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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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This study collected globally available surface global radiation (Rs) 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 Rs at a monthly scale but that aerosols determine the variability of Rs at a decadal 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:

(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.

(2) P14020: "The decadal variation in aerosols contributes more than 25% of the decadal variance in Rs at the majority of the individual stations" while the abstract stated "aerosols determine the variability of Rs 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.

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

Minor comments:

(1) P14011: "the direct solar beam irradiance exceeds 120 W mˆ−2" should be "the direct solar irradiance exceeds 120 W mˆ−2".

(2) P14013: "Chinese Meteorological Administration" should be "China Meteorological Administration"

(3) P14018: " theoretical SunDu". In general, we say "maximum possible SunDu"

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

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