

Interactive
Comment

Interactive comment on “Scaling regimes and linear and nonlinear responses of last millennium climate models to volcanic and solar forcings” by S. Lovejoy and C. A. Varotsos

Anonymous Referee #2

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General comments

This manuscript studied the linear and nonlinear responses of last millennium climate models to volcanic and solar forcings. By testing i) the additivity and ii) the intermittency of the responses, the authors found i) additivity of the radiative forcings works up until roughly 50 year scales; and ii) the volcanic intermittency was much stronger than the solar intermittency, but the model responses were not very sensitive. Therefore, an important conclusion was reached, that is, linear stochastic models may be valid from over most of the macroweather range, from about 10 days to over 50 years. This study is new, and the conclusion is important. Therefore, I would like to recommend publishing this manuscript in Earth System Dynamics after a minor revision.

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Specific comments:

1. The paper is not well structured. In the current manuscript, there are “1 Introduction”, “2 Data and analysis”, “3 Method”, “4 Intermittency: multifractal trace moment analysis”, and “5 conclusion” five sections. The main results are shown in “3 Method”, and “4 Intermittency: multifractal trace moment analysis”. But you still can find some method description in “4 Intermittency: multifractal trace moment analysis”. When reading the manuscript, one may easy get lost. Therefore, I suggest the authors to improve the paper structure, such as i) add a new section as “Results”, and move the results shown in “3 Method” and “4 Intermittency: multifractal trace moment analysis” into the newly added “Results” section; ii) move the subsection “4.1 The Trace moment analysis technique” into the “Method” section, etc.

2. The scientific idea, as well as the results, are not well explained. The authors spent too much energy in reviewing other works, which seems to be too much in details, and not so relevant. Therefore, I would like to suggest the authors to shorten the paper and make it more compact. Some less relevant introductions can be put into supplementary materials.

3. In the introduction, the authors summarized the scaling regimes of different time scales. They claim that the scaling behaviors is changeable. The “macroweather” regime (>10 days, $H < 0$) can continue to time scales of 10-30 years (industrial) and 50-100 years (pre-industrial), after which a new $H > 0$ regime is observed. They further introduce that the scaling picture has recently been extended to “macroclimate” ($H < 0$, from about 80 to 500 kyr) and “megaclimate” regimes ($H > 0$, from 500 kyr to at least 500 Myr). However, these results are based on the GCM controls runs and paleotemperature proxies, which may bring us with big uncertainties, or even biased scaling behaviors. I am not saying the changing scaling behaviors are incorrect, but one may need to be more careful when drawing a conclusion based on GCM control runs and paleotemperature proxies. Therefore, I would like to suggest the authors to at least mention the possible uncertainties (or even biases) in the GCM runs and paleotemper-

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ature proxies.

Technical corrections:

4. On page 1827, line 28, and on page 1828, line 1, the authors mentioned “Figure 2b (left)” and “Figure 2b (right)”. Unfortunately, I cannot find in Figure 2b a left subfigure, nor a right subfigure. I guess it should be “Figure 2b (top)” and “Figure 2b (bottom)”.
5. On page 1857, Figure 3a, the curve for “Multi-Proxies 1500-1900” is missing.
6. On page 1858, in the caption of Figure 3, it is confusing that there are surprisingly one sentence describing Figure 2. Line 3-4, “. . .Fig.2b left, “spliced” with a 10Be reconstruction with a 40 yr smoother, Fig. 2b right). . .” This sentence should be removed.

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