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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Assessment of the effect of air pollution controls on trends in shortwave radiation over the United States from 1995 through 2010 from multiple observation networks" *by* C.-M. Gan et al.

Anonymous Referee #3

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I had great pleasure in reviewing this manuscript. The assessment of the effect of air pollution controls in the US is based on an extensive set of SW irradiance measurement data. The separation of clear-sky data from the all-sky data is in particularly interesting. The interpretation of the data, however, needs some more work.

The paper can be be accepted if the following revisions are made:

1) In section 2.5: The abbreviations BON, GWN, PSU, SGP, TBL, FPK and DRA are given without explanations. Such are given in Table 1, but they should also be given in

the main text when introduced.

2) Page 23731 lines 27-29: "In theory, the direct SW radiation is affected by clouds, absorptive aerosols and certain radiatively active gases (e.g. water vapour and ozone) while the diffuse SW radiation is influenced by the clouds, scattering aerosols and atmospheric molecules."

This is not correct. Additionally, Rayleigh scattering of atmospheric molecules affects both direct and diffuse SW irradiance. Water vapour and ozone also affect the diffuse SW irradiance. Regarding the aerosols it is essential in the context of the paper that both absorbing and scattering aerosols affect the direct irradiance through extinction. The diffuse SW irradiance is also affected by both absorbing and scattering aerosols. The scattering aerosols at low AODs will increase the diffuse SW irradiance, while absorbing aerosols will decrease the diffuse SW irradiance. The lines in the text should be changed accordingly.

3) Page 23732 lines 1-2. It is not correct to neglect Rayleigh scattering due to the amplitude of this, however, the argument can be made that Rayleigh scattering can well be assumed constant over time and therefore does not affect a trend study such as this. Please correct the lines accordingly.

4) Page 23732, lines 15-19. In these lines, the aerosol indirect effect is suggested as a reason for the SW trends. Other possible reasons should also be listed, such as overall changes in the atmospheric circulation over the US in the period investigated. Whether the atmospheric circulation is affected by ENSO and global warming in the analysed period is also important to discuss here.

5) Page 23736, lines 17-19: "For all-sky, the "brightening" occurs at the same time that cloudiness exhibits a decreasing trend suggesting indirect effects of the decreasing aerosols."

Such a conclusion cannot be drawn. As stated in comment 4, the trends in clouds can

have multiple reasons. Indirect aerosol effects are still poorly understood and need further investigation as the authors correctly state earlier in this section. The lines should be changed to reflect this uncertainly or the mentioning of aerosols in this lines should be removed.

6) Abstract, page 23720, line 28: "... diffuse SW..." It should be specified whether it is diffuse all-sky SW or diffuse clear-sky SW that is referred to here.

7) Abstract, page 23721, lines 1-4: "In contrast to the eastern US, radiation observations in the western US do not show any indication of "brightening" which is consistent with the observations (...) that show the aerosol loading increasing slightly."

This conclusion is not in agreement with the results. In both Figs. 7 and 8 (all-sky and clear-sky) significant brightening is seen for both the eastern and western US. The brightening is slightly weaker in the west than in the east, i.e. trends of 0.5131 vs 0.6296 are given in Table 2, which partly could be due to AOD, however, stating that there is no indication of brightening is wrong. The sentence should be changed to be in accordance with the results.

8) References: In the first reference the letters: "<2341:SANSRB>" can be seen. This looks like an error.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 23719, 2013.