Long-term memory in 1000 years simulated temperature records

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We study the appearance of long-term persistence in temperature records, obtained from the global coupled general circulation model ECHO-G for two runs, using detrended fluctuation analysis. The first run is a historical simulation for the years 1000-1990 (with greenhouse gas, solar, and volcanic forcing) while the second run is a 1000 year control-run. We consider daily data of all grid-points as well as their biannual averages in order to suppress two years oscillations appearing in the model records for some sites near the Equator. Our results substantially confirm earlier studies of (considerably shorter) instrumental data and extend their results from decades to centuries. In the case of the historical simulation we find that most continental sites have correlation exponents γ between 0.8 and 0.6. For the ocean sites the long-term correlations seem to vanish at the Equator and become non-stationary at the Arctic Circles. In the control-run the long-term correlations are less pronounced. Compared with the historical run, the correlation exponents are increased, and show a more pronounced latitude dependence, visible also at continental sites. When analyzing the biannual averages, we find stronger long-term correlations in the historical run at continental sites and a less pronounced latitude dependence. In all cases, the exponent γ does not depend on the distance of the sites to the continental coastlines.