

# ***Interactive comment on* “Estimating the effects of aerosol, cloud, and water vapor on the recent brightening in India during the monsoon season” by Feiyue Mao et al.**

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Received and published: 3 August 2017

General Comments:

This manuscript summarizes an interesting study of the intra-decadal variability of surface solar irradiance over India during the monsoon. With observations from the A Train satellite instruments, the authors shown that cloud properties and water vapor and not aerosols play main roles in modifying the shortwave energy budget at the surface from 2006 to 2015. I recommend publication of the manuscript after minor revisions that aim to clarify some of the content and extend the discussion. The issues I would ask the authors to address are as follows: 1) The authors discuss the dimming/brightening

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in India during the monsoon period. Since the monsoon is commonly referred to the onset of rain over the Indian subcontinent, I would suggest restricting the data analysis to land only pixels, preferably Indian pixels. As shown in the figures, some of the cloud effects are different over the Bay of Bengal, the Indian Ocean compared to the subcontinent. 2) Albeit not subject of this study, I recommend putting the results into a broader context. This can be done by showing the surface solar radiation trend for the entire year and contrast the monsoon months, or by showing changes in temperatures/rainfall, or similar climate effects that put these interesting results into a broader context.

#### Specific Comments:

**Abstract:** The abstract does not reflect the entirety of the study and mentions temperature rises which are not discussed in the text. Some of the interesting results not mentioned are the TOA radiative changes and the atmospheric heating rates. Temperature and rainfall data could be added in the conclusions section to round up the study and be consistent with the abstract. “. . .increase in aerosol optical depth is paradoxical with the variation of surface shortwave radiation in India. . .”. “Paradoxical” may not be the best choice. How about rephrasing it, for example, “inconsistent”. As mentioned above, the figures span a much wider spatial range than “India”. Please use a land mask and focus on Indian monsoon region or change the title and text accordingly.

p.2, 26: In the literature, there are discussions about the shifting monsoon onset and end times with global warming. It would be good to explicitly explain the choice of June-Sept time-period as monsoon period. This is also important with respect to the monsoon region as discussed above.

p.5, 11: The SW band is defined from 0 – 4 $\mu$ m in the radiative transfer model and <5 $\mu$ m in CERES. Can you comment on it?

p.5, 29: Why was annual mean water vapor content used and not monsoon months in BUGSrad?

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Fig.1: Are these results for India or the region shown in the consecutive maps?

p.7, 1-15: With these cloud property changes the reader wants to know if these changes are reflected in rainfall data as well. A short discussion would be helpful.

p.7, 15-25: The changes in heating rates should also be mentioned in the abstract.

Technical Corrections:

In the abstract and throughout the text, please replace “in surface” with “at the surface”.

p.3, 3: was instead of were.

p.4, 22: Is the bias a monthly bias, and which ARM sites do they refer to?

p.6,20: “However, there is the fact that the reducing SSR is always occur with increasing aerosol levels (Folini and Wild, 2011).” This sentence is not clear and should be rephrased.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-429>, 2017.

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