

## ***Interactive comment on “Enhanced cold-season warming in semi-arid regions” by J. Huang et al.***

### **Anonymous Referee #3**

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Based on the CRU dataset, this paper analyzed the temperature trend elaborately of the different climatic regions from all over the world. It revealed an important fact that semi-arid regions have the most significant increasing variability. Simultaneously, it pointed out that the increasing variability has an obvious seasonal feature. This paper discussed more deeply about the possible mechanism that the semi-arid regions have a more significant increasing variability from the aspects of human activities and nature climate variability. The results provide an important reference for realizing the mechanism of global warming and regional climate change. I highly recommend here to publish this paper after modify these issues below:

1. The criterion of arid and semi-arid regions division is the key issue, which influenced the result of this paper. Traditionally, arid and semi-arid region is such district, which has more potential evaporation than precipitation. I want to know if

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- the definition of arid and semi-arid region in this paper consistent with the international criterion. The criterion of arid and semi-arid region division influences the ratio of contribution to global warming directly.
2. In figure 1, the semi-arid region is defined by the 109 years mean annual precipitation from 1901-2009. While it should be defined by 30 years mean annual precipitation, such as from 1961-1990, according to the international convention. This will avoid the influence to global climatic regions division of the long-term precipitation trend, so as to obtain a more exact global climatic regions division.
  3. In figure 2, the linear trend of temperature change should be significant tested to make sure if the temperature trend is reliable or not.
  4. In line 113, the word “expect” should be “except”.
  5. As we all know, the increasing trend of land surface air surface temperature over southern hemisphere is smaller than northern hemisphere's. We can see that the increasing trend of surface air temperature over the arid regions of northern hemisphere is smaller than the increasing trend of the semi-arid regions. On the contrary, the southern hemisphere has an opposite result. This phenomenon is very interesting. Can the author discuss a little bit here why does this happen?
  6. Does the figure 4 show the trend of mean annual land surface air temperature variability?
  7. According to the author's results, we can find out that the increasing trend in arid and semi-arid regions of Asia is more significant than that of North America and Europe. Why the increasing trend of Asia is the most significant? Including the reasons which the author mentioned, the author ignored the fact that, in the past few decades, also as we know warming period, most of the arid and semi-arid regions of Asia under a remarkable aridification period. This may be a possible important reason for this area has a more distinct increasing trend.

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