

Interactive comment on “Atmospheric impacts on climatic variability of surface incident solar radiation” by K. Wang et al.

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The authors would like to thank anonymous referee #2 for his detailed and helpful comments. Below are our point by point responses to his comments.

OVERALL

Comment: This study collected globally available surface global radiation (R_s) and sunshine duration data to investigate the causes of monthly and decadal change of solar radiation. The authors showed that the sunshine duration data can be used to reflect the radiation change and thus they extended the trend analysis from radiation stations to all sunshine stations. They found that variation of cloud cover controls R_s at a monthly scale but that aerosols determine the variability of R_s at a decadal

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time scale. The paper is well written and organized, and the result has high potential for improving our understanding to solar dimming/brightening and surface warming as well as aerosol-hydrology interactions. Dr. Stanhill has raised some critical issues, and hereafter I added several specific comments.

Response: Thanks

SPECIFIC

Comment: (1) The contribution of water vapor absorption. Due to global warming, the moisture in the air has increased. This would have enhanced water vapor absorption to solar radiation and thus contributed to decadal dimming. Although the radiation model has considered the impact of water vapor absorption, the analysis does not mention its possible effect on the decadal change of solar radiation.

Response: Thanks to pointing it out. We will add the following sentences to Line 17 of Page 14013: The water vapor absorption of solar radiation has been included in the calculation of R_c . This absorption contributed to the reported global dimming (about 1 W m^{-2} per decade) as atmospheric water vapor content increased with global warming.

Comment: (2) P14020: “The decadal variation in aerosols contributes more than 25% of the decadal variance in R_s at the majority of the individual stations” while the abstract stated “aerosols determine the variability of R_s at a decadal time scale”. This is somehow obscure and I suggest the authors give the correlation coefficient (or coefficient of determination) for the six individual regions to avoid misunderstanding.

Response: We will merge Figures 9 and 11, the correlation can be clearly see from the new figure.

Comment: (3) Suggest to merge Figure 9 and Figure 11, which will help identify the similarity between the AOD change and the R_s change

Response: We will merge Figure 9 and Figure 11 together.

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Minor comments: Comment: (1) P14011: “the direct solar beam irradiance exceeds 120 W m⁻²” should be “the direct solar irradiance exceeds 120 W m⁻²”.

Response: Will correct as suggestion.

Comment: (2) P14013: “Chinese Meteorological Administration” should be “China Meteorological Administration”

Response: Will correct as suggestion.

Comment: (3) P14018: “ theoretical SunDu”. In general, we say “maximum possible SunDu”

Response: Will correct as suggestion.

Comment: (4) Figure 13 is not presented well. I suggest adjusting the unit from W m⁻² per year to W m⁻² per decade and adjusting the color bar so that the trend at individual grids may be seen clearly.

Response: Will correct as suggestion.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 14009, 2012.