Lorentzians vs global warming hysteria

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Everybody knows that we are living in the era of global warming.
There is very serious proof of this statement

Let me try to present my talk in an informal way in writing:

1. Climate fluctuations can be traced throughout the entire history of the Earth .

2. A simple Fourier transform of numerous palaeoclimatology data on temperature changes (without any suggestions, any approximations, any corrections ad hoc) demonstrates that fluctuations in temperature and solar insolation are characterized by a random process with a single time constant on the order of (5-8) thousand years. This process can be traced on the time scale of ~ 10,000,000 years. It takes into account glacial periods and periods of intense warming

3. It looks like fluctuations of the Sun insulation are responsible for the temperature fluctuations with ~ 8000 years.

4. The dominant role of the random process with ~ 8000 years makes "short-term" (at characteristic times of ~ 200-500 years) forecasts of climate change not reliable.

5. Contemporary history (last several thousand years) of the Earth climate fluctuations shows that the modern global warming is not the most intensive and not the longest warming.

proof of global warming

There are also some other not so interesting but may be more detailed proofs of this phenomena.

However…This is not the first, second, third or even the hundredth global warming…

Only 20 000 years ago at the location of this Conference lay an ice shield of 2.5-3 km thickness. ***This monstrous ice shield quickly melted away without any influence of human activity.***
About ~ 12,000 years ago people settled in the territory of modern Scandinavia.

More recent story: about 1000 years ago:
Viking Age: VIII – XI century of our era

Between 800 and 1200 AC vikings could navigate at latitudes, where floating ice is now encountered. They settled in Greenland which was a **GREEN land** at that time.

In XII-XIII AC on the Baltic coast and in England people grew grapes

Approximately 700 years ago, in the XIII-XIV CE a new global cold wave occurs.

Greenland was covered with ice. Humans died out.

Pieter Bruegel the younger. "Ice-skating"(about 1600 AC.)

Just 500 years ago.

Approximately 300 years ago new (modern) global warming began.

Climate fluctuations can be traced throughout the entire history of the Earth .

So now the main question is:

What role does human activity play in modern warming?

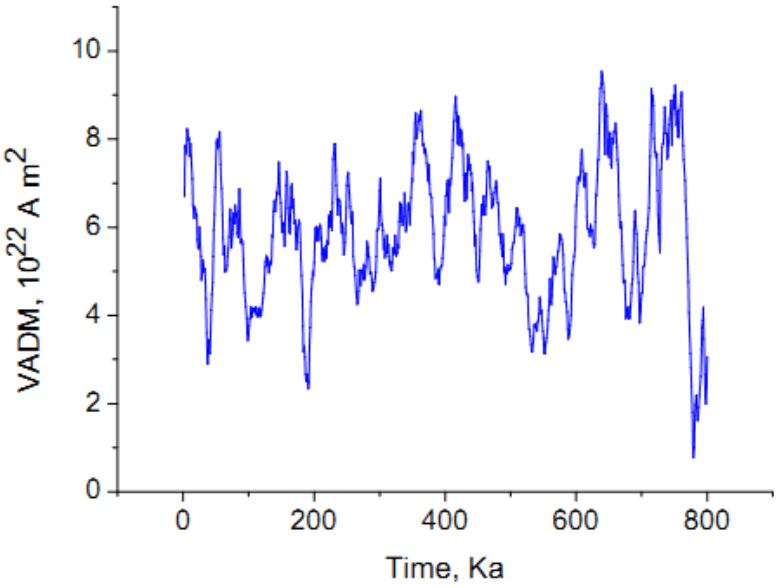
The only scientific way to predict the coming future climate changes is to correctly analyze such changes in the past

Palaeoclimatology, palaeoecology, paleogeography have amassed thousands records of climate changes in time intervals of hundreds, thousands, millions, and even dozens of millions years. These dependencies and the cross-correlation of these parameters are analyzed and continue to be analyzed using highly sophisticated techniques.

Researchers usually try to identify periodic and quasi-periodic processes in these paleoscientific records

That's is very useful, very complicated, and very smart activity....However……

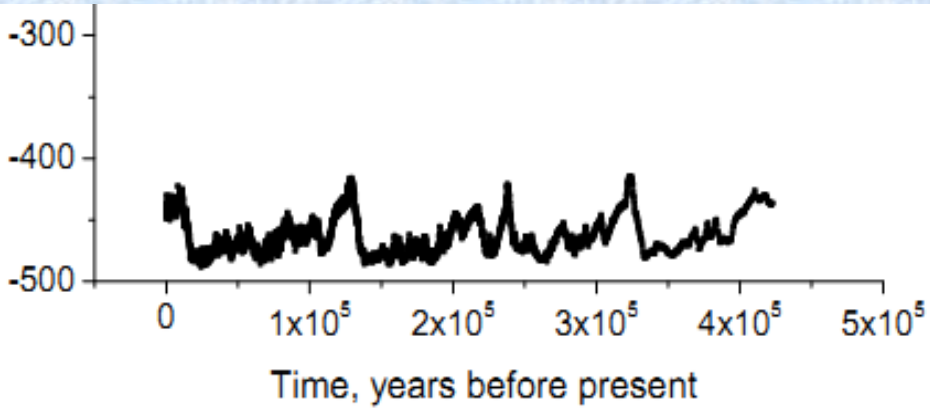
However…… ***For those that are involved in studying noise, these paleodata look often simply as noise***



The time dependence of the virtual axial dipole moment (VADM) for 800 Ka (800 000 years (Y. Guyodo and J. Valet, *Nature* 399 (1999) 249-252.)

VADM is **very important quantity for sailors, geodesists, cartographers, etc…**

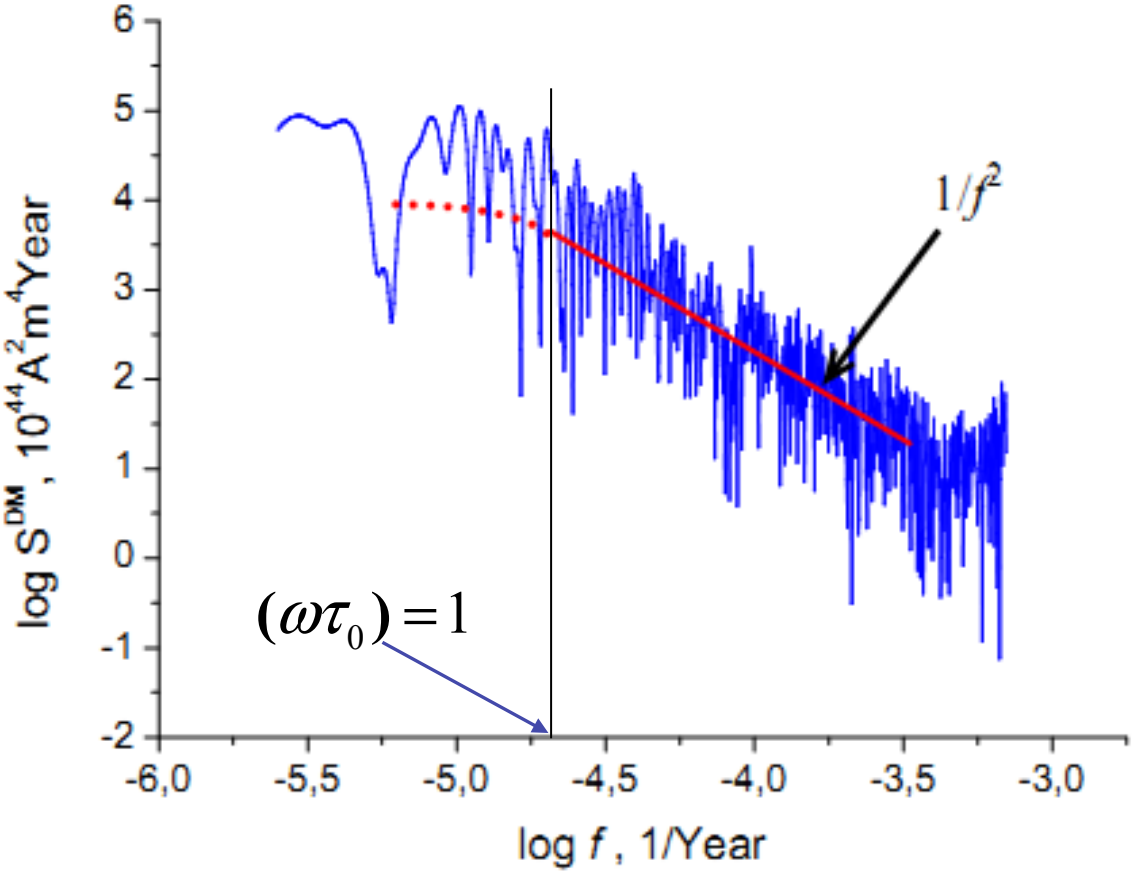
VADM is intensity of an imaginary axial (along the Earth's rotation axis) centric (located in the centre of the Earth) dipole that would produce the estimated archaeo-/palaeointensity at the sampling site.



The time dependence of the deuterium content in ice cores for 420 000 years (Antarctica). (J. R. Petit, et al., *Nature* 399 (1999) 429-436)

The fluctuations in the deuterium content are proportional to temperature fluctuations (deuterium thermometer)

Let's assume that these data represent a random functions, and **determine the spectral density of fluctuations for such noise dependences.**



The frequency dependence of spectral density fluctuations, for the time dependence of virtual axial dipole moment (VADM).

Solid and dotted red lines are guidelines to the eye.

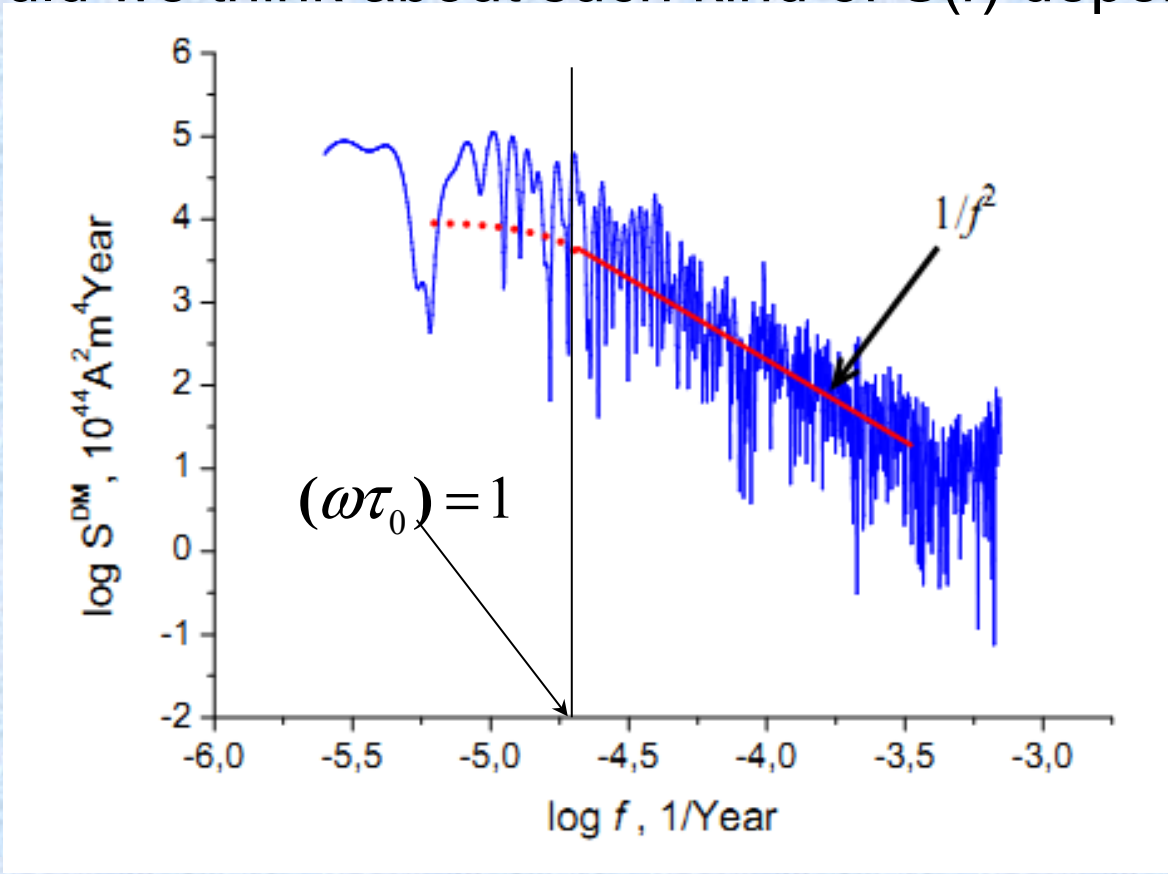
Those who do not recognize a Lorentzian can cast the first stone

This is the result for **VADM !**

$$S \propto \frac{\tau_0}{1+(\omega\tau_0)^2}$$

$$\tau_0 : (1/2\pi)\times 10^{4.7} : 8000 \text{ years}$$

What should we think about such kind of *S*(*f*) dependence?



There is a very powerful natural phenomenon that can be traced on the scale of 400,000 years, which plays a very important, perhaps, a decisive role in long-time fluctuations of **VADM.** ***This phenomenon is a unknown random process with a single-time-constant*** τ_0 ***of about 8000 years***.

VADM is a very important quantity for saylors, geodesists, cartographers, etc…
However, our point of interest now is the temperature fluctuations.

There are many factors with a very wide spectrum of time constants affecting climate fluctuations

Some of them are::

Plate tectonic motion

Solar radiation variations

Small variations of the Earth orbit relative to the Sun (Milakovitch cycles)

Catastrophic volcanic eruption

Fall of giant meteorites

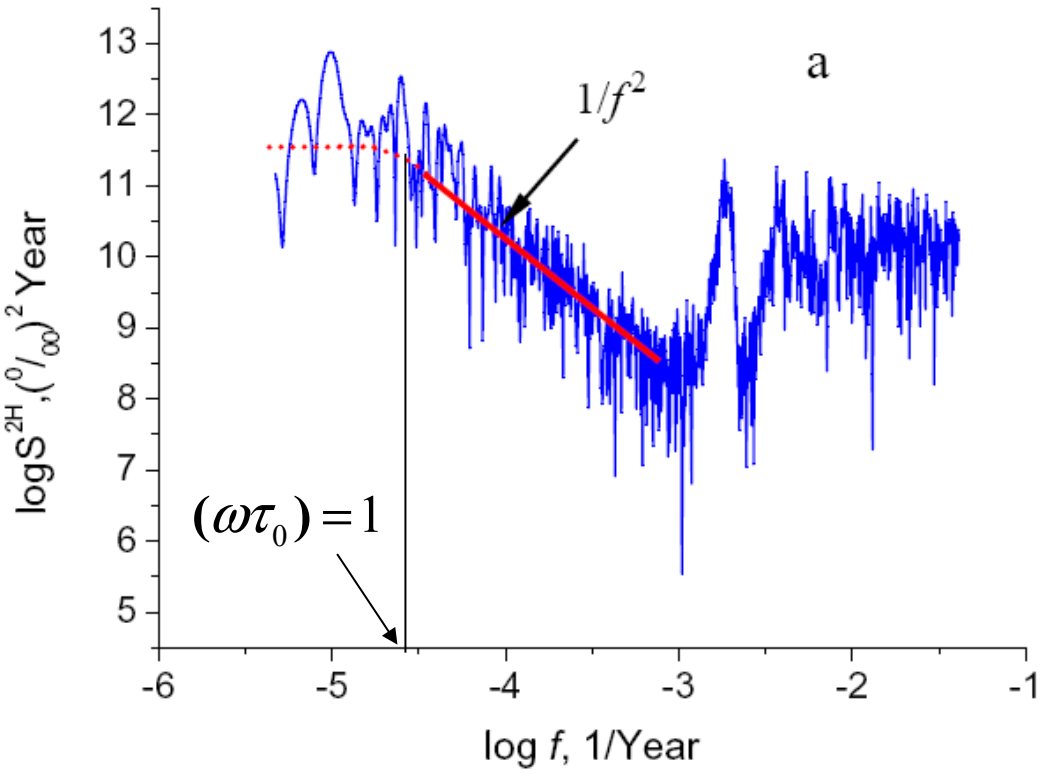
The change in the position of the Earth's magnetic poles

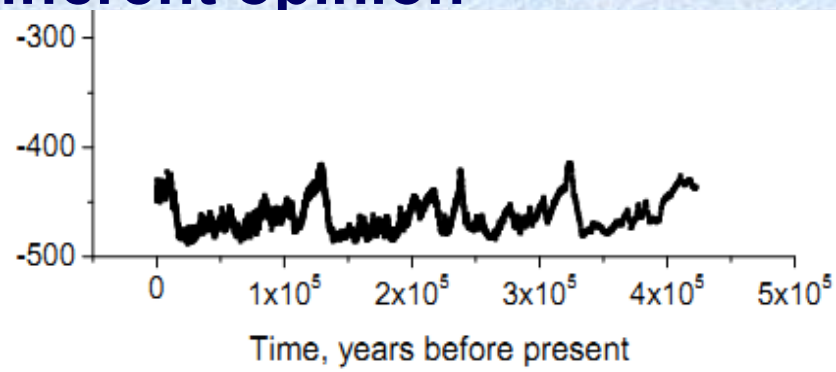
Displacements of ocean currents

Fluctuations of atmospherical circulations, etc., etc.,

That is why, when we started to process data on the temperature fluctuations of the climate, we expected that the spectral density of these fluctuations would have the 1/f or 1/f-like form.

However, the Lord held a different opinion





The time dependence of the deuterium content in ice cores for 420 000 years *(We have already seen this dependence)* ***It is noteworthy to remind that t*****he fluctuations in the deuterium content are proportional to temperature fluctuations (deuterium "thermometer")**

The frequency dependence of spectral density fluctuations, S^{2H} for the deuterium content (**Vostok Ice Core Deuterium Data for 420,000 years**).

The solid and dotted lines are guidelines to the eye.

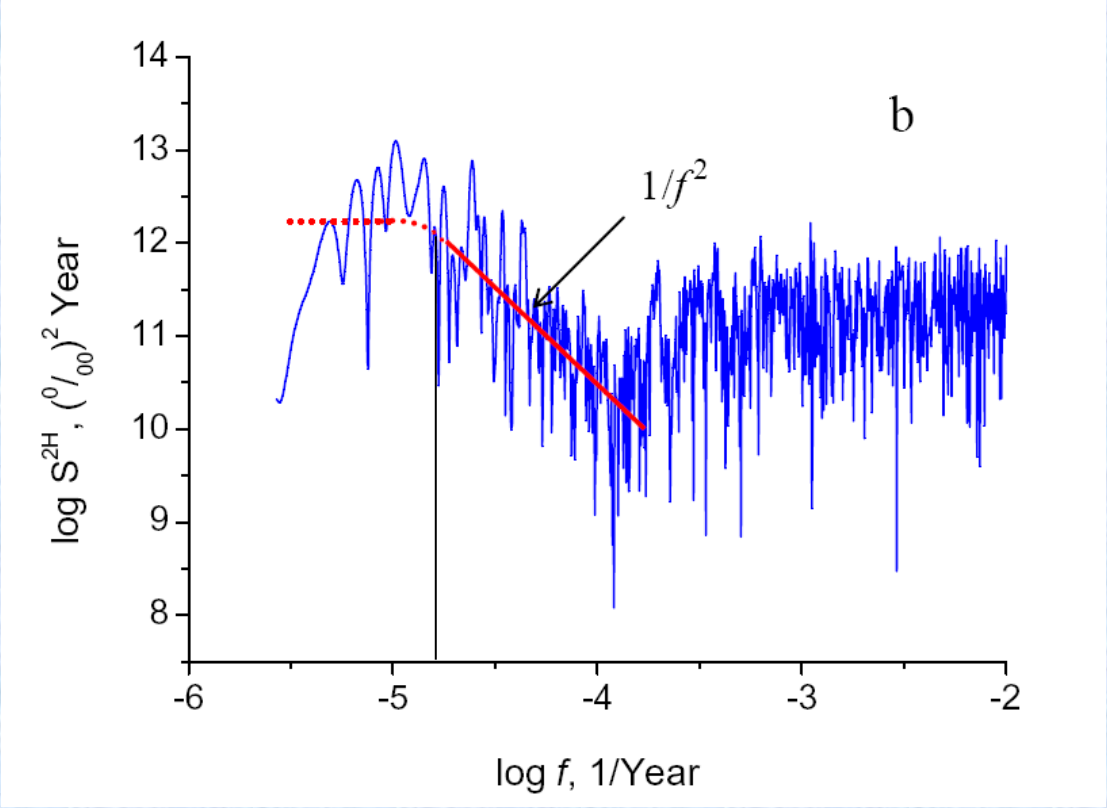
One can see again the Lorentzian with approximately the same characteristic time

$$\tau_0 : (1/2\pi)\times(10^{4.5}-10^{4.7}) : (5-8)\times 10^3 \text{ years}$$

Attention: These are fluctuations of the temperature. For 420 000 years

Similar dependence for another Antarctic station

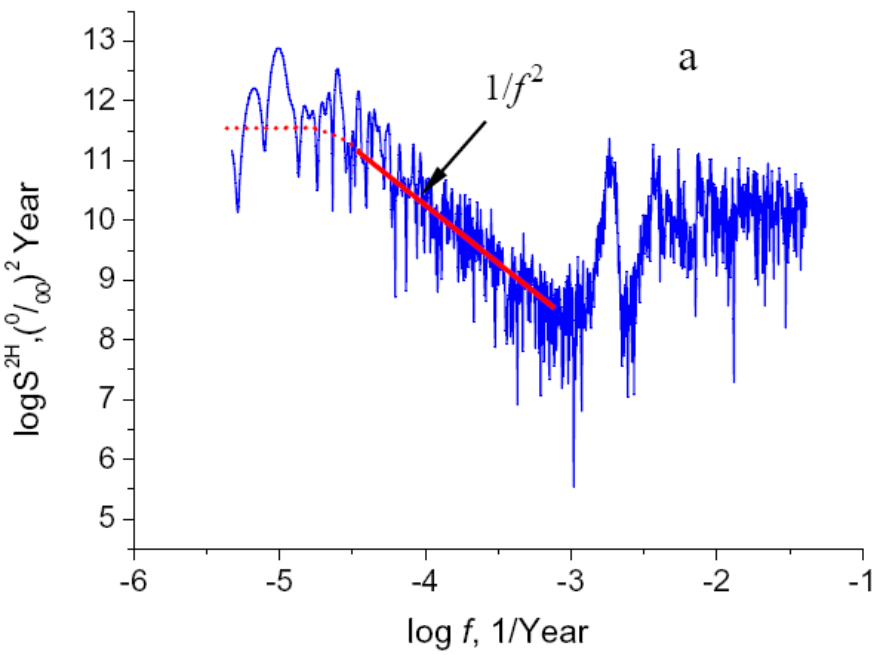
(EPICA - European Project for Ice Coring in Antarctica)



The frequency S^{2H} dependence of spectral density fluctuations, for the deuterium content (**EPICA community** members, 2004. "**Eight glacial cycles from an Antarctic ice core.** Nature, 429, No 6992, 623-628,)

One can see again the Lorentzian with approximately the same characteristic time of $(5-8)\times 10^3$ years.

What should we think about such kind of $S(f)$ dependences?



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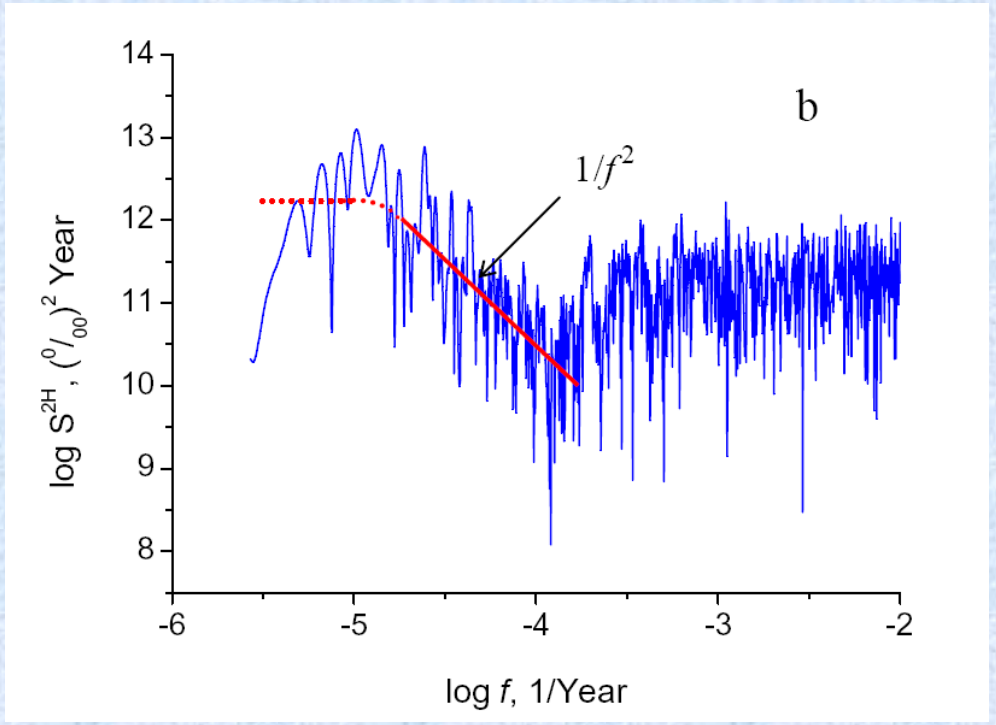


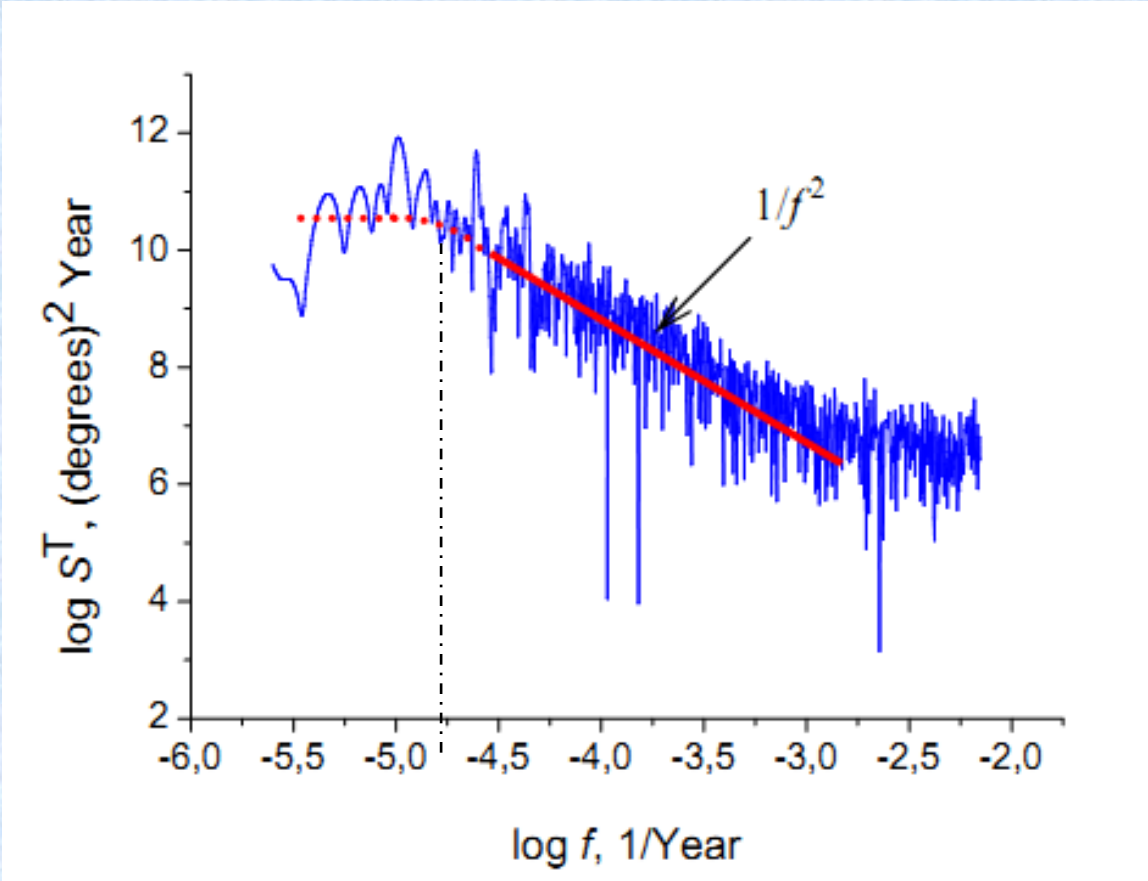
EPICA

There is a very powerful natural phenomenon that can be traced on the times of the order of 400,000 years. This factor plays a very important and, perhaps, a decisive role in long-time fluctuations of **TEMPERATURE (At least in Antarctica). *This phenomenon is a random process with a single-time-constant τ_0 of about (5-8)000 years***.

*Please pay attention that **at large times of about 10^4 years the dependencies are very similar. At "high frequencies" of about several hundreds years the spectral characteristics are very different.***

Antarctica, EPICA, deuterium thermometer – 800 000 years

Jouzel J., et al. 2007. Orbital and Millennial **Antarctic** Climate Variability over the Past 800,000 Years. Science, 317, 793-796.



The frequency dependence of the temperature spectral density fluctuations

$S \sim 1/f^2$ at $10^{-4.7} \le f \le 10^{-3}$ 1/year.

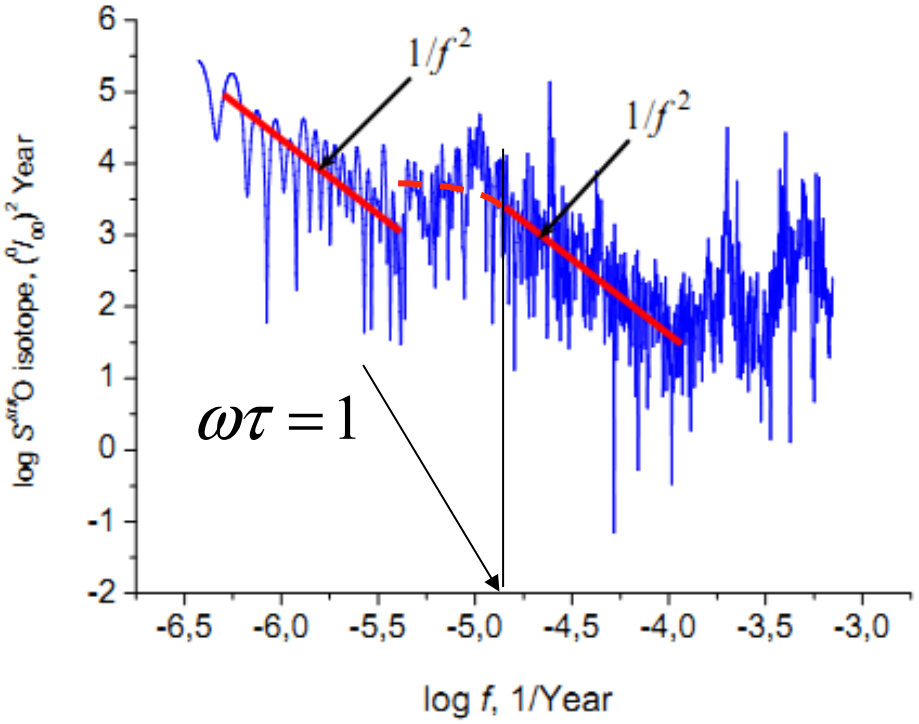
Characteristic time constant τ_0 ~ 5000- 8000. Again

Data on more general (global) Earth temperature fluctuations

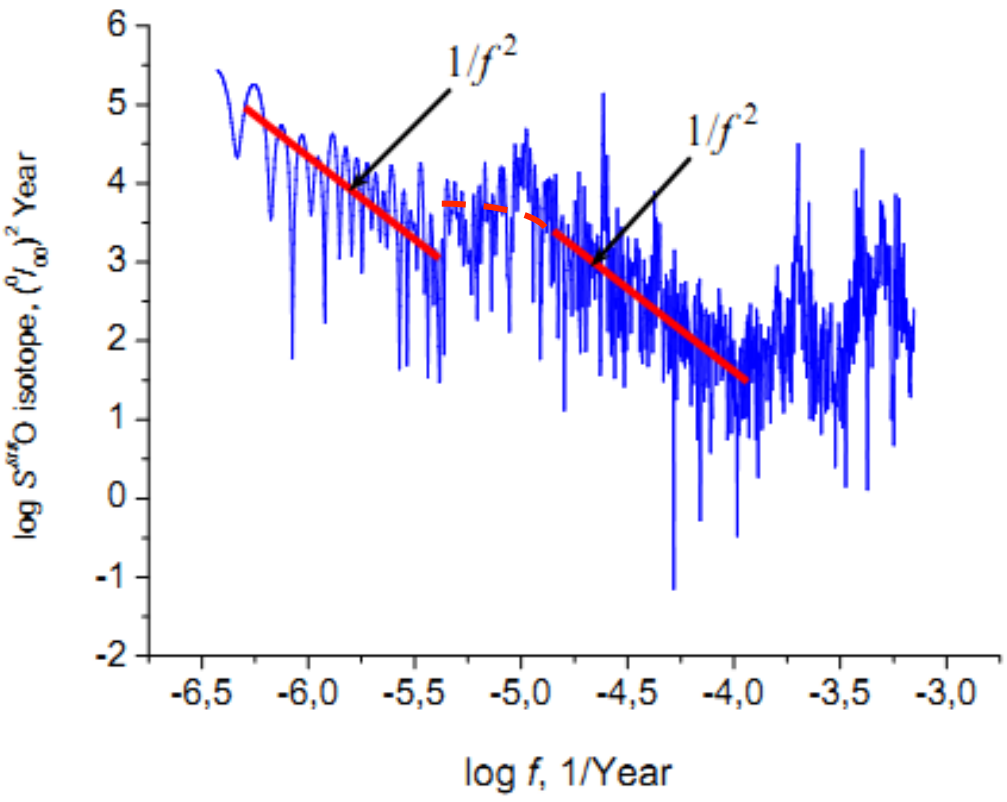
In addition to "deuterium "thermometer", so-called "oxygen thermometer" is well known in paleoclinmatology:

Fluctuations of oxigen isotope $^{\delta 18}O$ in ice cores and ocean benthic are also proportional to the temperature fluctuations

Lisiecki L.E. and Raymo M.E.,. (Paleoceanography, 20, PA1003, (2005)) **presented an *average of 57 globally* distributed benthic and ice $^{\delta 18}O$ records *for 5.3 million years* collected from the scientific literature.**



The frequency dependence of TEMPERATURE spectral density fluctuations for globally distributed benthic and ice $^{\delta 18}O$ records for 5.3 Myr.



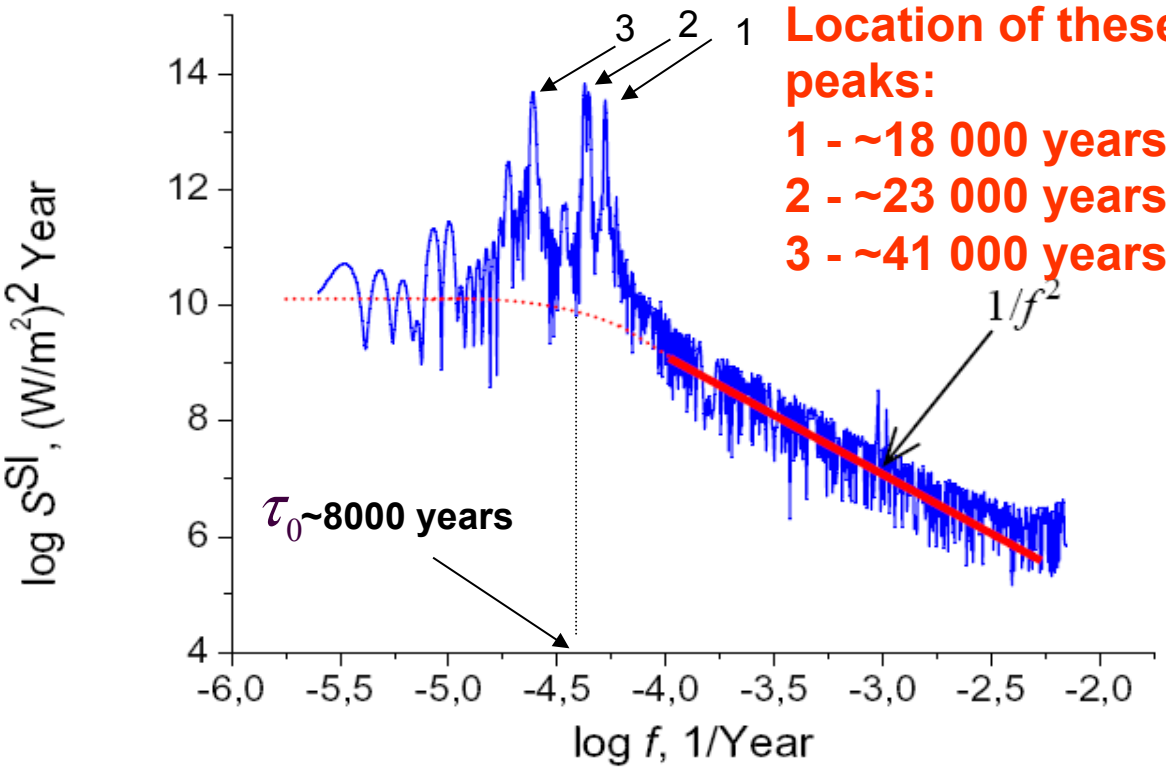
For "high frequency" part of this dependence of about 10^4 year, the value of τ_0 is close to the corresponding values of, τ_0 found for Antarctic data

For the "low-frequency" part of the dependence($10^{-6.3} \leq f \leq 10^{-5.3}$ 1/ year), the value of τ_0 cannot be found from the data presented. It is obvious, however, that the characteristic time of τ_0 this random process, exceeds 10^5 years.

There is a very powerful natural phenomenon that can be traced on the times of the order of 5 000 000 years. This factor plays a very important and, perhaps, a decisive role in long-time fluctuations of **TEMPERATURE (around the Earth).** ***This phenomenon is a random process with a single-time-constant of about (5-8)000 years***.

Fluctuations of solar insolation. 10 000 000 years

Berger A. and Loutre M.F., (**Insolation values for the climate of the last 10 million years**, Quaternary Sciences Review **10**, 297 (1991)



Location of these peaks:
1 - ~18 000 years
2 - ~23 000 years
3 - ~41 000 years

1. One can see the Lorentzian (again) with τ_0~8 000 years.

Because the Sun is the Master of the Earth, we can assume (just assume) that the temperature (and VIDM) fluctuations with τ_0 ~ 8000 years are caused by fluctuations of the insulation.

The frequency dependence of spectral density fluctuations of insulation **for 10 000 000 years**

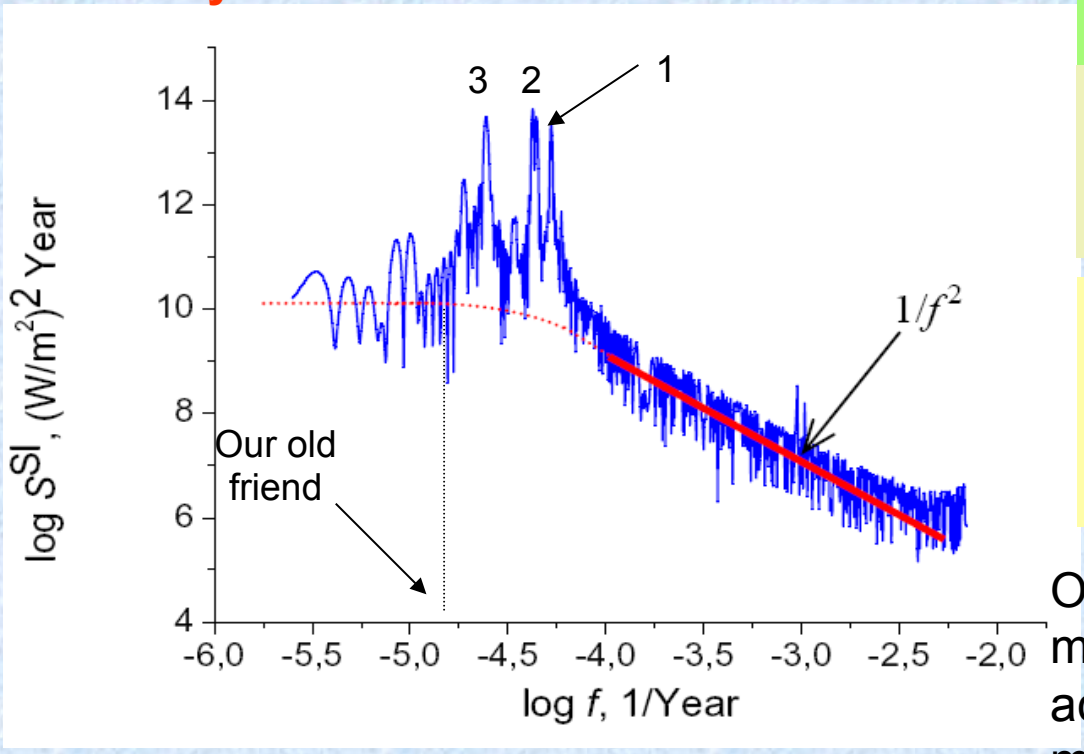
But… what is the meaning of the sharp peaks 1,2,3?

2. Please note, that there is no trace of the Lorentzian with τ_0 >10^5 years. Hence, **not insulation is responsible for the temperature fluctuations with large (>10^5 years) time constant.**

Peaks in insulation for 10 000 000 years

We were happy to make sure that one of these spectral noise density dependences is supported by celestial mechanics equations

Location of the peaks (our Fourier transform):
1 - ~18 000 years, 2 - ~23 000 years,
3 - ~41 000 years



The frequency dependence of spectral density fluctuations for insulation (10^7 years)

41,000-years: The angle between the axis of rotation of the Earth and the normal to the plane of the orbit oscillates with a period of **41,000-years;**

23,000 years: The period of the precession of the Earth's orbit is **26,000** years.

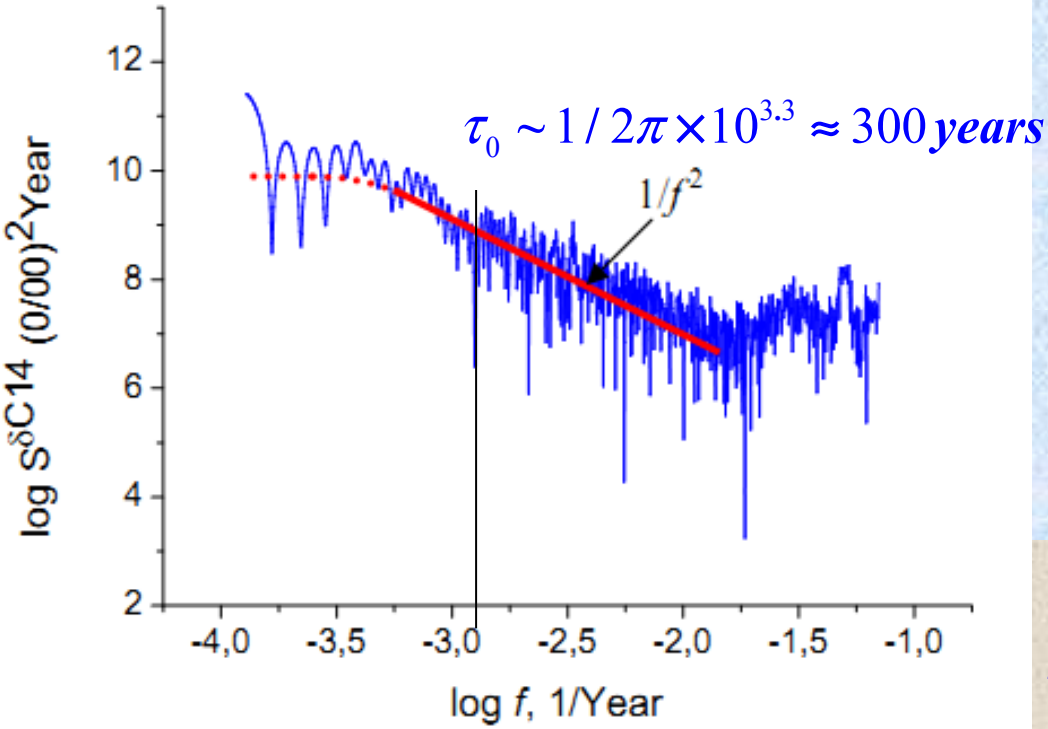
18,000 years: The combination of rotation of the elliptical orbit and precession gives a period of **21,000 years**

Of course, the accuracy of the "noise" measurements is not comparable with the accuracy of the equations of celestial mechanics.

Atmospheric radiocarbon $^{\delta 14}C = {}^{14}C/{}^{12}C$

We also analyzed data on atmospheric radiocarbon fluctuations for last 24 000 years.

Radiocarbon dating is one of the most important technique for determining the age of objects containing organic materials.



The frequency dependence of spectral density fluctuations for the atmospheric radiocarbon $^{\delta 14}C$

Stuiver M., et al., 1998. INTCAL98 radiocarbon age calibration, ***24,000-0 cal BP****, Radiocarbon* ***40****, 1041-1083.*

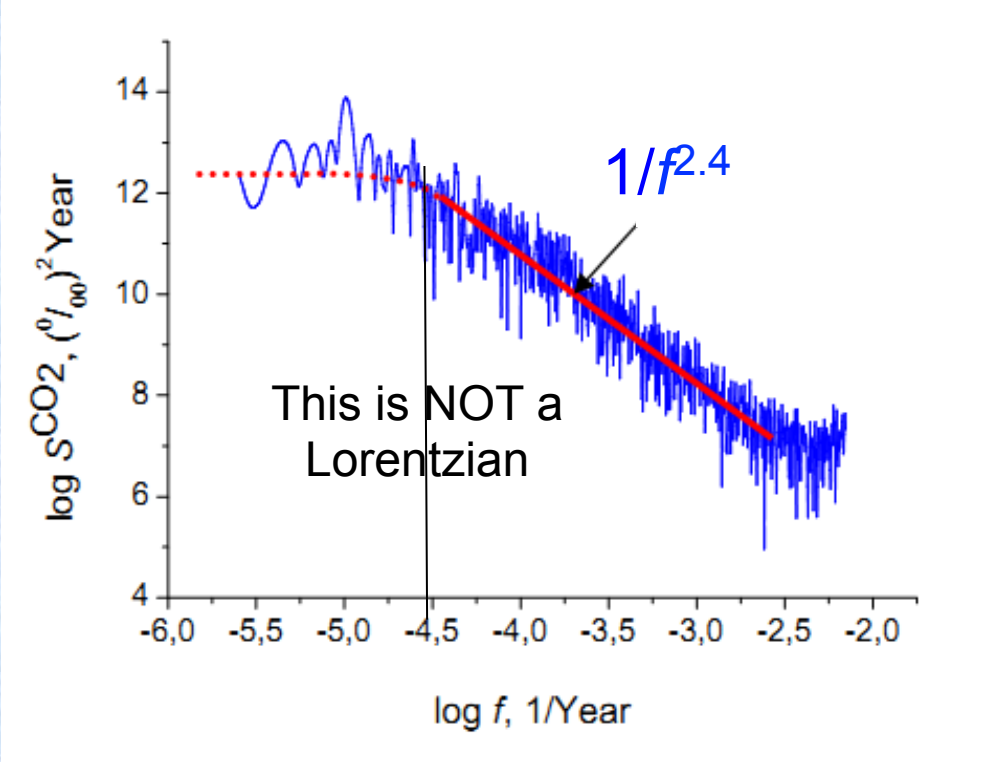
The spectrum of $^{\delta 14}C$ variations in the tree rings over the **last 8-10 thousand years demonstrates the presence of numerous periods with duration of 11 to 2400 years**. The 200-year variation period was found from measurements of the solar and terrestrial components of the atmospheric $^{\delta 14}C$ variations. However, the presence of a random process with characteristic time constants $\tau_0 \approx$ 300 years was not noticed

As seen, ***a random process with a single-time-constant*** τ_0 ***of about 300 years***.

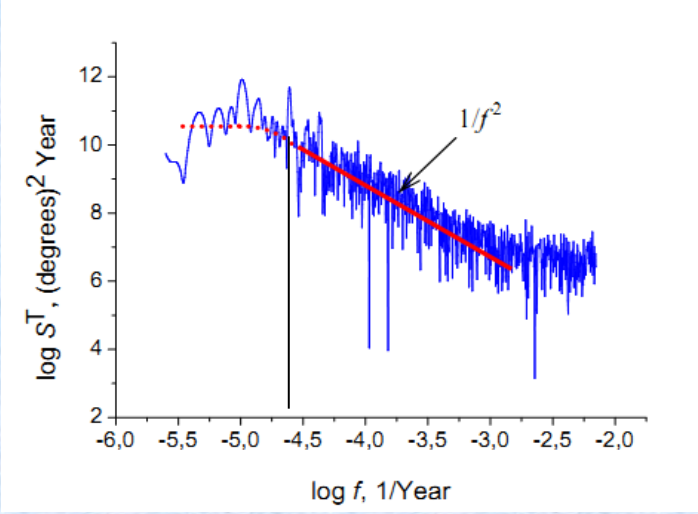
plays a very important, perhaps, a decisive role in long-time radiocarbon fluctuations.

The frequency dependence of spectral density fluctuations for **carbon dioxide ($C0_2$)** (one of very famous greenhouse gases)

Jouzel J., et al. 2007. **Climate variability over the past 800 000 years**, Science, 317, 793-796.,



Pay attention that the slope of $S(f)$ dependence follows to the law $S(f) \sim 1/f^{2.4}$ (not to the law $1/f^2$). That' NOT a Lorentzian



This is the dependence for the temperature fluctuations (data are taken from the same paper)

The slopes $S(f) \sim 1/f^{\gamma}$ with $\gamma > 2$ appears, as a rule, when analyzing natural or man-made disasters: floods, crises, stock crashes, etc.

Schroeder M., "Fractals, chaos, power laws", New York, Freeman and Company 1991.

Preliminary results

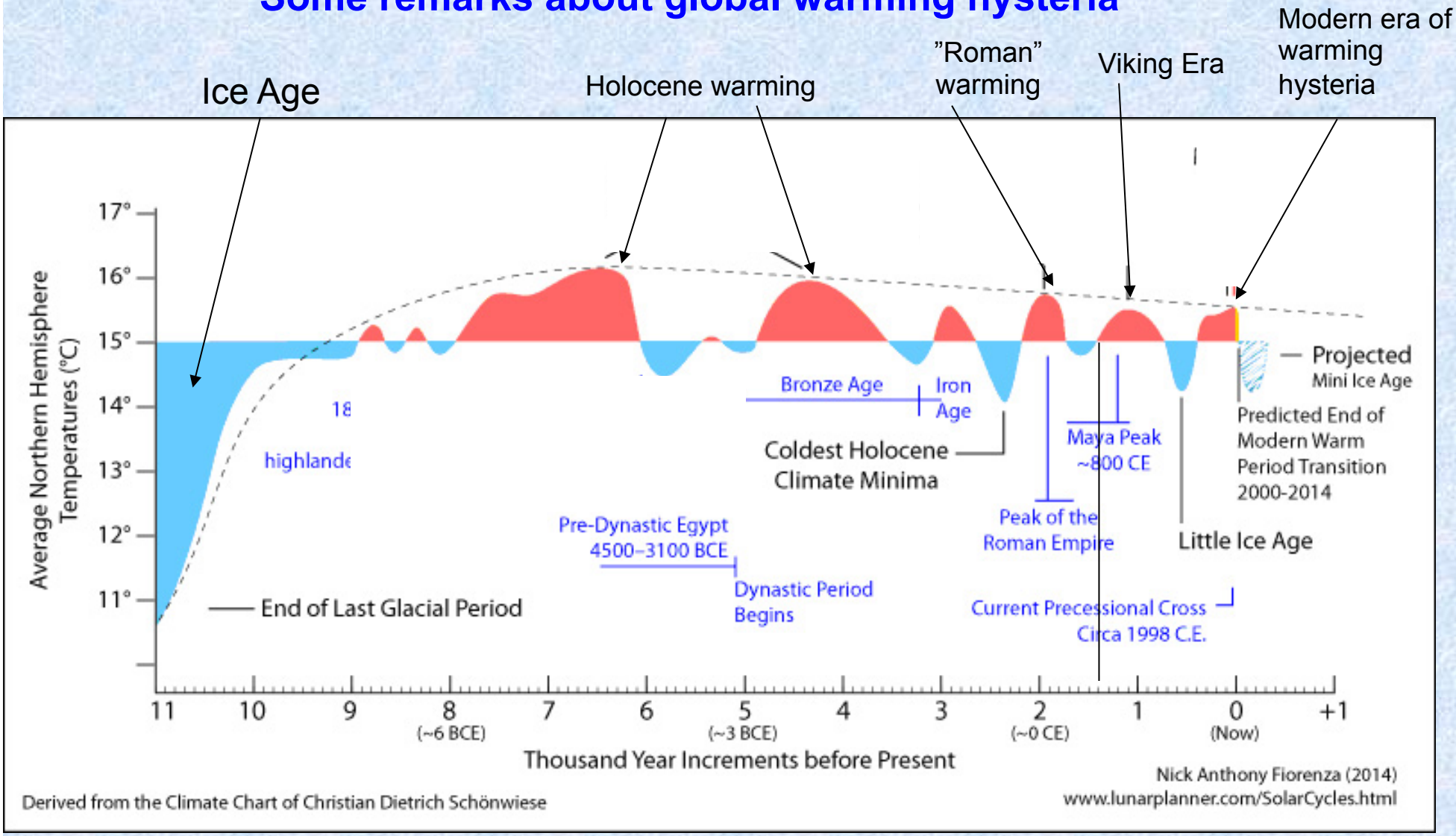
1. Interpretation of paleoclimatic data as random functions and calculation their spectral density reveals interesting and previously unknown regularities .
2. Along with the known periodic and quasiperiodic processes in the formation of many paleoclimatic parameters, an important role play **random processes** with a single time constant τ_0.
3. **The nature of such processes is interesting though not clear. As far as we know, it has never been discussed previously**
4. Fluctuations in temperature and solar insolation (and VADM) are characterized by a random process with a single time constant τ_0 on the order of (5-8) thousand years.
   We have traced the effect of this process on the time scale of ~ 10,000,000 years
5. Because the Sun is Lord of the Earth it seems plausible that the temperature (and VADM) fluctuations with τ_0 ~ 8000 years are caused by fluctuations of the insulation.
6. The dominant role of the random process with τ_0 ~ 8000 years makes "short-term" (at characteristic times of ~ 200-500 years) forecasts of climate change not reliable.

7. For the temperature spectral density fluctuations there is another Lorentzian with a time constant τ_0 > 100,000 years. **This random process is not associated with fluctuations in solar insolation.**

8. It seems that the observed random process with a time constant of τ_0 ~ 300 years for **atmospheric radiocarbon** $\delta^{14}C$ **= ^{14}C /^{12}C** should be taken into account in analysis of radiocarbon data.

9. An analysis of $C0_2$ (**carbon dioxide)** fluctuations reveals the frequency dependence characteristic of natural or man-made disasters: floods, crises, stock crashes, etc.

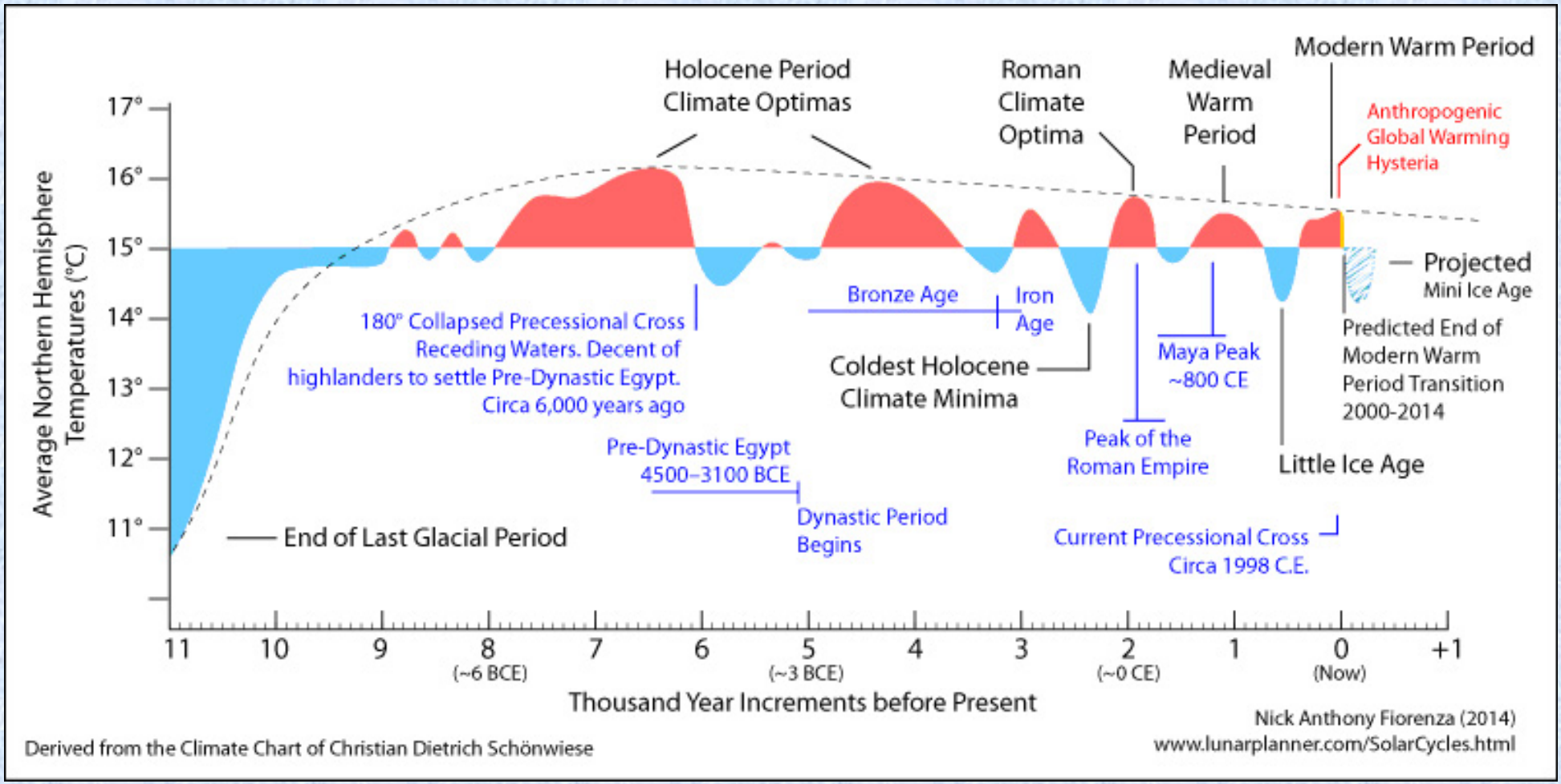
Some remarks about global warming hysteria



Time dependece of average Northern Hemisphere Temperature (°C)

From von Schönwiese C-D. «*Klimatologie*» (UTB GmbH, 2013)

One can see that modern warming does not give any grounds for panic



1. Maximal average temperature during last (modern) warming is comparable with that during Viking Age. And much less than the average temperature during Holocene warming and even during Roman warming.

2. Modern Greenland Is not a green land indeed.

3. Grape harvests on the Baltic coast and in England still remain modest

Conclusion

There is a powerful natural random process of unknown nature with a characteristic time of about 5-8 thousand years. It can be traced for at least 10,000,000 years and takes into account glacial periods and periods of intense warming.

It seems that modern human activity exerts an incomparably less influence on the climate than this unknown factor.

It appears that an honest scientific answer to the question of whether the observed current warming is a consequence of human activity should be:

"We do not know, but it looks very likely *no.*"

Thank you so very much for your patience.