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Discussions

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Interactive comment on "Contribution of Surface Solar Radiation and Precipitation to Spatiotemporal Patterns of Surface and Air Temperature Warming in China from 1960 to 2003" *by* Jizheng Du et al.

Jizheng Du et al.

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Received and published: 20 January 2017

Please find our response below your comments

1) General Comments This is an important paper with interesting Figures on the regional variation of surface temperature trends over China, and their relation to regional precipitation and SSR. The biggest challenge for this reviewer is that I unsure exactly what the elegant Figures show. There are critical gaps between the methods section and the Figures. The legends rather than the text try to explain the content of the Figures, and they are written for the authors, not for a global audience, which will struggle

to follow the missing steps in the logic. The reader cannot connect the symbols in Methods to the symbols in the Figures, and the description of the Figures.

Reply: Thank you for the high recommendation and constructive comments. We have carefully checked and revised logical structure of paper and unified the symbols for Methods and Figures. Below please find our point to point response to your comments.

2) Technical details Comments: Methods uses Traw and Tadjusted and monthly anomalies, as well as 'z' for a regression fit to monthly anomalies of T. Do all the graphs show anomalies? Which ones show Tadjusted? Which ones show regression fits 'z'?

Reply: In this study, all of trends and regression analyses are based on the monthly anomalies of temperatures (T, including Ts-max, Ts-min, Ta-max, Ta-min), surface solar radiation (Rs) and precipitation (P) during 1960-2003. We explicitly claimed in Lines 213-214: "The linear trends reported in this study were calculated by a linear regression based on monthly anomalies of T, Rs, and P" and in Lines 229-230: "The impact of Rs/P on Ts-max/Ta-max is calculated by a multiple linear regression (Roy and Haigh, 2011) from monthly anomalies.". In this revised paper, we deleted the Eqs. (1) and (3) and revised Eq. (2) into: T=SRs*Rs+Sp*P+c+

All the confusing symbols including Traw, Tadjusted, and 'z' were removed from the revised paper. After revision, the main manuscript and figure captions are consistent. We further revised the figure captions to make them clearer and more concise.

3) Comments: Eq (1), 2 and 5 are just textbook definitions, which are poorly defined for this specific analysis. They use 'a' and 'b' as symbols for different coefficients in 1, 2 and 5. The values for these (a, b) in this analysis may appear in later figures, but the reader has to guess how they were actually computed. Which Figures show which coefficients or adjusted variables is unclear, because they are largely labeled the same: e. g Ts-max or Ta-min, or just 'PC'.

Reply: In this revised paper, we deleted the Eqs. (1) and (3) and revised Eq. (2) (see our response to your last comment). The symbols of 'a', 'b', and 'PC' were removed from the revised paper. Following comments from the other reviewers, the figures of partial correlation coefficients were moved from main text to the supplementary material section with full names labelled.

4) Comments: Relabel PCa, PCb, PCc, PCd etc with a clear connection to a numbered equation coefficient. Use the same specific language to describe the coefficient in both methods and text introducing the Figure.

Reply: See our response to your last comment. We have removed the symbols of 'PC' and relabeled partial correlation coefficients with full names.

5) Comments: Consider adding a simple label to distinguish Tadjusted from T in the Figures.

Reply: In the revised paper, we used 'Adjusted temperatures' (e.g. 'Adjusted Ts-max') instead of Tadjusted.

6) Comments: L177-180 Comment that the number of sunshine duration stations (105 in Wang et al. 2015a) is still small compared with the Ta data. How well are they distributed in western China?

Reply: Wang et al. (2015a) only used the sunshine duration data where direct observations of surface solar radiation were available to make comparison. Sunshine duration and Ta have been observed at each weather station and their numbers are the same. In this study, we used the recently released daily meteorological data at ∼2000 stations, which is the best data one can obtained now. Its spatial distribution was shown in Fig. 1.

7) Comments: L242 What are the coefficients 'a' and 'b'; and their uncertainties? Cross-reference where you show these. When you reach Figs 5 and 6, it is unclear how they relate to Eq (2)

Reply: We revised the equation (see also our response to your comment No. 1). After revision, the main text and figure captions are consistent in the symbols. We have added the 95% confidence intervals to and based on two tailed t-test, e.g. in lines 339-340: "Ts-max was the most sensitive to Rs, followed by Ta-max, and their national means were 0.092 ± 0.018 °C (W m$-2)-1$ (95% confidence) and 0.035 ± 0.010 °C(W m$-2)-1$ (95% confidence), respectively." and Lines 374-375: "The national mean sensitivities of Ts-max and Ta-max to P were -0.321 ± 0.098 °C 10 mm-1 and -0.064 ± 0.054 °C 10 mm-1 (95% confidence), respectively.".

8) Comments: L245 There are no equations 3 and 4.

Reply: The equation (3) was incorrected labelled as the equation (3) in original manuscript. In this revised paper, we deleted the Eqs. (1) and (3), and one equation was kept.

9) Comments: L251 and Figs 2 and 3. Are these Traw or Tadjusted?

Reply: Both Figs 2 and Figs 3 are yearly anomalies of original data of temperatures without adjusting impacts of Rs and P. Only Figs. 7, 8, 9d, and S10 were adjusted temperature and they were explicitly claimed in the figure captions.

10) Comments: Section 3.1.1 and Table 1, all these results are presented as mean trends with no estimate of uncertainty. Add some error estimates.

Reply: We have added the 95% confidence intervals for all of trends in new version.

11) Comments: Section 3.2.1 You need an explicit explanation of Fig 5 and then 6, The reader cannot see clearly how they were constructed. What are these partial correlation coefficients using precipitation as control? Do they relate to the Tadjusted in (5) or the sensitivities in (2)? Nothing has been defined or connected logically (and Eq (3) and (4) are missing? Same issues for Figure 8 and 9.

Reply: We have added an explicit explanation of partial correlation coefficients and the logical connection between partial correlation analysis and multilinear regression

analysis in Methods: "Figs. S3 shows the coefficients of determination of multilinear regression equation (Eq (1)), which indicates how much variance of T can be attributed to that of Rs and P. The high coefficients of determination show that the linear regression performs well, in particular for south China and the North China Plain. To separate the contribution of the Rs and P, we further calculated the partial correlation coefficients between Rs and T (or P and T), which were shown in Figs. S4 and Figs. S5." (Lines 234-240). In addition, we have added explicit introduction in the caption of Figs 5 (Figs S4 in new version): "The linear partial correlation coefficients calculated based on the monthly anomalies of the Rs and T, and avoiding the impact of precipitation (P), which can estimate the proportion of variances of T that can be attributed to the variation of Rs in Eq (1).". We have added similar introduction in the caption of Figs 8 (Figs S5 in new version).

12) Comments: Fig 6 Is this the coefficient 'a' in Eq (2)? Where do you show coefficient 'b'? Is it in Fig9?

Reply: Figs 6 (Figs S7 in new version) show the coefficient 'a' ('$S_{(R_s)}$' in new version) and Figs 9 (Figs S9 in new version) show the coefficient 'b' ('S_P' in new version). We have replaced 'a' with '$S_{(R_s)}$' and 'b' with 'S_P' and used the same symbols in Methods and Figures.

13) Comments: Fig 11 Is this the first time Tadjusted is plotted?

Reply: Yes, it is. We have added the label('adjusted') in all Figures of adjusted temperatures (see Figs 7, Figs 8, Figs 9 and Figs S10 in new version), e.g. 'Adjusted Ts-max' in Figs 7.

14) Comments: L136 and L770 cite different references for the dataset.

Reply: We make it consistent and cited Cao et al.

15) Language issues The structuring of sentences is generally very good, but verbs and tenses need occasional editing, but I will leave this to later editing. An example is

106 LST. . . plays an important role in climate change 107 research because it directly relates to the land surface energy budget. Previously, Ts 108 values used in regional climate research were primarily derived.

Reply: We have carefully checked English usage of this, and tried to make it more concise and clearer. As a result, more than 1400 words was reduced. The manuscript has been sent out for Professional English editing.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1022, 2016.