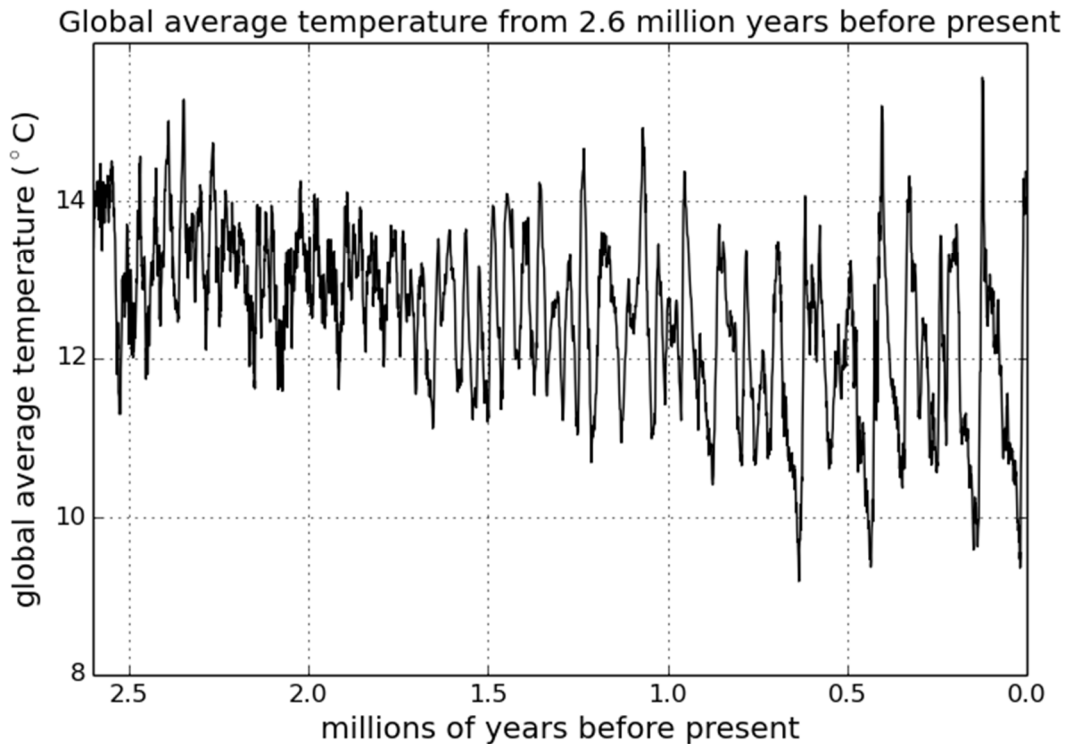


## Mid-Pleistocene Transition.



data: Zachos et al 2008,  
Nature doi:10.1038/nature06588

The planet has gradually cooled since the warmth of the Eocene (around 50 million years ago). This is associated with long-term geological process slowly drawing down carbon dioxide out of the atmosphere. The cooling has not been smooth however, with several transitions identified in the system caused by climate feedbacks (often involving ice). First Antarctica became glaciated around 35 million years ago; then land ice became common in the Northern Hemisphere around 2.7 million years ago. Initially, the amount of ice in the Northern Hemisphere was driven by variations in the obliquity of the Earth's orbit (one of the Milankovitch Cycles) - giving roughly 40,000 year long glacial cycles. Yet as we entered into the past 1 million years, these cycles became visibly longer. Each of the past 8 glacial cycles has lasted around 100,000 years instead of 40,000.

The reason behind this shift is unclear and university geographers are still arguing on the topic. It is clear that the size of the ice-sheets in the more recent 100,000 year world are larger.

Possible mechanisms are:

- A). The ice moves more slowly over land, because all the slippery soil had been worn away and left just bedrock underneath the ice sheets. It therefore builds up higher as less of it gets to the melting zone.
- B). Changes in the ocean circulation put it past an unknown threshold - probably in the Southern Ocean.
- C). Changes in the dustiness of the atmosphere (associated with long term shift in the vegetation on land).

But perhaps more interesting is trying to think about why the shift happened. Geographers are debating this point too. However there seems to a general consensus that if the geological drawdown of carbon dioxide had been allowed to continue, the Earth would eventually reach a state of permanent ice-cover. Whether that would have been in 100,000 or 2 million is purely academic - humans' greenhouse gas emissions have sent the Earth's climate in a completely different direction.