

## ***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. For comments of REFEREE #2, we reply on them step by step.

1) Referee. The authors explain the model in clear way, however, I consider that the case of PDO is not sufficiently explained or maybe it is not clear. What real variables are the responsible of the change?

Authors. This paper focuses on proposing a novel method based on Logistic model to detect the process of an abrupt climate change. In order to investigate that the real variables are the responsible of the change, there are so many works to be done, and the method to detect the process of an abrupt climate change may be a new powerful

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tool. Although we just apply this method to the PDO index now, but we are going to work on more variables of climate system in the future and try to get the most key factors.

2) Referee. When you use a toy model you must give a role to the variables of model because this toy model can be applied to several fields, (ecology, climate sciences,...)

Authors. In section 2, the parameters of Logistic model are discussed in detail. Based on this discussion, the characteristics of the process of abrupt change of the ideal time series are shown, then we can detect the transition process of the PDO via research its characteristics. According to the results of the ideal time series, we suggest that this method can be used for other fields.

3) Referee. With the title of the paper the reader wait a better explanation of the abrupt changes in the series of PDO. Can we predict changes in the PDO with this model?. It would be really interesting. Therefore I consider that the paper could be published in the NPG journal after a revision and better explanation of the section 3 of the paper. The authors must explain the role of each variable of the toy model in the particular analyzed case.

Authors. As what we have replied to referee #1 (question 3), the answer to the question about prediction work is “Yes”. We are going to apply this method to predict the end time of an abrupt change. According to the Eq.8, the quantitative relationship shows us a potential way to predict the end time.

4) Referee. Therefore I consider that the paper could be published in the NPG journal after a revision and better explanation of the section 3 of the paper. The authors must explain the role of each variable of the toy model in the particular analyzed case.

Authors. Based on the Logistic model, an interesting relationship between these parameters is shown. And according to Eq 2 & 8, we can calculate the parameters  $v$ ,  $u$ ,  $k$  of Logistic model, where parameters  $v$  and  $u$  correspond to the states before and after

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the abrupt change respectively,  $k$  is a instability parameter(page 46~49). During the application to the real time series, parameters  $v$  and  $u$  correspond to the states before and after the abrupt change of PDO, and  $k$  is a parameter indicated the instability of PDO. In section 3, we will add more explanation about the meaning of these variables.

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