

Analysis Methods in Atmospheric and Oceanic Science

AOSC 652

Review of Assignment #9

Week 10, Day 3

4 Nov 2016

AOSC 652: Analysis Methods in AOSC

Fourier Series and Spectral Analysis

The Earth's orbit varies on periods of:

100,000 years

41,000 years

23,000 years

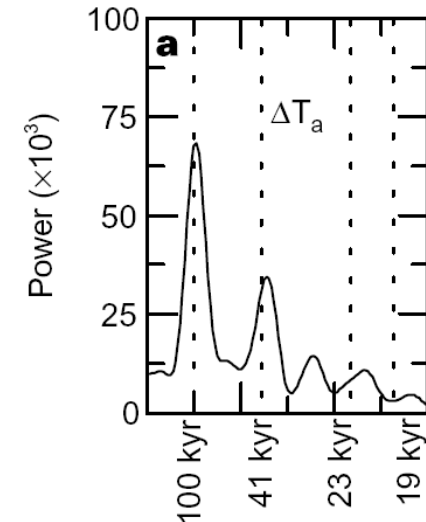
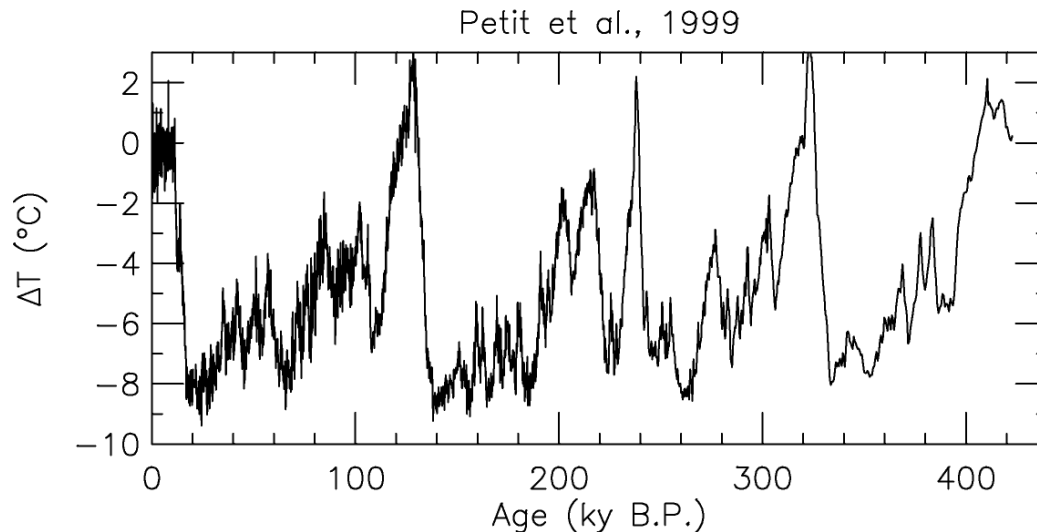
19,000 years

due mainly to the gravitational pull of other planets

Remarkably, these periods are embedded in Earth's long term climate record

Paleoclimate Temperature Record From The Vostok Ice Core

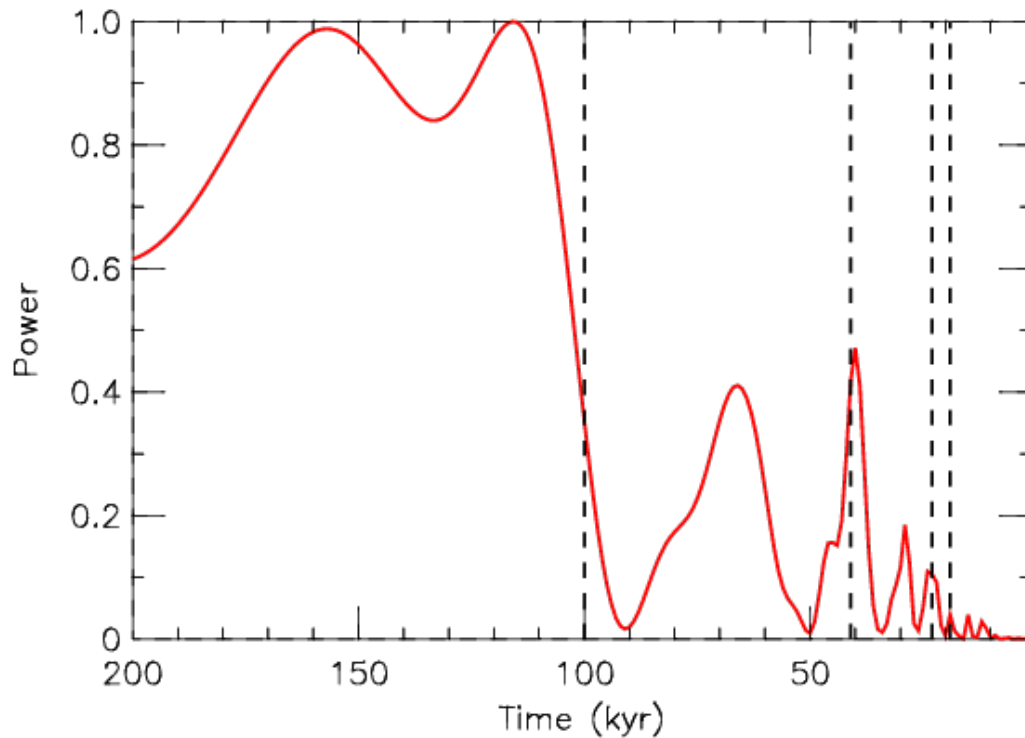
Petit *et al.*, *Nature*, 1999.



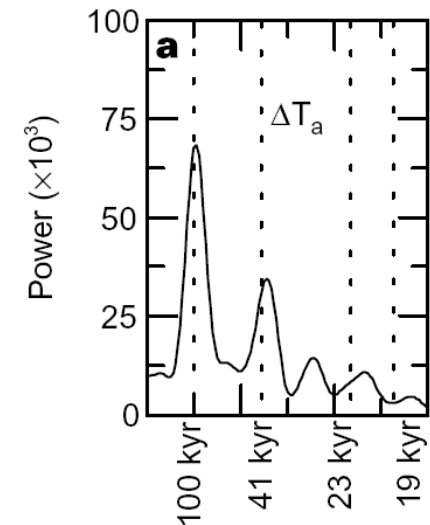
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Fourier Series and Spectral Analysis

Power Spectrum : Petit et al., Nature, 1999
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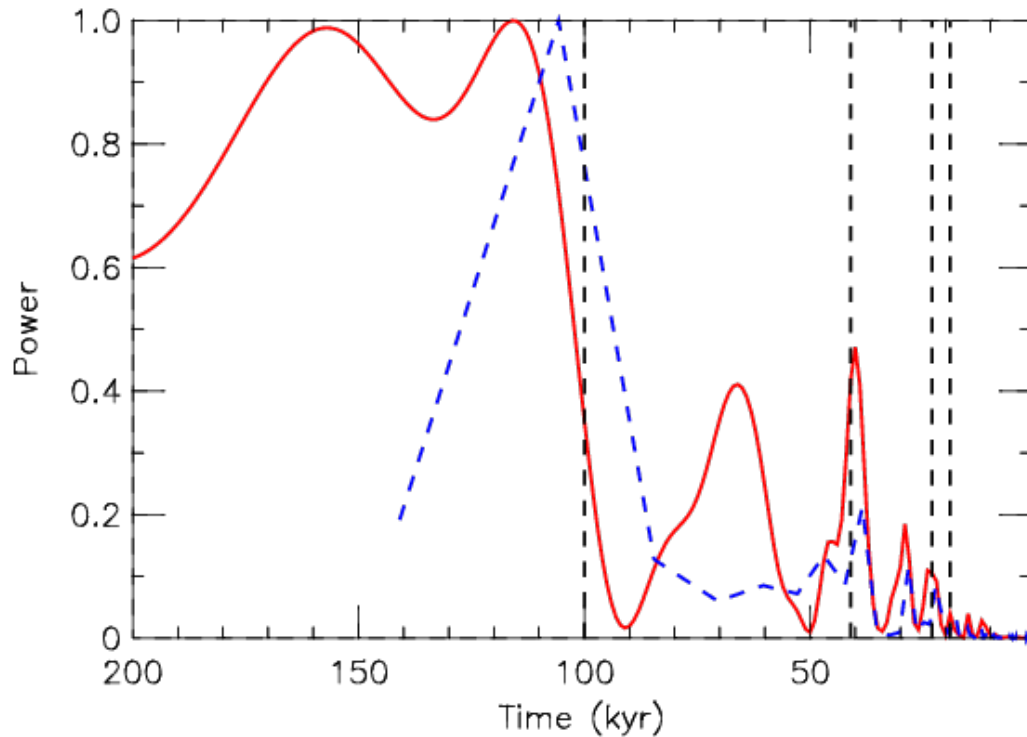
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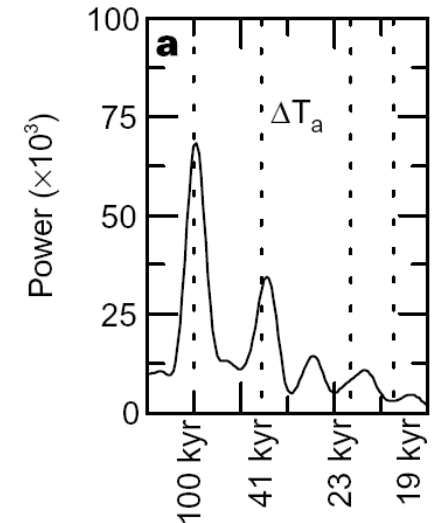
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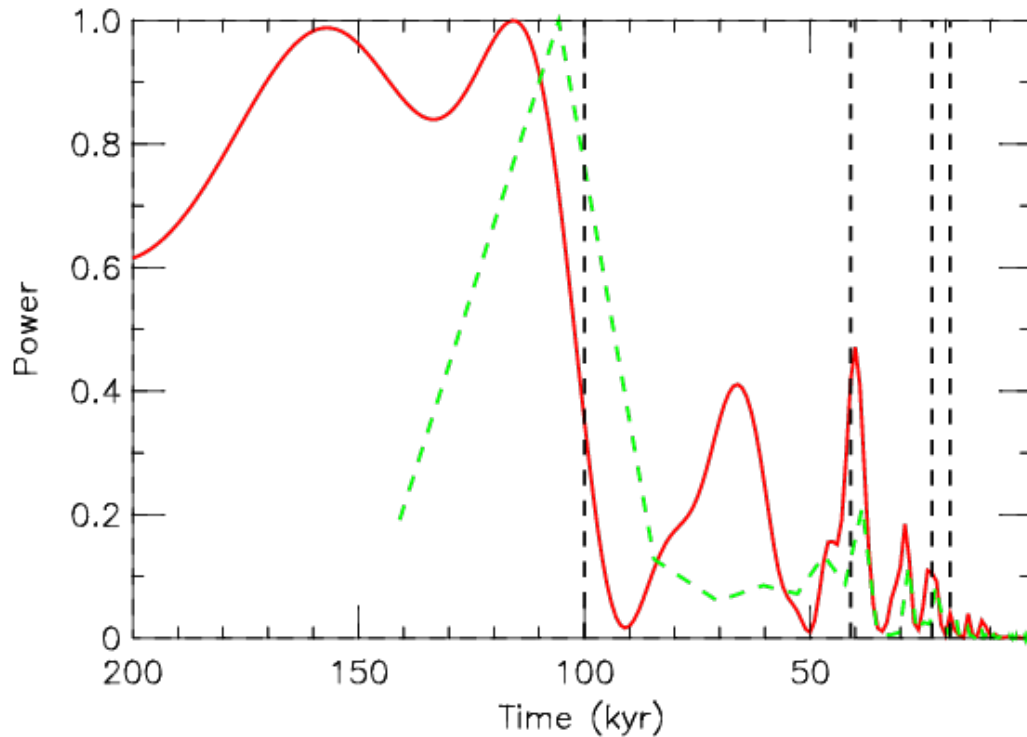
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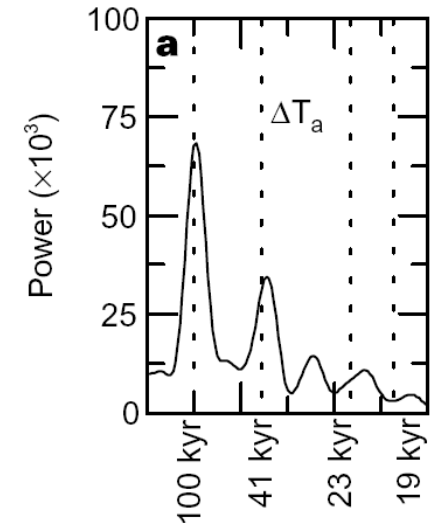
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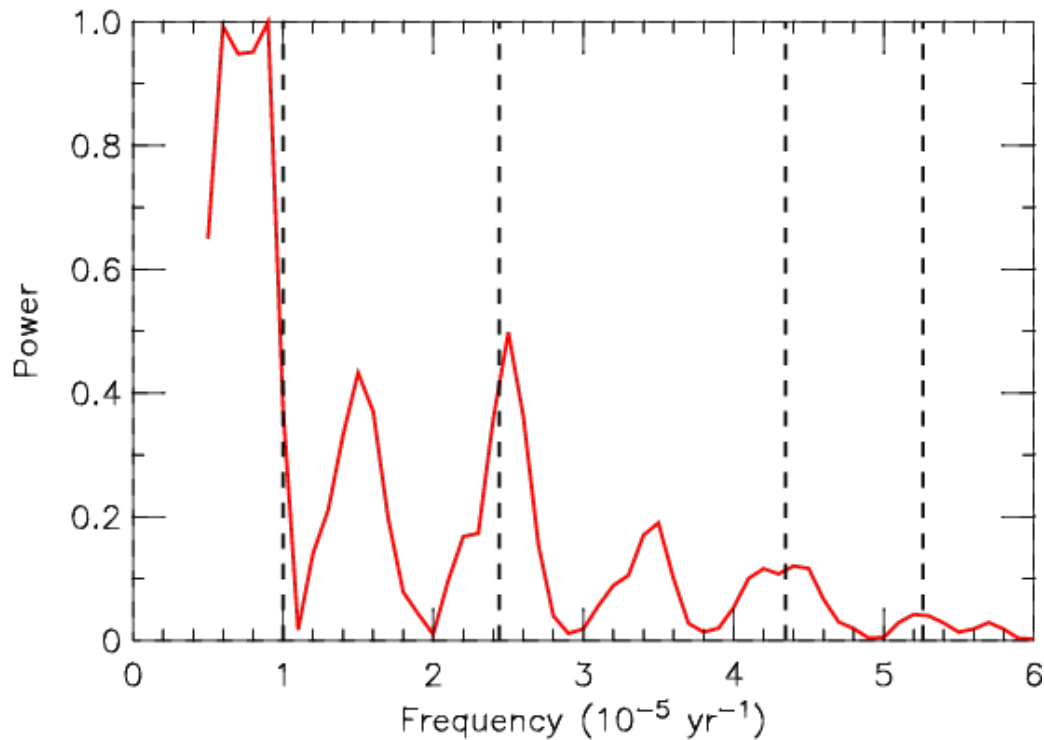
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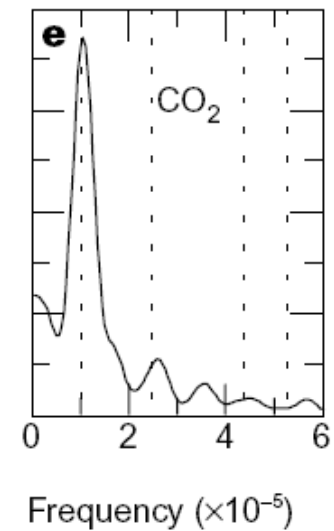
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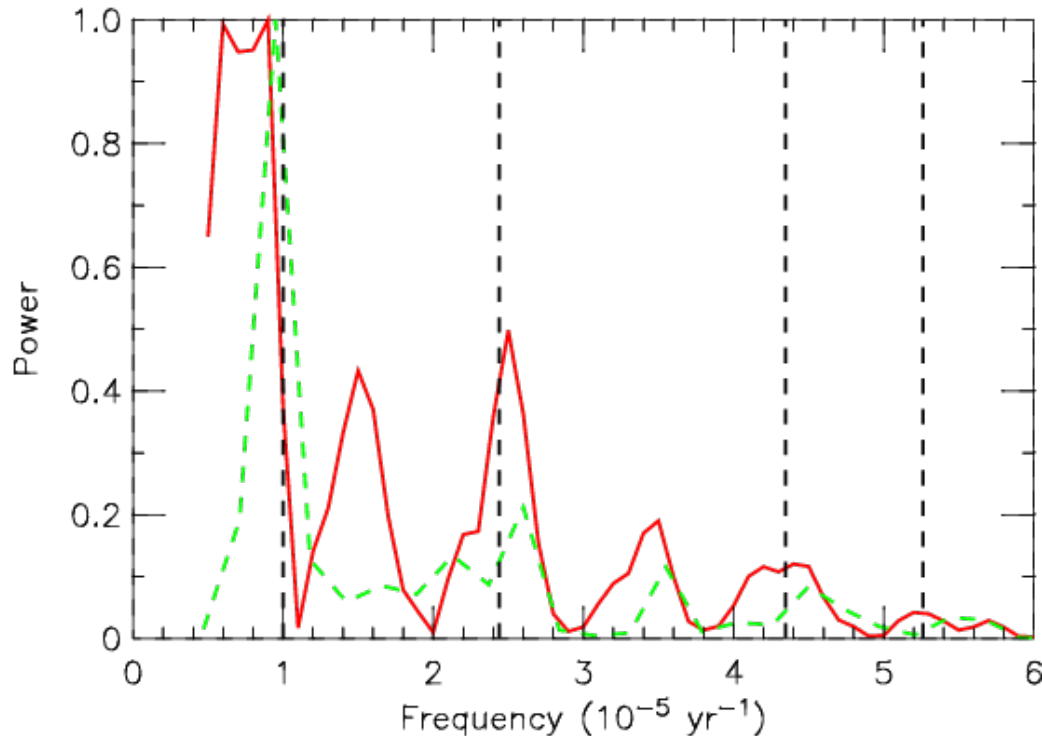
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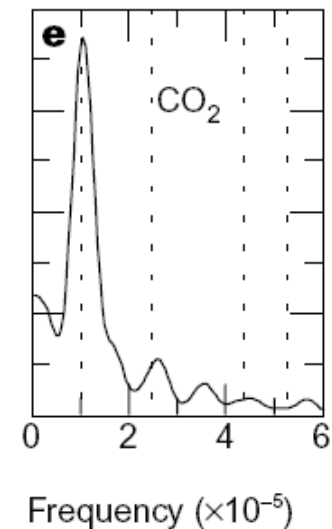
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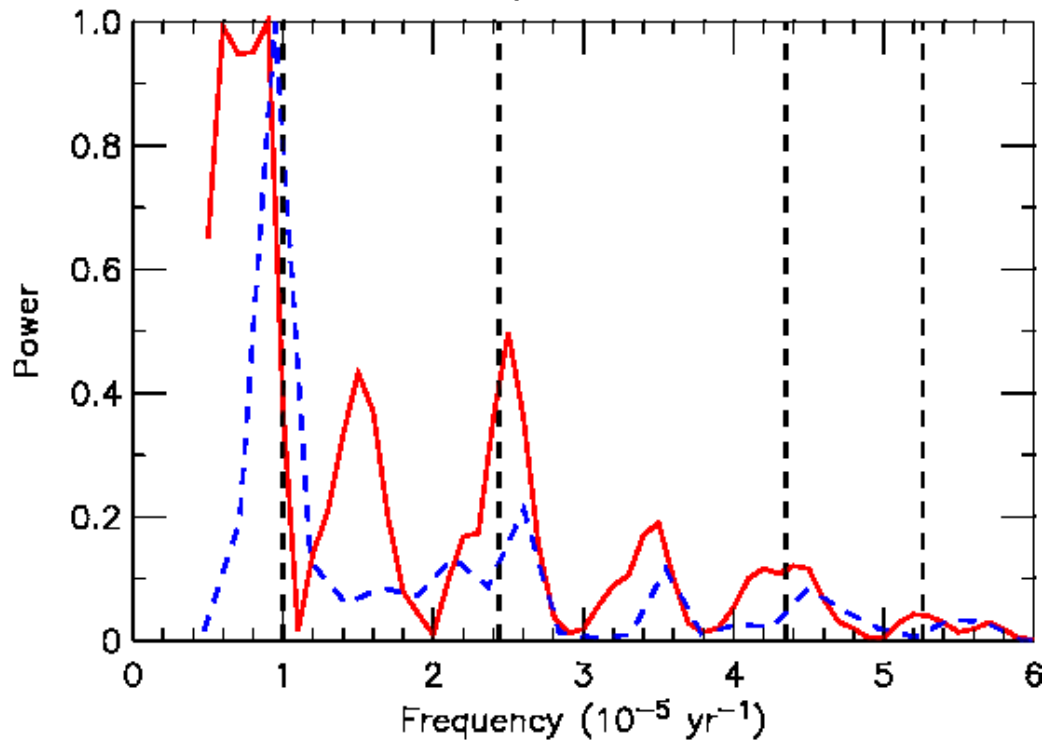
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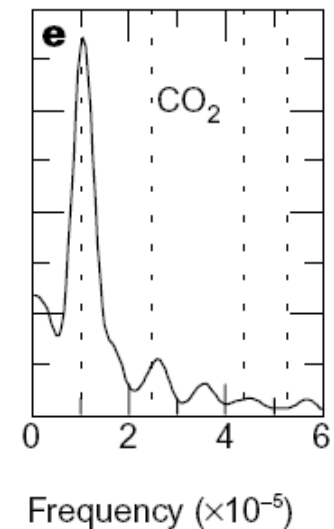
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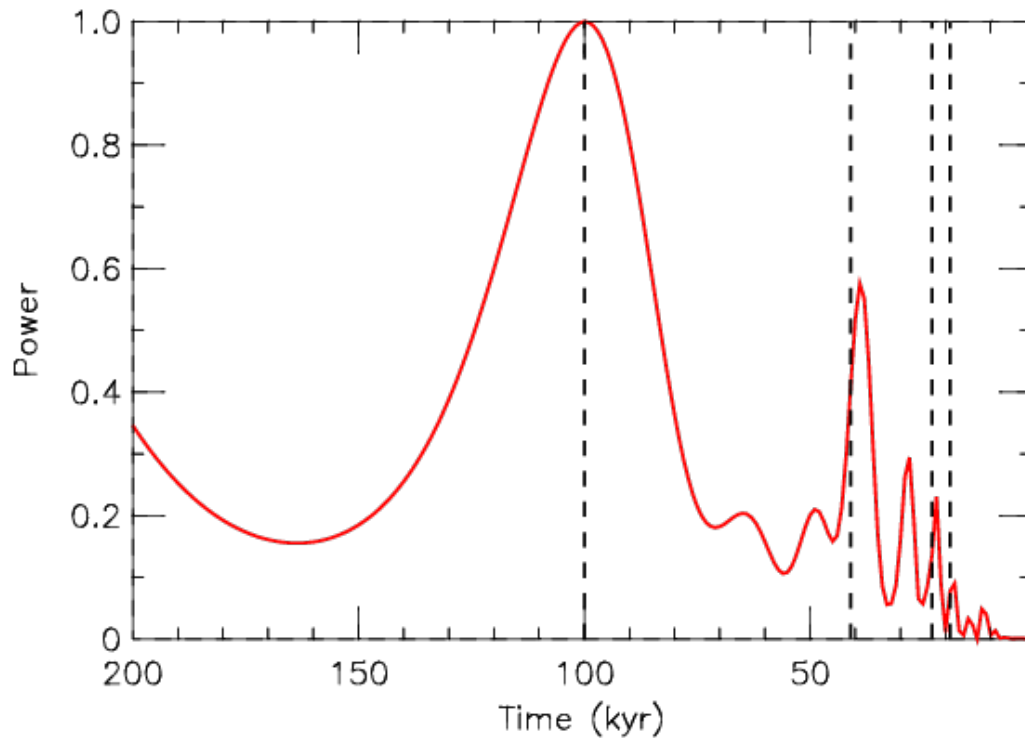
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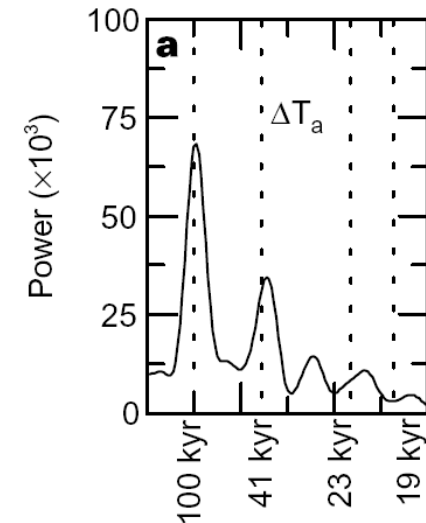
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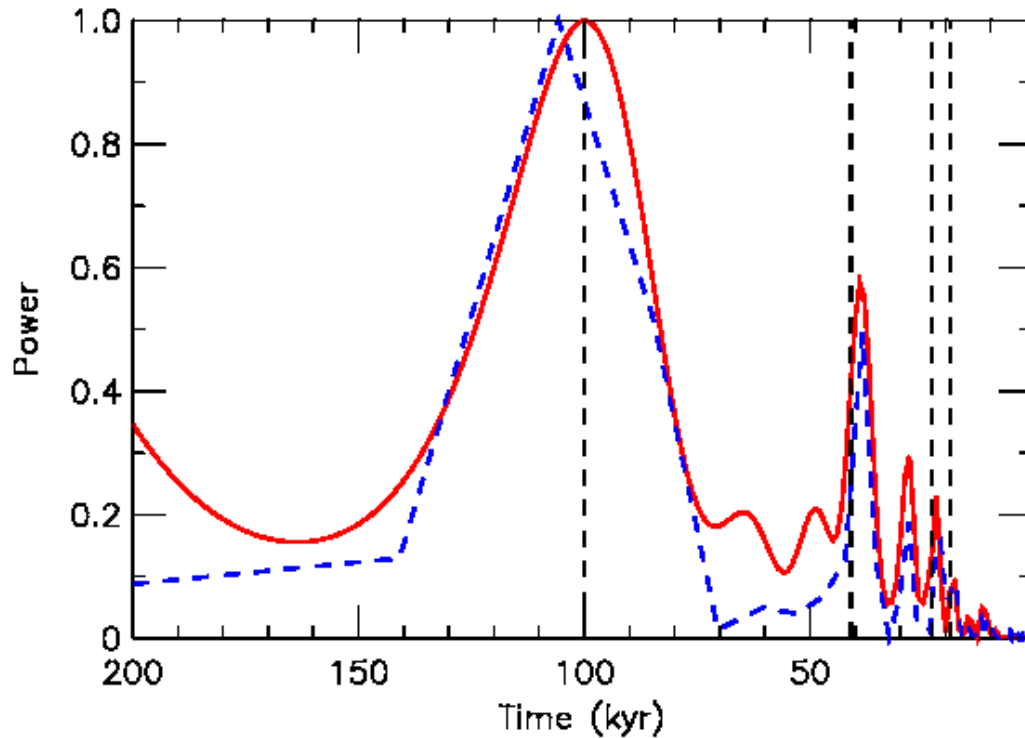
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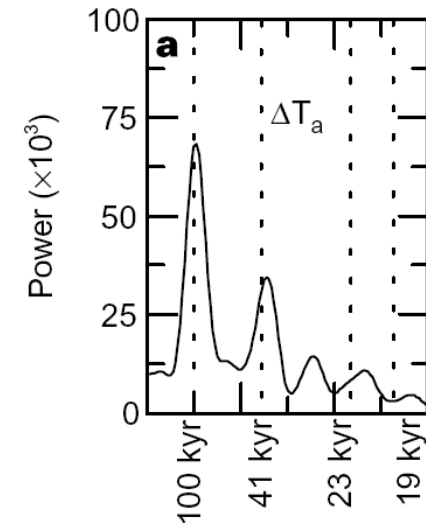
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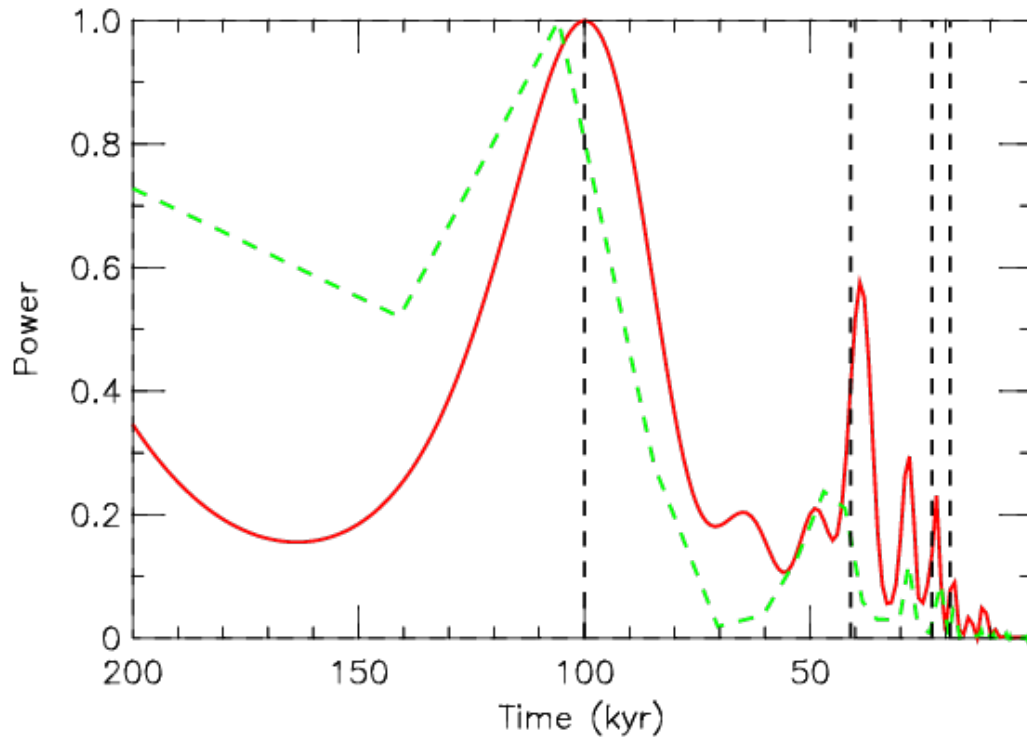
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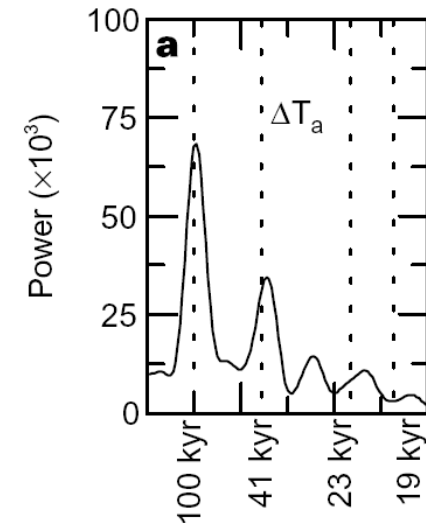
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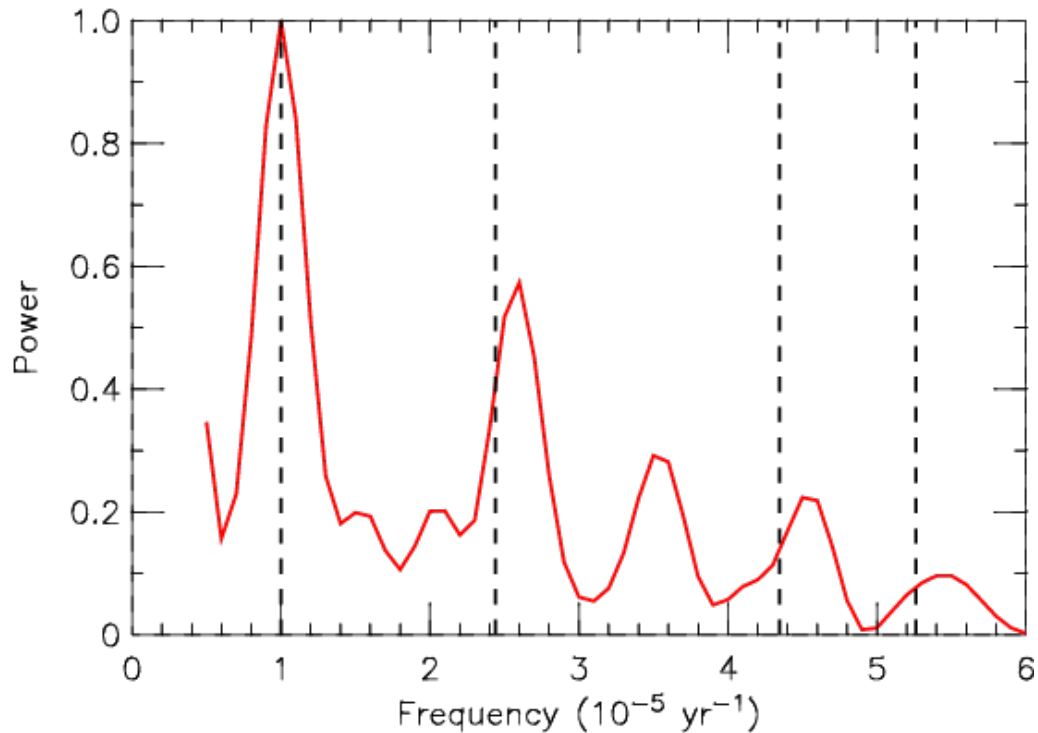
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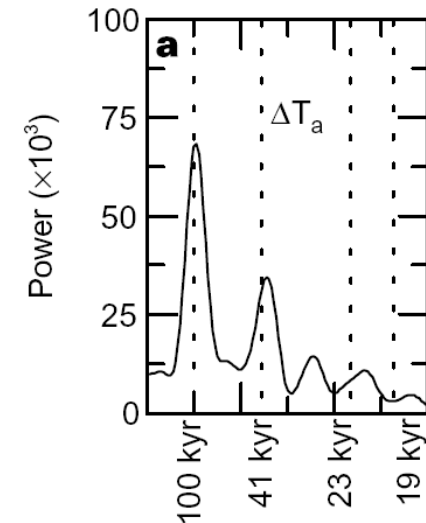
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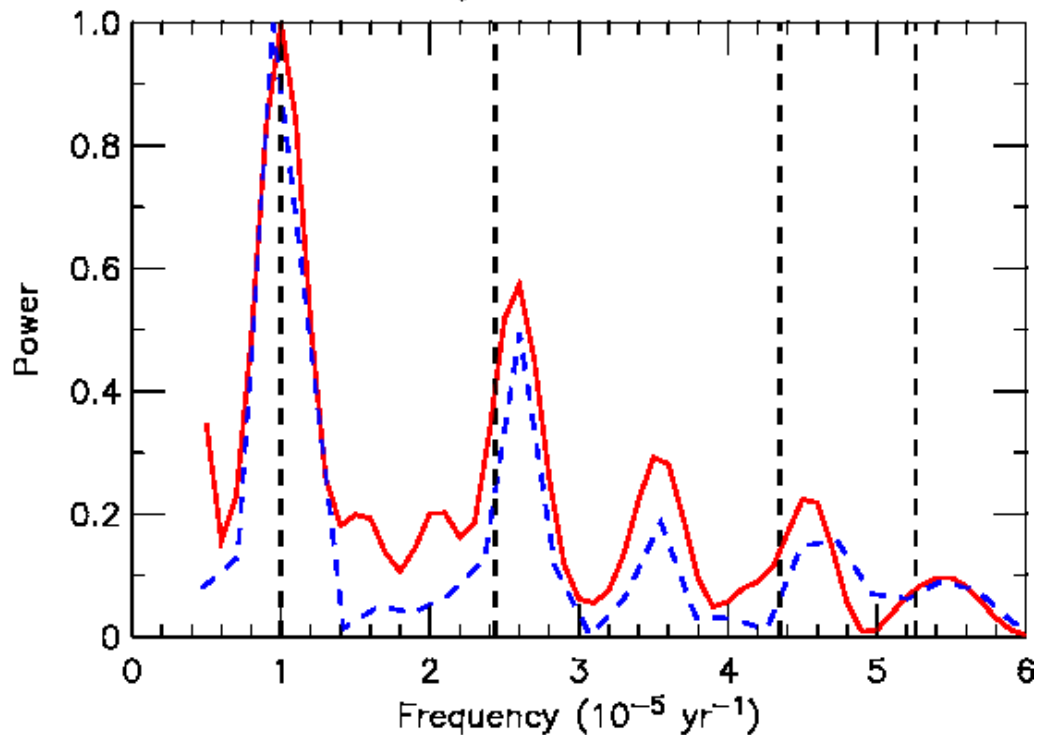
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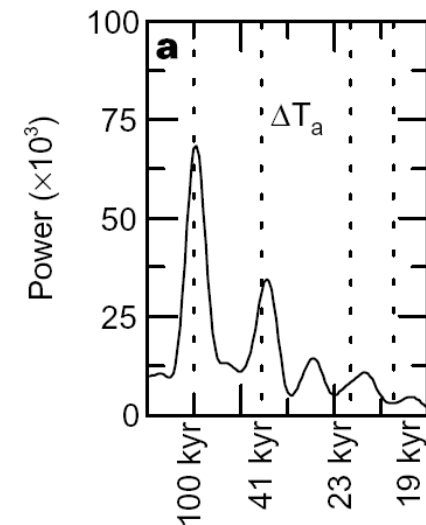
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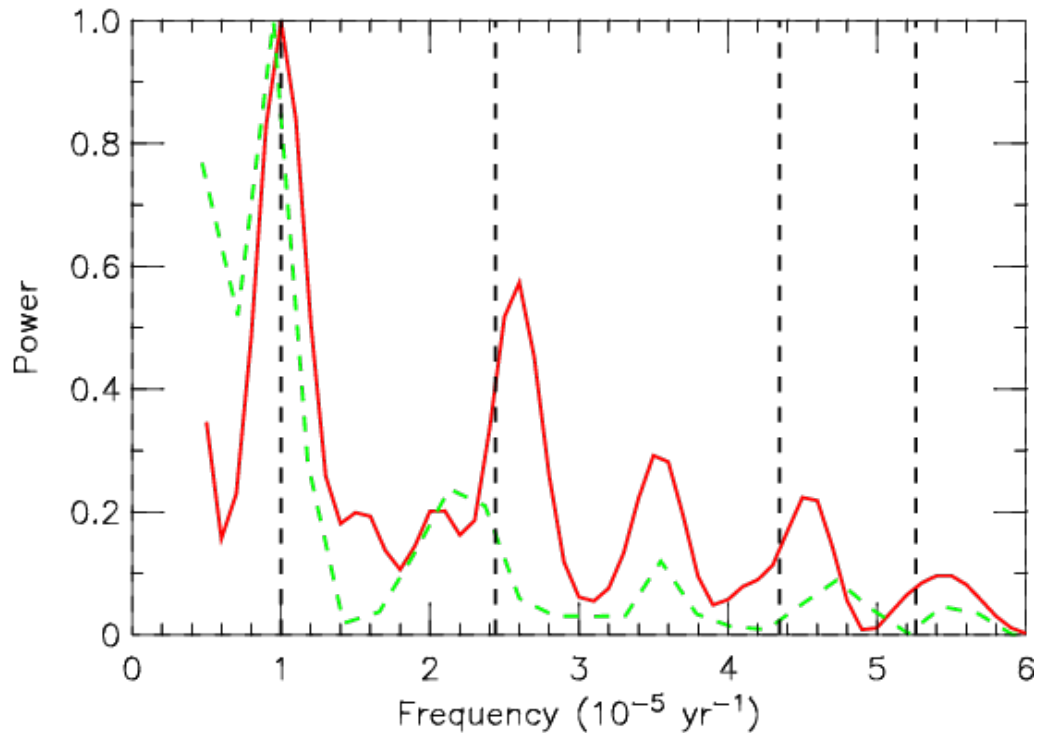
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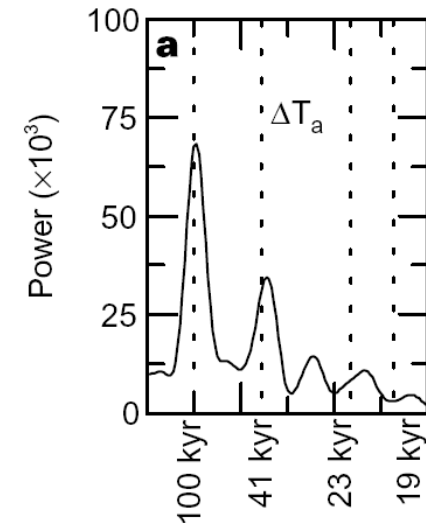
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Two ways to handle:

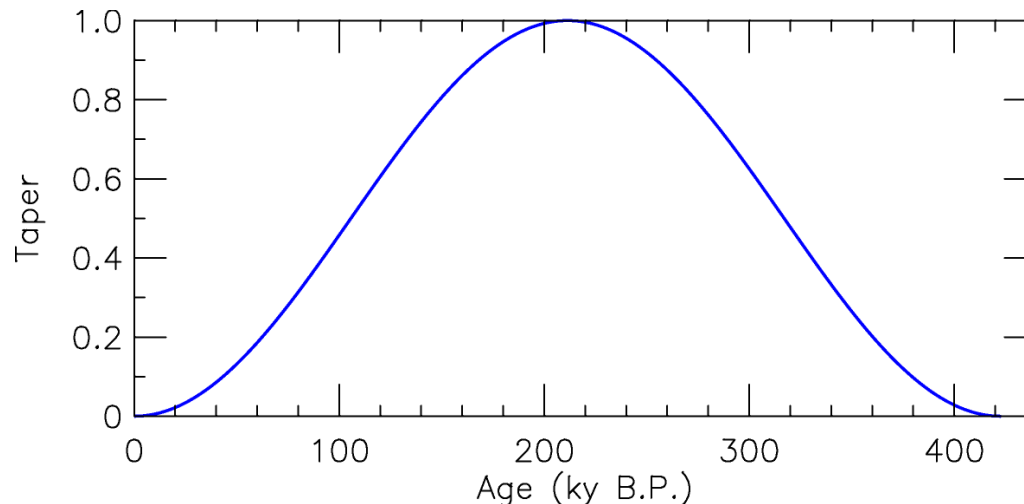
- a) Blackman-Tukey method: involves taking an autocorrelation of the data, which “blurs” the power spectrum at high frequency
- b) Taper function: involves multiplying the raw data by a function that minimizes weight of data collected at beginning and end of the time series. Then, signal \times taper is analyzed.

Hanning cosine taper function:

$$\text{taper}(t) = 0.5 [1 - \cos(2\pi t / T)]$$

where T = length of time interval

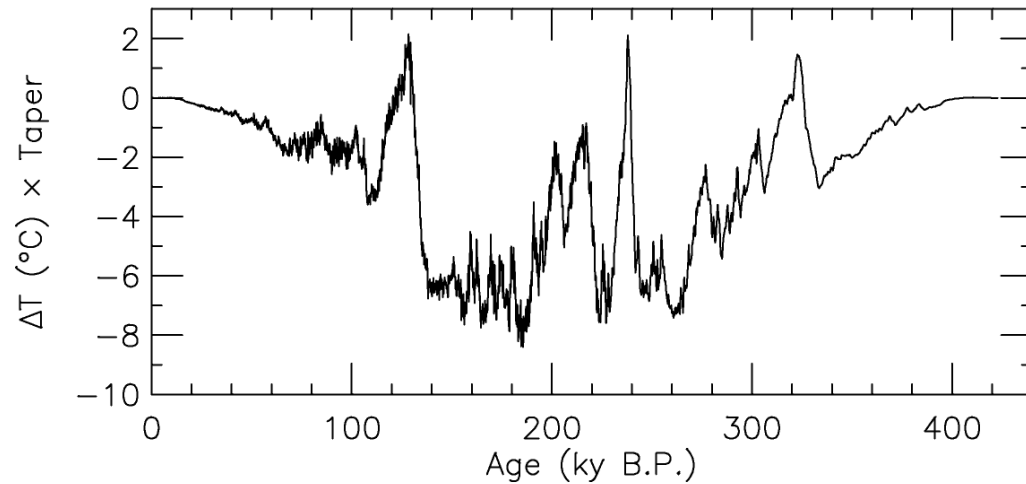
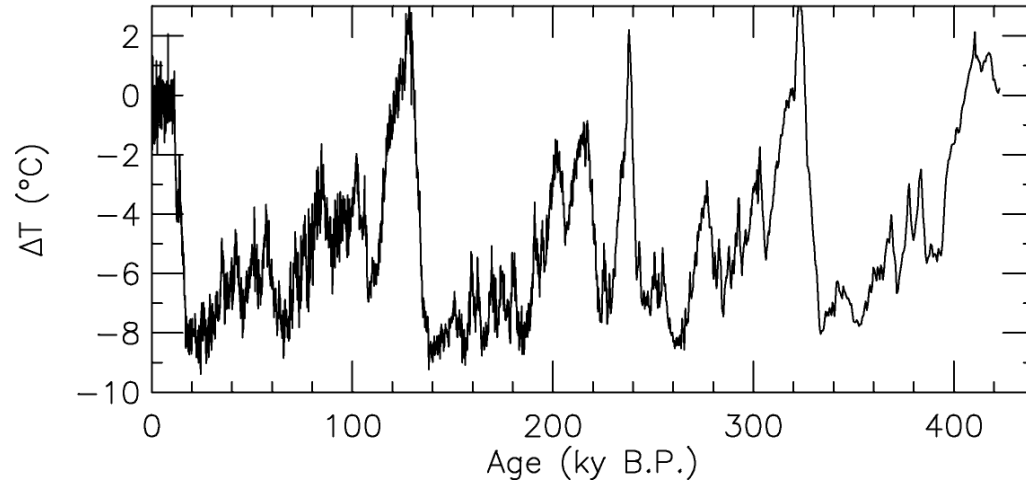
What does this function look like?



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Paleoclimate Temperature Record From The Vostok Ice Core

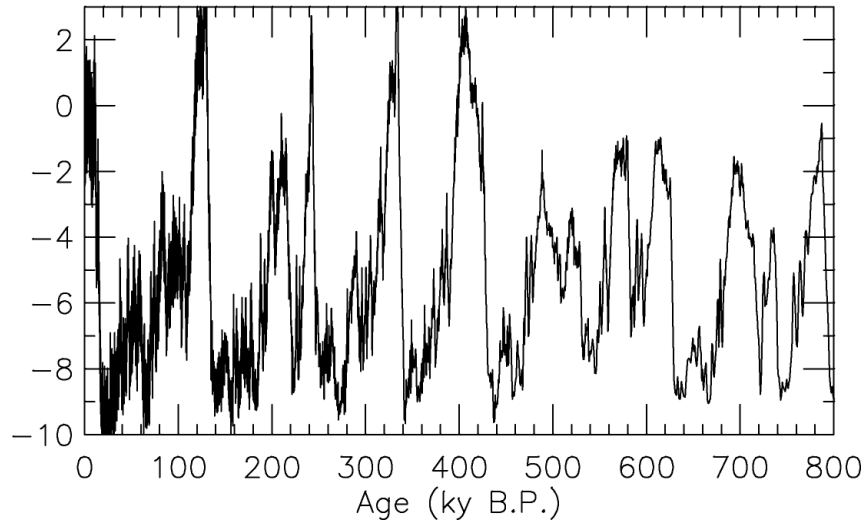
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Paleoclimate Record from EPICA Dome C

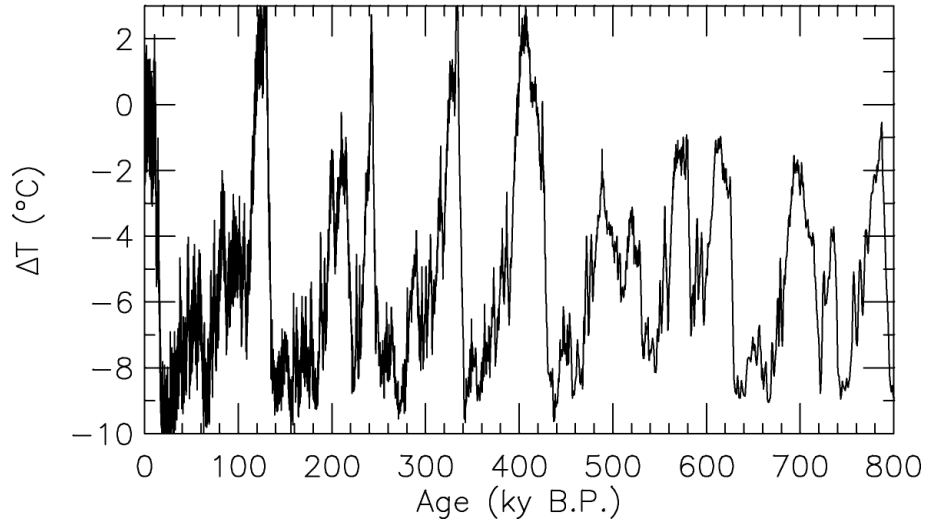
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