

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

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We are very appreciative for the reviewer's thorough review of the paper. His/her suggestions and comments have been most helpful in improving the readability of the paper as a whole. The revised version of the paper has addressed all of the reviewer's concerns. We hope this revision is now acceptable for publication. The following are our point-by-point responses to the reviewer's comments:

Question 1: The temperature dataset from the Climatic Research Unit (CRU) was filled with longterm climatological values (the mean temperature during 1961-1990) when nearby observations were unavailable. This affects the Arctic and the arid and semi-arid regions, where observations are scarce in the early years. An example of this problem can be found in the following figure. Because the long-term mean temperature during 1961-1990 was cooler than the air temperatures in recent decades, the infilling

C3028

of the long-term mean values in the early half of the 20th century would exaggerate the over all warming trend during 1901-2009. Users should be mindful of this problem when using the CRU data. Does the filling of long-term mean values affect the overall conclusions of this study? Do your conclusions also hold in recent 60 (or 30 years) when more observations in the arid and semi-arid regions become available?

Response: We agree with reviewer's comments, the CRU has its merit and shortcoming. But we also calculated the trend of temperature over different kind of region for three different periods (1920-1949, 1950-1979, 1980-2009) (see Figure below). The curve of trend for 1920-1949 and 1950-1979 are similar as the period of 1901 to 2009 over semi-arid region. The variability of temperature in the period of 1980-2009 is a little different with the whole trend. The figure show a constant decrease from arid to wet region.

Question 2: The semi-arid is characterized by relatively low annual precipitation and having scrubby vegetation with short, coarse grasses. It is fine to define the arid and semiarid regions based merely on annual total precipitation. However, besides the traditional arid and semi-arid regions in the middle latitudes and subtropical, this definition also classified the majority of the Arctic as the semi-arid regions. Enhanced warming was previously identified in the Arctic. Observations showed that the surface air temperatures in the Arctic have warmed at about twice the global rate in the past several decades (ACIA, 2004). How much warming identified in the semi-arid regions (defined in this study) is due to the warming in the Arctic? It would be nice to evaluate the relative contributions of the enhanced warming in the semi-arid regions over the middle latitudes and the Arctic.

Response: Although most of Arctic has been classified into the semi-arid region obey this standard of classification, the enhanced warming major happens in mid-latitude area of North Hemisphere, especially in semi-arid region of Asia, Europe and North America. We also calculate the contribution of mid-latitude to global warming to emphasis the importance of semi-arid region in mid-latitude to avoid the influence from

C3029

Arctic.

Question 3: The authors claimed that the semi-arid regions play a dominant role in the global warming and account for nearly half of the continental warming. This is not a surprise as the semi-arid regions occupied nearly half of the global land areas (see your Fig.1).

Response: We agree with that by using the precipitation as the classification standard, the semi-arid region takes a large area ratio to globe. But based on the table 2, we also find that the semi-arid regions which exclude the high latitude area still play an important role in global warming.

Question 4: Was the temperature in the Antarctic used to calculate the mean temperature over the global land surface? The CRU dataset contains no temperature data in the Antarctic, but the trends in the Antarctic were shown in Fig.2.

Response: The temperature in the Antarctic has not been used to calculate the mean temperature. We have re-drawn the figure 2 to remove the abnormal part in Antarctic area of the original one.

Question 5: What method was used to estimate the long-term trend?

Response: We first calculate the regional averaged temperature by using the Formula (1), and then calculate the linear trend by using standard statistical method (Chandler, R. E. and Scott, E. M.: Statistical Methods for Trend Detection and Analysis in the Environmental Sciences, Wiley, 2011).

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C3030

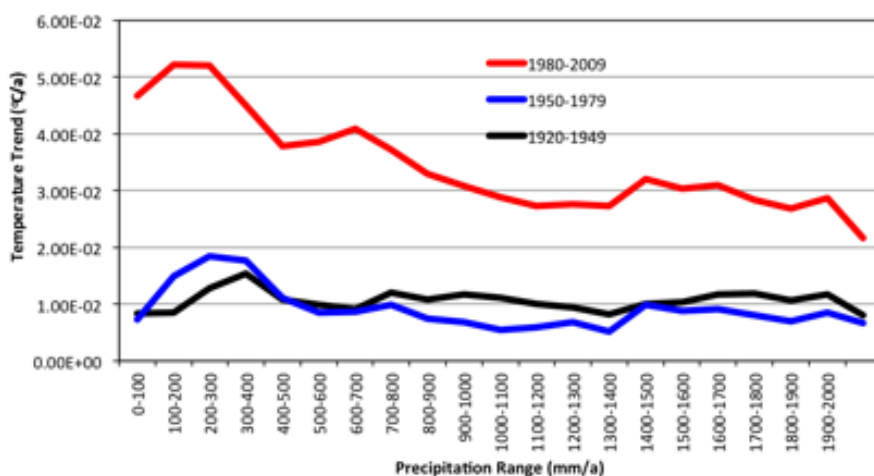


Fig. 1.

C3031