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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of observed diurnal cycles of aerosol optical depth on aerosol direct radiative effect" *by* A. Arola et al.

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The paper is devoted to the assessment of the influence of aerosol diurnal cycle on the total 24-hour radiative effect at the TOA. On the base on AERONET data as the input parameters the authors estimated the radiative effect of diurnal aerosol variability and compared it with that estimated with average aerosol values as well as with the single value taken at the MODIS overpass time. Text has a good structure and is well documented. However, the reviewer has some remarks.

Major remarks: 1. In Section 2.2 more information on the calculation RT scheme should be given. It would be useful to present the accuracy of RT calculations in the libRadtran package. What spectral interval is considered?

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If the unusual conditions are observed for a particular site (for example, extremely high AOTs in fire smoke conditions, which can strongly affect the typical diurnal cycle) what the technique was used for removing the possible biases in diurnal cycle? This can be added to the section 2.1.

2. Since it was mentioned that the MODIS surface albedo had been applied, could you clarify what the assumption - black-sky and white-sky albedo - was used? This might be important in winter conditions when the aerosol effect over bright surface can be positive. It would be very interesting to see the effects of diurnal cycle of aerosol with taking into account for surface albedo effects (at least, to distinct the cases with bright snow and sand surfaces and grass).

3. The paper is devoted to the analysis of radiative effects from all AERONET sites. However, the most part of the paper is devoted to the description of only the 4 or 8 sites. And there is only one Figure which concerns the effects obtained over all sites. I would recommend to add the Table with the statistics for all the data.

4. It would be also useful to add the analysis of possible physical causes of the diurnal aerosol cycle where it is possible, at least.

5. At the same time formally at different wavelengths the diurnal cycle can be not the same (the changes in coarse mode can influence more in near infrared region). This, of course, would not play great role but can be described in the text.

Minor remarks:

page 10328 line 6: “at the top” instead of “on the top” missing preposition before ADRE?

line 19: seems wrong preposition: “in individual. . .”

page 10329 line 7 remove or change somehow “also”

line 16 Please, clarify why the accuracy is increasing at higher air mass. The possible

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effect of coarse mode scattering within the angle of view of the instrument may work in opposite direction?

page 10330 Please, explain, why do you use the Angstrom Exponent over the 380-500 nm range, which differs from widely used 440-870nm range.

page 10331 line 8 Please, move the sentence “We required. . .” to the subsection 2.1

line 12-15: You used a,b,c separation which was not used in the text. It should be used or removed.

page 10333 line 28 “profound” is not good to use here (may be “significant”?)

page 10334 line 11 (not shown) - why not shown? Not clear.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 10327, 2013.