Global Warming
Lecture 2.2
The Temperature Record

Temperatures throughout Earth history

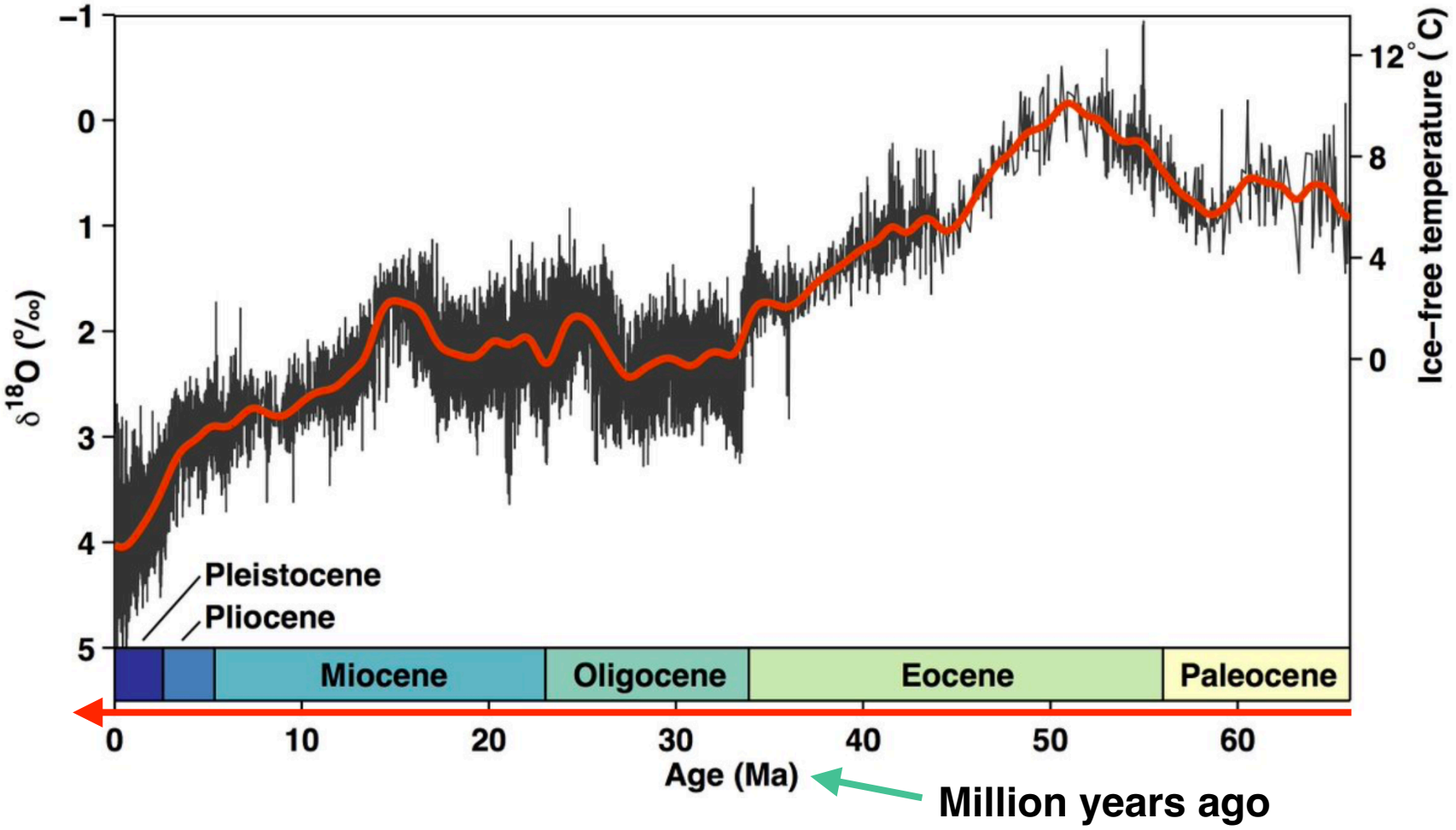
A few times hundreds of million years ago

Now

50 million years ago

Temperatures throughout Earth history

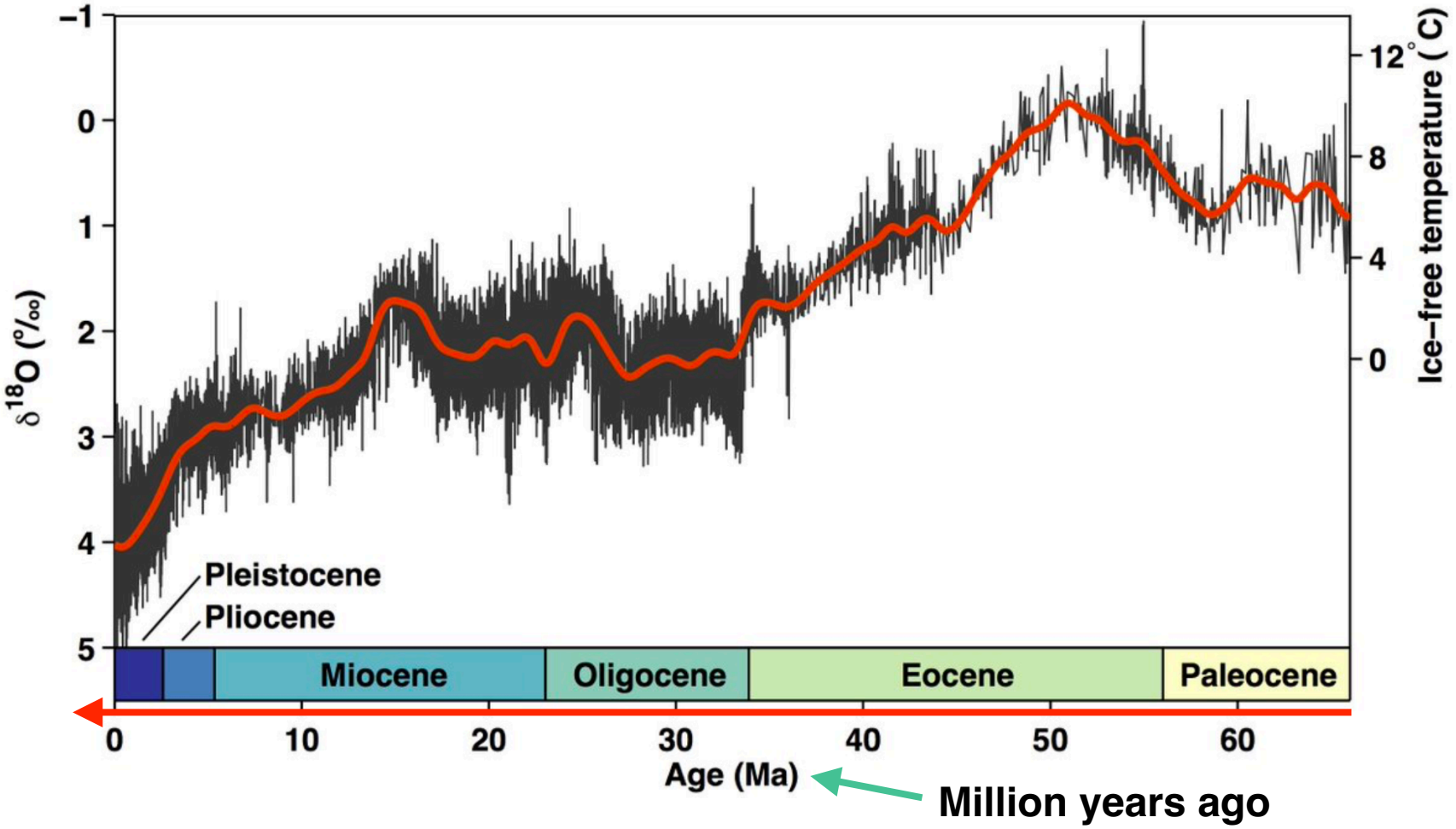
The Zachos Curve



Temperatures throughout Earth history

Small variations in isotope of O_2: Gives you ice-free temperature OR rough amount of ice

The Zachos Curve



Million years ago

Temperatures throughout Earth history

The Zachos Curve

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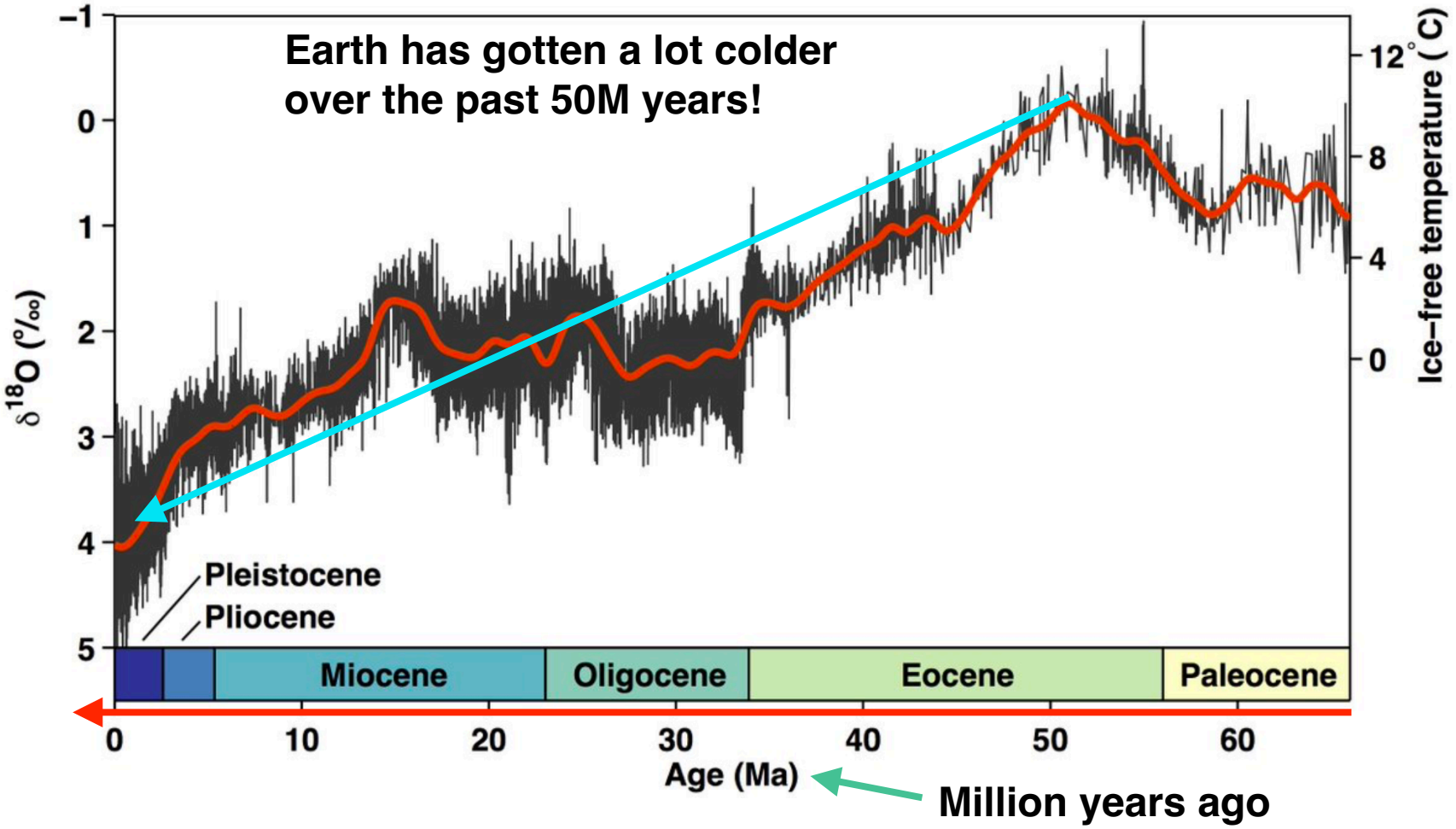

Temperatures throughout Earth history

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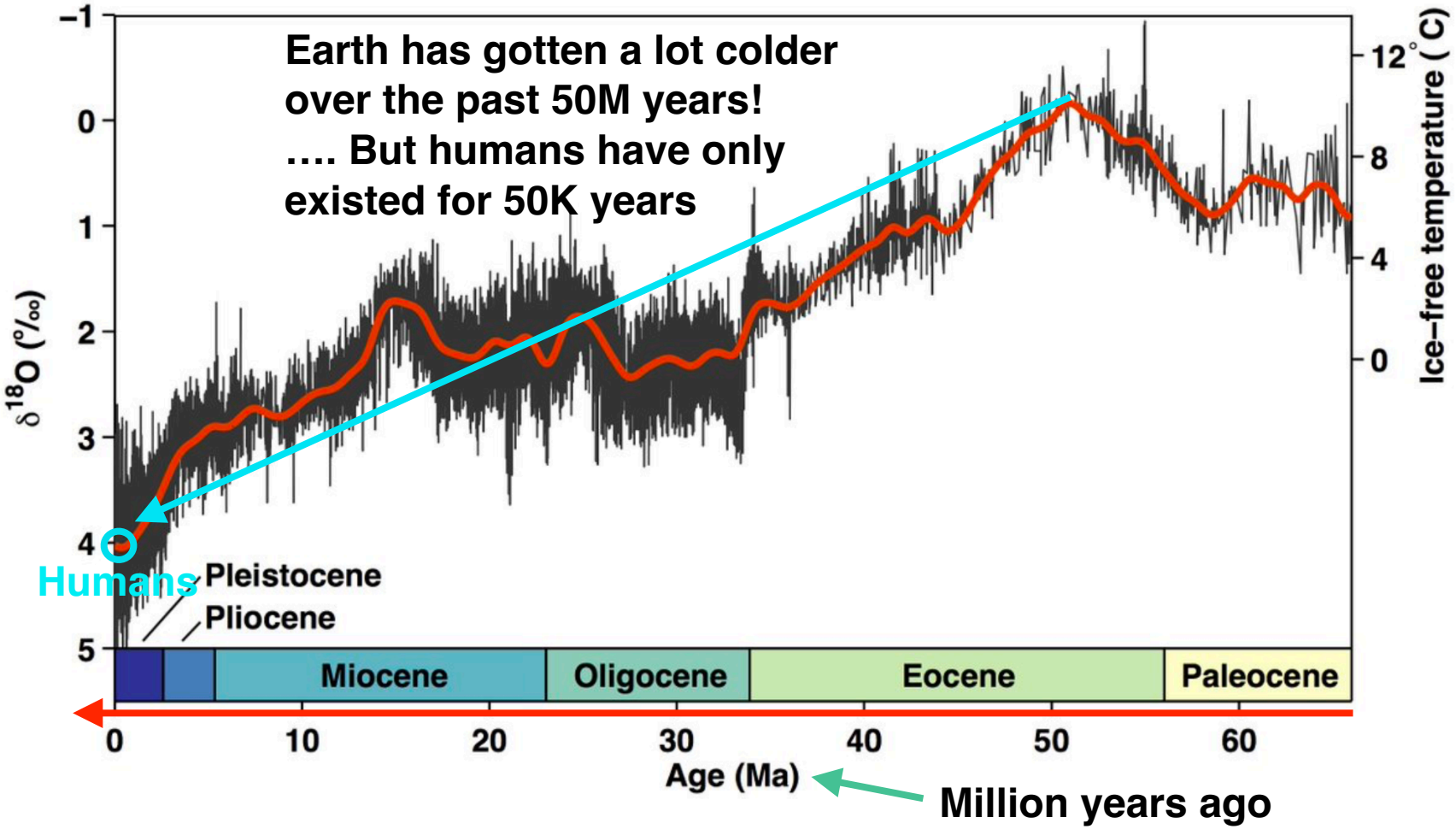

How to read a scientific paper

1. **Read the title of the paper:** What's the main point?
2. **Read the abstract carefully:** What's the main problem, approach and results?
3. **Scan through the figures:** What story is the figure telling? What's the main conclusion of each figure? 5-10min on this!
4. **Start answering the questions:** You'll know which figure to go to, now read its caption in more detail.

http://static.berkeleyearth.org/papers/Results-Paper-Berkeley-Earth.pdf

Abstract

We report an estimate of the Earth's average land surface temperature for the period 1753 to 2011. To address issues of potential station selection bias, we used a larger sampling of stations than had prior studies. For the period post 1880, our estimate is similar to those previously reported by other groups, although we report smaller uncertainties. The land temperature rise from the 1950s decade to the 2000s decade is 0.90 ± 0.05°C (95% confidence). Both maximum and minimum daily temperatures have increased during the last century. Diurnal variations decreased from 1900 to 1987, and then increased; this increase is significant but not understood. The period of 1753 to 1850 is marked by sudden drops in land surface temperature that are coincident with known volcanism; the response function is approximately 1.5 ± 0.5°C per 100 Tg of atmospheric sulfate. This volcanism, combined with a simple proxy for anthropogenic effects (logarithm of the CO_2 concentration), reproduces much of the variation in the land surface temperature record; the fit is not improved by the addition of a solar forcing term. Thus, for this very simple model, solar forcing does not appear to contribute to the observed global warming of the past 250 years; the entire change can be modeled by a sum of volcanism and a single anthropogenic proxy. The residual variations include interannual and multi-decadal variability very similar to that of the Atlantic Multidecadal Oscillation (AMO).

Keywords: Global warming; Kriging; Atlantic multidecadal oscillation; Amo; Volcanism; Climate change; Earth surface temperature; Diurnal variability