

Interactive comment on “A novel method for analyzing the process of abrupt climate change” by P. C. Yan et al.

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Dear Referee,

We appreciate your interest to our article and your comments.

We reply on them step by step.

1) Referee. In figure 5b why state 4 does not have the same frequency as state 2? I would have expected (due to the symmetry of the ideal model) to be the same.

Authors. In figure 5b, only the “start states” is counted. For a system which is similar with the ideal model, the method is applied to detect the start states and end states. However, sometimes the length of sub-sequence is too short to cover the entire abrupt

C21

change process because the truly length of the process is unknown. Several condition could be happened during the detection as follows:

Condition 1. When the sub-sequence is moved to the moments before 150, such as 30(as shown as box 1 in Fig. 1a), the “start states” are always counted as state 2. And this is how we get the frequency of state 2.

Condition 2. When the sub-sequence is moved to the moments after 150, such as 170-250(as shown as box 2 in Fig. 1b), the “start states” could be counted as state 2.5, 3.0 et al. And this is why the states between 2~4 have values in figure 5b of the paper.

Condition 3. When the sub-sequence is moved to the moments after 350, such as 360(as shown as box 3 in Fig. 1c), the “start states” are always counted as state 4. And this is how we get the frequency of state 4.

Condition 4. There is no condition 4. Because in box 4(Fig 1d), the location of sub-sequence is break away from the sequence of the model. Thus, the frequency of state 4 is less than the frequency of state 2. On the contrary, when the end states” is counted only, the frequency of state 2 is less than the frequency of state 4, as shown in Fig. 2.

2) Referee. That the PDO is involved in global temperature variability has been demonstrated in other previous studies (for example, Tsonis et al: A new dynamical mechanism for major climate shifts, Geophys. Res. Lett., 34, L13705, 2007).

Authors. It's true that the PDO index captures the essence of climate variability as saying in the Referee #1. And for the same reason, we use this index to detect the process of abrupt change. Our result shows that the process is exist as same as what we get from an ideal model, and the persist time of the process is related to global warming.

3) Referee. I would like the authors to discuss if their method can be used to predict the next abrupt change. It's one thing to detect past abrupt changes and another to predict

C22

the next one. Can future values of parameters μ and ν be predicted from a series of past values?

Authors. The answer is "Yes". We are going to use this method to predict the end time of an abrupt change process. According to the result in this paper, especially Eq.8, the quantitative relationship shows us a possible way to solve the prediction problem. But Prior to this, there are another works need to be done firstly, including understand the character of parameter k which might be relate to some meteorological elements, and the parameters h and μ which could be calculated if the abrupt change has begun. In addition, parameter ν is constant based on Eq.8, which means the persist time of abrupt change process is almost fixed.

Interactive comment on Nonlin. Processes Geophys. Discuss., 2, 43, 2015.

C23

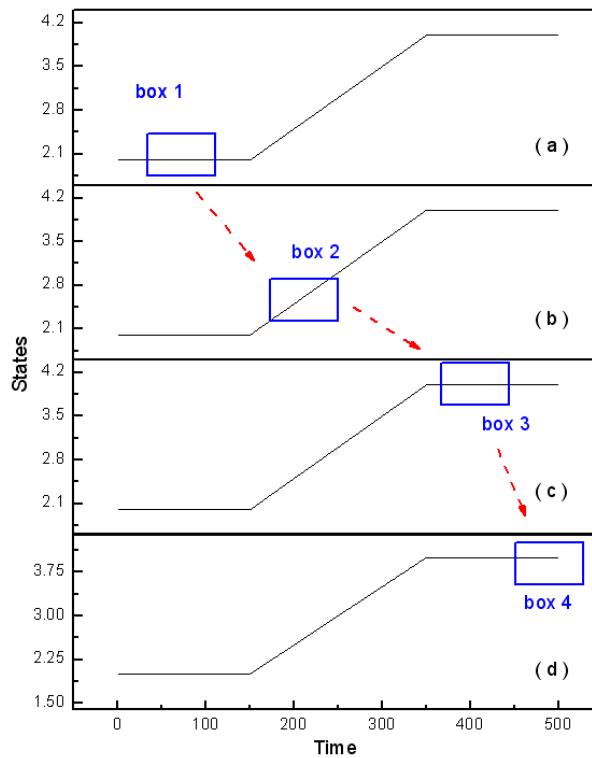


Fig. 1. Fig 1. Moving process of sub-sequence on the entire time series

C24

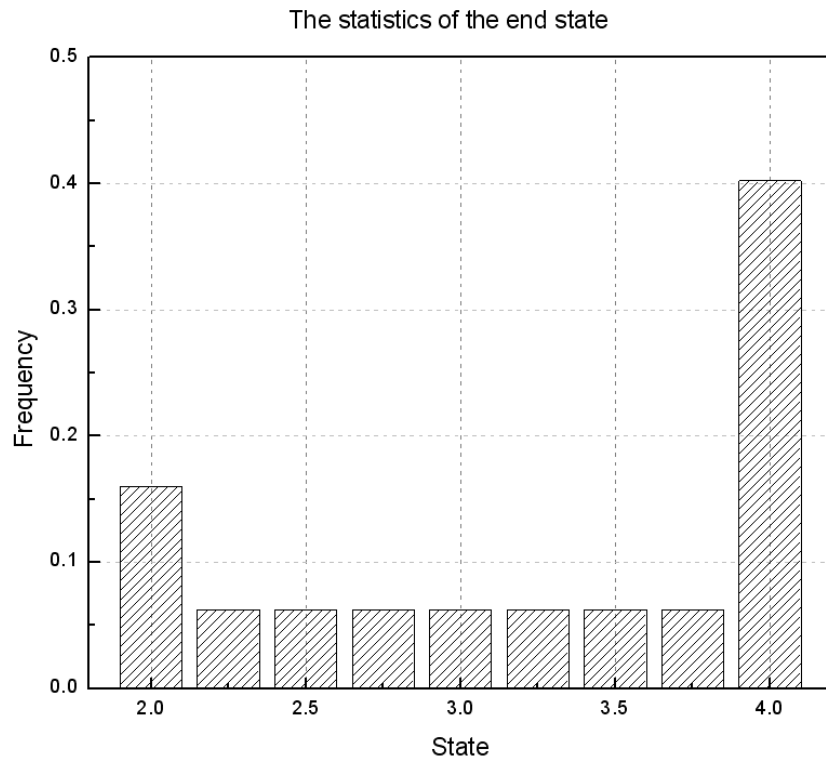


Fig. 2. Fig 2. The statistics of the end state