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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effective aerosol optical depth from pyranometer measurements of surface solar radiation (global radiation) at Thessaloniki, Greece" *by* A. V. Lindfors et al.

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General comments

The authors present a method for determining a proxy for atmospheric optical depth (AOD), termed effective AOD in the paper, based on surface solar radiation (SSR, also called global radiation) measurements in clear sky conditions. In addition to SSR measurement data, the proxy requires only atmospheric water vapor column density, generally available from reanalysis of global meteorological observations. As SSR is commonly routinely measured at meteorological stations, this makes the developed proxy highly valuable in examining the atmospheric aerosol load in various environments and also studying long time series trends related to global dimming and brightening. Accurate information on global AOD and it's changes are especially needed when assessing the role of aerosol particles in the climate change.

The developed AOD proxy is compared to AERONET derived AOD, and the agreement is found to be generally very good. Sources of uncertainties in the methods input data are discussed, and the sensitivity of the method's results to these uncertainties are presented sufficiently. Two daily example cases are presented, where the proxy AOD performance is studied in detail and the possible reasons for discrepancies from AERONET AOD are discussed.

The theory and results of the study are explained in enough detail. The paper is well structured, language is fluent and the figures presenting the results are of high quality. I have some minor specific comments and questions, which I list below, but overall I recommend this paper to be published in Atmospheric Chemistry and Physics.

Specific comments

Page 33267, line 19: Other reference the authors might add is Wang et al. (2009).

In Section 3.1 it is said that the effective AOD can be given as a look-up table as function of the measured SSR, solar zenith angle and water vapor column density. As the look-up table is site specific, it would be helpful to provide more information on how to produce these tables to a given location (using aerosol and surface properties suitable for the site). For example, do the authors have plans to make the procedure available online, or as a supplement to the paper, or available upon request from the authors? I think this kind of information would help researches who are not necessarily experts of aerosol optical properties and radiative transfer calculations to pick up the method and extend the results to other environments.

Page 33274, lines 4–6: Similar "ripples" in the SSR also seem to be present on the 18th September between 8–12 UTC, at least when visually comparing the top and bottom

ACPD

12, C12681–C12683, 2013

Interactive Comment

panels of Figure 1. Why is the data not screened as cloudy then?

Page 33274, discussion at end of the page: Have the authors performed any performance test for the method, where the cloud screening criteria would be relaxed, and if yes, how would this affect the results? This would help to evaluate the method's usefulness to use SSR data from sources where the cloud screening is not possible to perform with such accuracy as in the present study (for example, when using long-term data records).

Chapter 4.2 (Sensitivity of AOD_eff): Do the authors have some guidelines about situations or environments, where the method would be expected to perform much worse than in the Thessaloniki case? For example, on page 33277 lines 13–14 it is stated the single-scattering albedo (SSA) has the largest effect on the method results. Are there environments where the authors would not recommend their method to be used because of possible error sources related to SSA? This type of advice (if possible to give) would help the larger atmospheric research community in using the method.

References

Wang, K., Dickinson, R. E., and Liang, S.: Clear sky visibility has decreased over land globally from 1973 to 2007, Science, 323, 1468–1470, doi:10.1126/science.1167549, 2009.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 33265, 2012.

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12, C12681–C12683, 2013

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