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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Fifty-six years of Surface Solar Radiation and Sunshine Duration at the Surface in São Paulo, Brazil: 1961–2016" *by* Marcia Akemi Yamasoe et al.

Anonymous Referee #2

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The paper by Akemi Yamasoe et al. presents the results of the analysis of a 56-year record of surface downward solar irradiation with respect to other atmospheric parameters for São Paulo, Brazil. The authors try to define the main drivers of changes in irradiation during the period of study. Although some of the findings are interesting, improvement is necessary prior to publication. More specific comments are provided below.

L50: Since the two different trends are not a global phenomenon (e.g. even some of the referred studies show different results for China and India), I suggest adding "over wide regions of the world" or something similar after "documented".

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Discussion paper

L58: Zerefos et al. (2009) could be also cited at this point (in addition to Wild 2012):

ZEREFOS, C.S., ELEFTHERATOS, K., MELETI, C., KAZADZIS, S., ROMANOU, A., ICHOKU, C., TSELIOUDIS, G. and BAIS, A. (2009), Solar dimming and brightening over Thessaloniki, Greece, and Beijing, China. Tellus B, 61: 657-665. doi:10.1111/j.1600-0889.2009.00425.x

L65-66: Relative discussion (regarding the main drivers of the trends over particular areas) can be also found in:

- Kazadzis, S., Founda, D., Psiloglou, B. E., Kambezidis, H., Mihalopoulos, N., Sanchez-Lorenzo, A., Meleti, C., Raptis, P. I., Pierros, F., and Nabat, P.: Long-term series and trends in surface solar radiation in Athens, Greece, Atmos. Chem. Phys., 18, 2395–2411, https://doi.org/10.5194/acp-18-2395-2018, 2018.

- Manara, V., Brunetti, M., Celozzi, A., Maugeri, M., Sanchez-Lorenzo, A., and Wild, M.: Detection of dimming/brightening in Italy from homogenized all-sky and clear-sky surface solar radiation records and underlying causes (1959–2013), Atmos. Chem. Phys., 16, 11145–11161, https://doi.org/10.5194/acp-16-11145-2016, 2016.

- Manara, V., Bassi, M., Brunetti, M. et al. 1990–2016 surface solar radiation variability and trend over the Piedmont region (northwest Italy). Theor Appl Climatol 136, 849–862 (2019). https://doi.org/10.1007/s00704-018-2521-6

L92: Delete “Thus,”

L118: Please define if this is the standard (k=1) or the expanded (k=2) uncertainty.

L135 – 147: I am very skeptical about the methodology used to study the effect of aerosols. The authors have used a very small number of cloud-free days for each year in the period July – October in order to study the effect of aerosol. I doubt that with such a small number of days (i.e. 9 days for some years) the authors can get safe conclusions. Furthermore, I do not think that the results can be generalized for the whole year.

L172: The AOD from MODIS at which wavelength?

L173 – 175: “Shortly . . . spectrum”. Please add the appropriate reference.

L177 – 178: Again, I believe that the authors should analyze and discuss the AOD and the AAI for different seasons in the year, and for the whole year. This way they would also provide some evidence for what they claim, i.e. that the effect of aerosol is significant only in July – October.

L168 – 183: Some discussion regarding the uncertainties in the AOD and AAI product would be useful.

L211:” it is listed amongst the 24 strongest El Niño events”. The 24 strongest events during which time period?

L227 – 229: “After 1983, the trend behavior of all variables changed”. What does this phrase mean? How do the authors define the “change”? While it is acceptable to study the trends for two different periods, the authors cannot support that there is a change in the trends without any further statistical analysis. What I mean is that someone could argue that e.g. the trend in SSR did not change at all, or that the trend in SD changed in 1980. If the authors want to support their statement that “the trend changed” in a particular year, or period of years, they should use more robust statistical analysis. See for example the methodology used by Yang et al., 2006 in order to investigate whether there is a statistically significant change in the trends of stratospheric ozone: Yang, E.S., Cunnold, D. M., Salawitch, R. J., McCormick, M. P., Russell, J., Zawodny, J. M., Oltmans, S., and Newchurch, M. J. (2006), Attribution of recovery in lowerâĂŘstratospheric ozone, J. Geophys. Res., 111, D17309, doi:10.1029/2005JD006371.

L242 and L243: “Period” instead of “P eriod”

Section 3.2: Again, my main concern regarding the analysis for the effect of clouds is that the number of cloudless days is too small. So, the results may be misleading. I don’t know if making the analysis for a particular time in the day (e.g. local noon?)

could give more reliable results.

Section 3.3 Since AOD and SSA measurements from AERONET are available at Sao Paolo since 2000, I suggest that they should be also used in the analysis. The AOD measurements could be even used to evaluate the MODIS product. The AERONET data will give more information relative to the fact that: “In the case of diesel fueled vehicles, the number of new registered vehicles in the São Paulo city increased from about 5000 in 2000 to more than 25000 in 2010, the year with the highest number of registrations”

L385 – 390: As the number of cloud-free days analyzed for each year is small, I do not think that the authors can be sure that AOD did not change.

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