
- Speleothem⁴ <500 kyr
- Document
- Sediment
- Composite
Proxy Record Problems

- Questions
  - Northern Hemisphere vs. Southern Hemisphere
  - MCA vs. LIA
  - Location
    - Scarcity and geography
  - No data over oceans
- **Reconstruction plots**
  - Based on modern (1961-1990) mean
  - How do they fill in the gaps?
    - Gray hatch marks = unable to calibrate with modern long-term data

- **Reconstruction plots (cont’d)**
  - Gaps (cont’d)
    - Calibrate based on spatial temps
  - Warmth south of Greenland
  - Non-linear scale
Proxy vs. Model

- **Proxy**
  - La Niña

- **GISS**
  - No volcanic forcing
  - Spatial Patterns
  - Height = 80km

- **NCAR**
  - Solar + Volcanic Forcing
  - Height = 36km

All include 0.37 W/m² solar radiative forcing in MCA vs. LIA.
Mann, et al. claims the warming of the MCA is a dynamical result of the solar forcing during the time.
- Caution must be taken with model data

If anthropogenic climate change is affected in the same way as warming was during the MCA-LIA period, it could have serious consequences on regional climate such as drought patterns.
References


