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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Discriminating low frequency components from long range persistent fluctuations in daily atmospheric temperature variability" *by* M. Lanfredi et al.

Anonymous Referee #1

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Article 8220;Discriminating low frequency components from long range persistent fluctuations in daily atmospheric temperature variability8221; by Lanfredi et al. is yet another attempt to challenge the well-established long-term correlations in the atmospheric temperature.

First of all, there exists a study by [Pelletier, EPSL, 158, 1998] showing that the scaling of temperature records becomes more pronounced when considering longer time periods, up to random-walk exponent for time scale of 100 kyr (the result was obtained using the conventional power spectrum, without employing the DFA).

On the other hand, one can consider the Central England Temperature (CET) daily time

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series since 1772 (85K datapoints) to realise that its spectrum is not flat (not white) in time scales above 80 days and can be approximated by a straight line in a log-logo plot. The same diagnostics, but as monthly series since 1659, was used in [Pelletier 98], see Figs.2,3 (in Fig.3, the spectrum was obtained using FFT with a Hanning taper, and $S(f) \sim f^{-0.47}$).

When considering asymptotics of available temperature records, we are dealing with time scales up to centennial, and here works like the one by Pelletier are quite relevant. If the authors prefer non-averaged data, I suggest to consider paper by [Huybers and Curry, Nature, 441, 2006], where they plotted patch-work spectral estimates combining instrumental and proxy records (CET record is shown there, too, see Figure 2, blue curve). Without averaging, the spectra still indicate power-law behaviour at centennial scale (which is too short to be influenced by the Milankovitch cycles).

In a manuscript dedicated to asymptotic power-law in temperature records discussing these issues is essential, in my opinion. Otherwise, a non-expert reader might have been misled regarding the processes and mechanisms in the climate system: the figures in the authors' manuscript show that something nonlinear happens in short-term scale (Fig.2), but this is not related to power law in asymptotic scale, - and then there are oscillations which can be attributed to finite-size effect or to the DFA algorithm (the last points of the curves are related to the biggest window size, where polynomial fit might be biased), etc.

Yes, spikes in the data are able to influence the power spectrum at lower frequencies. However, the periods of three Milankovitch forcings are far too long to explain all the power around centennial scales. This is the area of further investigation, obviously. And it should be discussed in a paper with such a claim.

Moreover, there exist studies (see, for instance, Rybski et al, JGR, 113, 2008), where similar to observed power-laws are detected in much longer modelled records (1000-yr simulations of ECHO-G general circulation model in the mentioned paper, see Fig-

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ure 3). This confirms the initial studies claiming the power-law behaviour on shorter observed series, and this is where climate models are very helpful.

I cannot agree with presenting the data in the current format in the manuscript. The authors should provide equivalent figures with artificial power-law data of the same length (not their model data), if they aim to test all the influencing factors. The data should be superimposed with a variable seasonal cycle of about 365 days (because in nature it is not precise), then the seasonality should be filtered out, and the data studied using several scaling techniques. The power spectrum is informative and should be used to compare results with DFA. There is no single perfect tool, and when claiming strong results, especially contradicting the previous studies, the data should be analysed as rigorously as possible; for instance, showing four power spectra (raw or logarithmically binned) for the named four cities would be very helpful for discussing the asymptotic behaviour.

In short, without discussing the above issues, the manuscript might be misleading for the general scientific audience.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 5177, 2009.