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Interactive comment on "Long-range memory in millennium-long ESM and AOGCM experiments" *by* L: Østvand et al.

L: Østvand et al.

lene.oestvand@gmail.com

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Thanks to Svante Henriksson for the comment and for making us aware of their recent paper, which we will of course cite in the revised version.

Henriksson et al. analyse COSMOS global temperature series and obtain lower spectral exponents than we do, in particular for the unforced simulation. The reasons for this discrepancy are the following:

The COSMOS simulation has a very strong ENSO-like signal, considerably stronger than in instrumental or reconstruction data. This leads to a distinct spectral "hump" in the global temperature on frequencies from 1 to 1/6 (1/yr), but with a long tail towards lower frequencies. The spectral shape of the ENSO signal is apparent from their Fig.

8a and their Fig. 8b gives an indication of a much wider power-law range with an index β closer to 1 in temperature series recorded remote from the ENSO region. The globally averaged temperature is a superposition of signals having these two spectral shapes, and the result is that the range of frequencies f>1/6 (1/yr) are influenced both by the ENSO hump and the underlying power law which dominates on higher lattitudes. This leads to an apparent lower slope (lower β) of the log-log spectrum in this range.

The authors make a point of splitting the spectrum of a non-scaling global signal into short pieces (ranges) and compute slopes for each of these ranges. We cannot see that this has physical meaning, since what appears as different ranges are results of combining (averaging over) signals with different scaling properties; in this case power-law scaling signals from temperate and polar zones, and quasi-oscillatory signals from the tropical oceans.

The goal of our analysis has been to uncover the underlying power-law scaling which prevails away from the ENSO region, and is why we have focused on DFA. It has been shown that the DFA analysis it is relatively insensitive to oscillatory perturbations, which is quite apparent from our DFA fluctuation function for the COSMOS simulations. In comparison, the WVA is much more sensitive (see attached figure). However, the underlying scaling also becomes apparent from the power spectrum if we analyse monthly, deseasonalised, data. This is shown in panel (b) of the attached figure for the COSMOS control simulation. This figure will replace our old Figure 7.

In the revised paper we have estimated exponents from spectra for all data sets, and used monthly, deseasonalised data where such data are available.

This should resolve the particular discrepancy pointed out by Henriksson. There are many other interesting issues discussed in their paper that would be interesting to discuss in more depth, but we believe the right place for this is in a separate paper.

Interactive comment on Earth Syst. Dynam. Discuss., 5, 363, 2014.

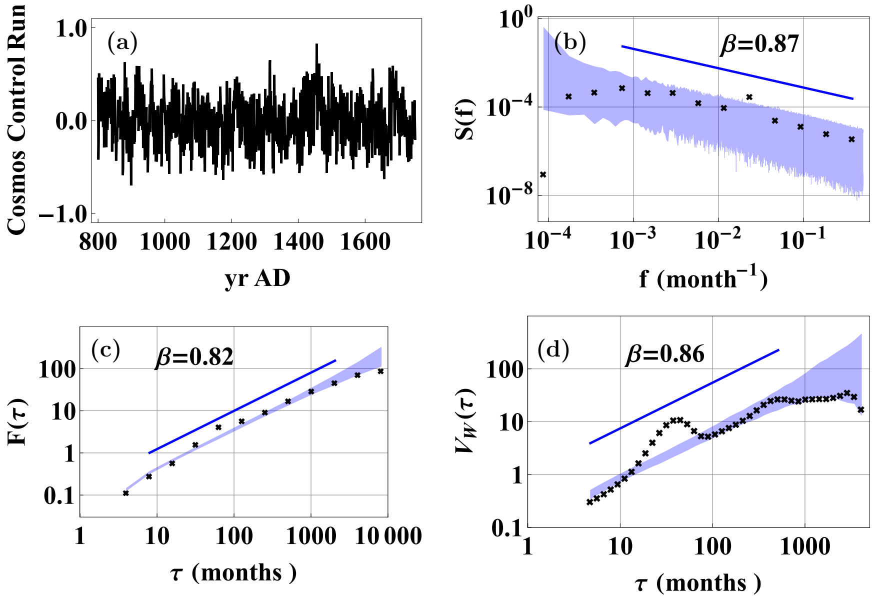

Fig. 1. New Figure 7