A bit of Palaeoclimate

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Introduction

- What is it?
- Why bother?
- How do people do it?
- Isn't this really hard?
- Unresolved issues and a controversy

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- In principle, entire history of the planet.
- In practice, not the entire history of the planet.

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- Climate sensitivity

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3. Infer relationship between the two
4. Proxy data + inferred relationship $\rightarrow$ infer past climate

How do people do it?

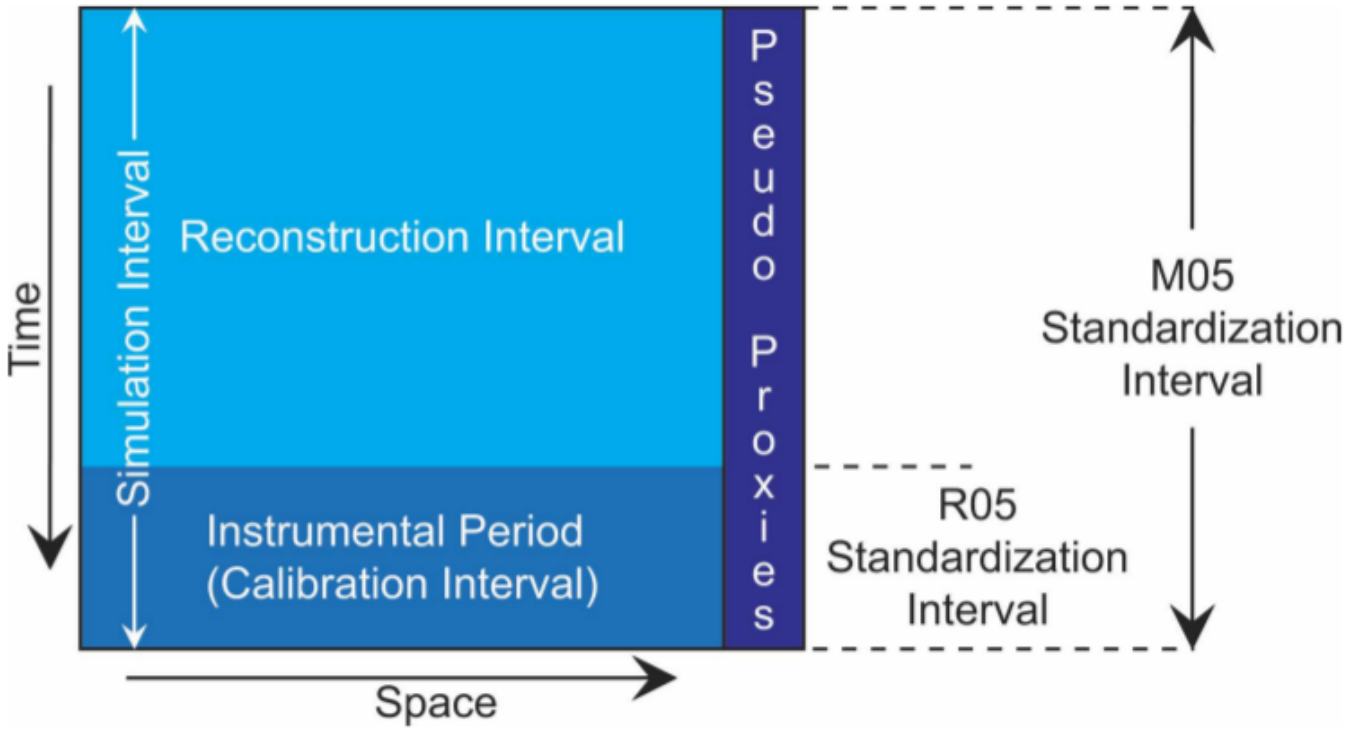

Figure 1: [Smerdon and Kaplan, 2007]

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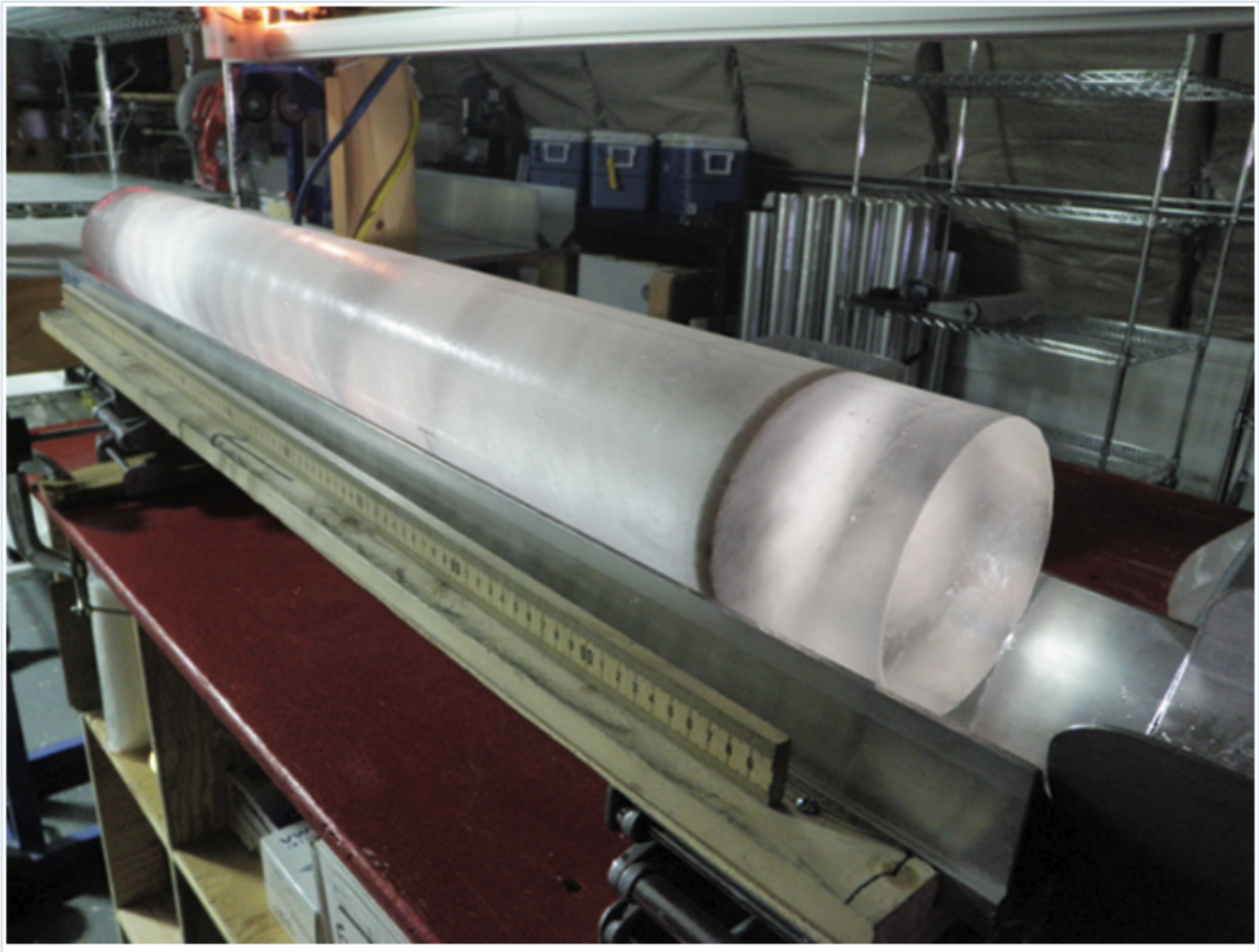

The dark band in this ice core from the West Antarctic Ice Sheet Divide (WAIS Divide) is a layer of volcanic ash that settled on the ice sheet approximately 21,000 years ago.
—Credit: Heidi Roop, NSF

Figure 2: An ice core: `https://icecores.org/icecores/`

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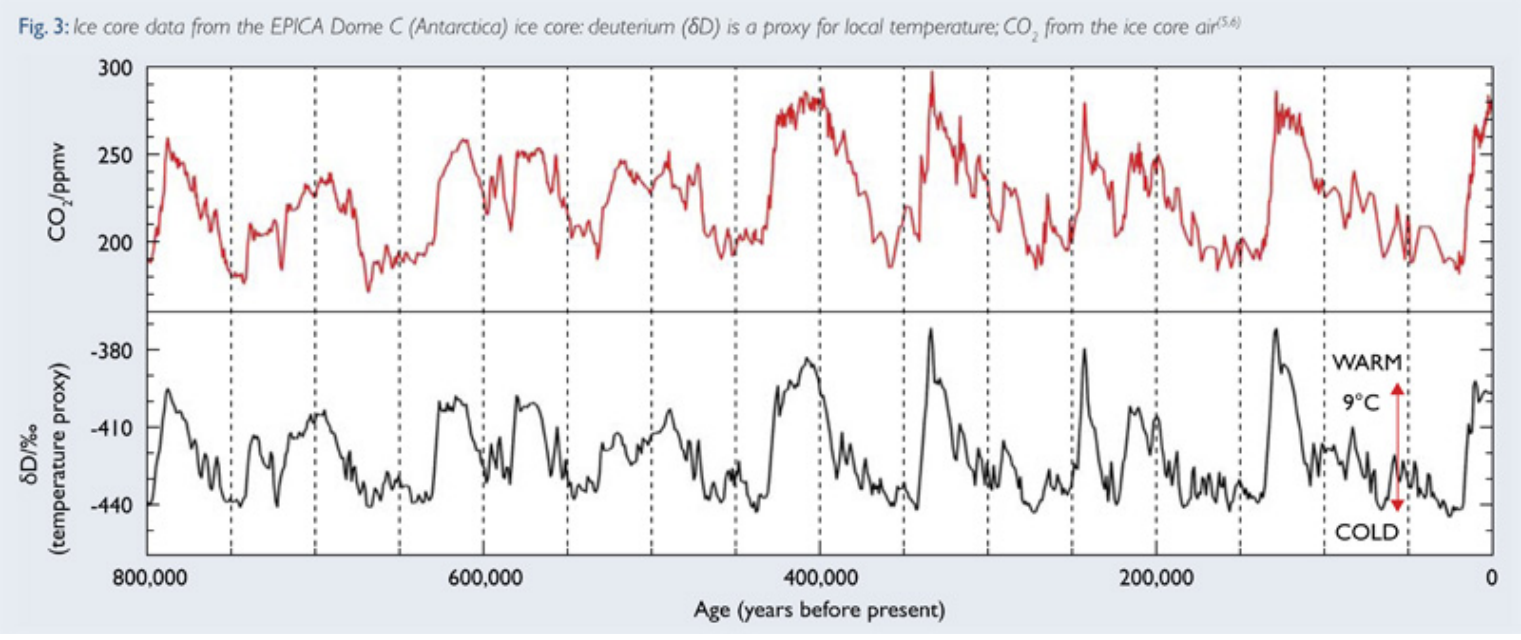

Figure 3: `https://www.bas.ac.uk/data/our-data/publication/ice-cores-and-climate-change/`

How do people do it?

Usual assumptions:

- Relationship between proxy and direct is stationary
- Linearity
- Preprocessing steps are reasonable

Isn't this really hard?

- Yes

Unresolved / contentious issues

- "Hockey Stick Curve"
- [Mann et al., 1998] - temperatures for last 800 years
- [Mann et al., 1999] - temperatures for last 1000 years
- 2001 IPCC report

Unresolved / contentious issues

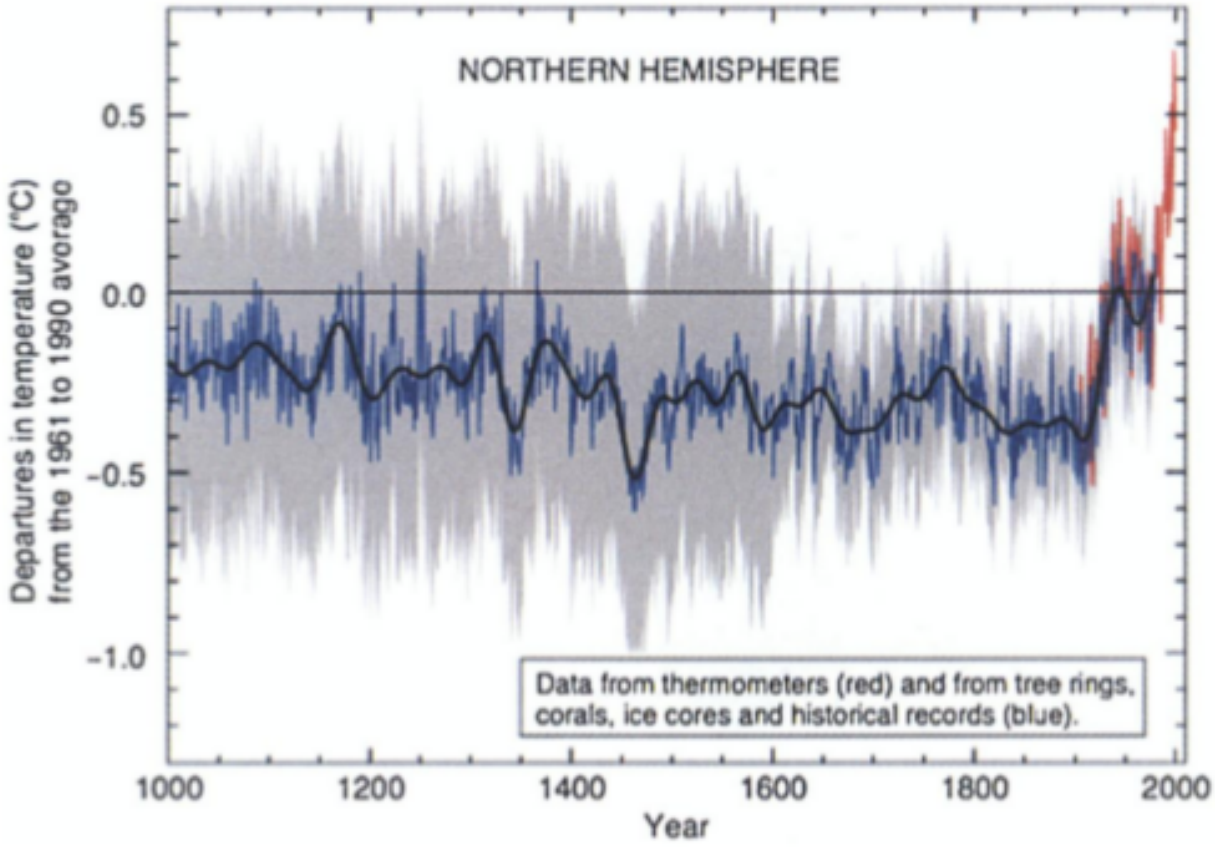

FIG. 1. *Multiproxy reconstruction of Northern Hemisphere surface temperature variations over the past millennium (blue), along with 40-year average (black), a measure of the statistical uncertainty associated with the reconstruction (gray), and instrumental surface temperature (red), based on the work by Mann, Bradley and Hughes (1999). This figure has sometimes been referred to as the "hockey stick." Source: IPCC (2001).*

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- No actual wrong-doing
- Minimal effect of public opinion (maybe) [Anderegg and Goldsmith, 2014]

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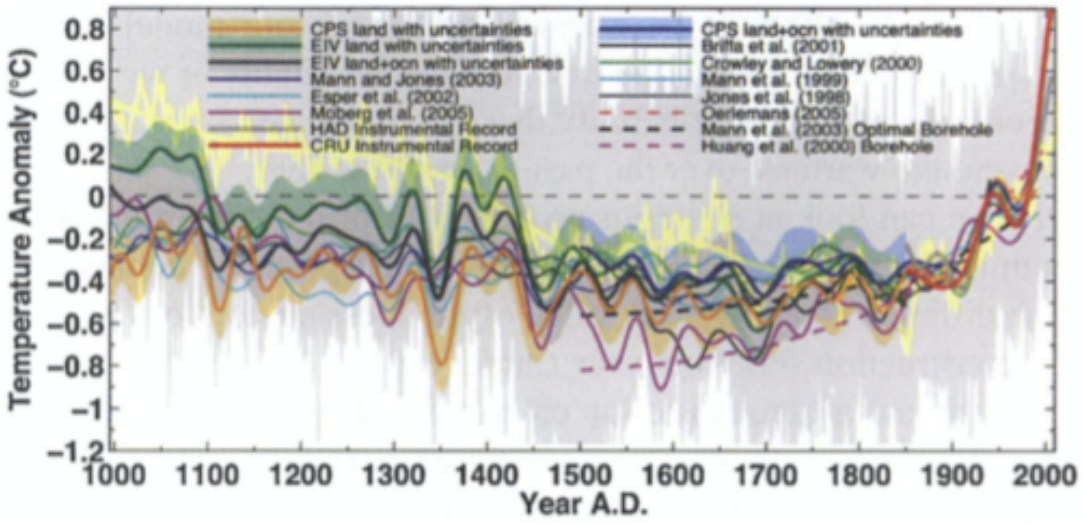

FIG. 17. *This figure modifies Figure 3 from Mann et al. (2008). We take that figure and superimpose the backcast from Bayesian model of Section 5. The backcast is given by the thin yellow line, the smoothed backcast by a thick yellow line, and the backcast error in gray.*

Figure 4: [McShane and Wyner, 2011] + rejoinder


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