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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Improved retrieval of direct and diffuse downwelling surface shortwave flux in cloudless atmosphere using dynamic estimates of aerosol content and type: application to the LSA-SAF project" *by* X. Ceamanos et al.

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The concept of SIRAMix is sound. This is an innovation that may be likely adopted in several operations. As underlined by the authors, the diffuse DSSF is strongly dependent on the type of aerosols. Having more than one type produces more accurate results on the diffuse. This is demonstrated in the comparison between SIRAMix and McClear diffuse DSSF.

The authors state that the difference in diffuse is only due to aerosol types. I'd like to

see a discussion why ruling out the possible influence of the ground albedo.

The clearness index is a valuable means to better understand the performance of a model. The clearness index, also known as the atmospheric transmissivity, is the ratio of the DSSF (global, direct or diffuse) to the similar quantity but at the top of the atmosphere. The change in solar radiation at the top of atmosphere due to changes in geometry, namely the daily course of the sun and seasonal effects, are usually well reproduced by models and lead to a de facto correlation between observations and estimates of DSSF hiding potential weaknesses. Clearness indices are stricter indicators of the performances of a model regarding its ability to estimate the optical state of the atmosphere. Though the clear sky indices are not completely independent of the solar zenith angle as they decrease as this angle increases, the dependency is much less pronounced than in DSSF. Accordingly, I'd like to see tables with clearness indices like Tables 4, 5 and 5 for DSSF as it will help to better identify the potentials of SIRAMix.

Clear-sky detection is not discussed at all. This should be performed as it is particularly important when comparing to a clear-sky model like McClear. The algorithm used should be described.

I suspect that the clear sky cases may not be all clear and this may prevent an accurate comparison between SIRAMix and McClear as the latter is only for clear sky conditions. Several stations (Carpentras, Sede Boqer, Tamanrasset) are appearing in this paper as well as in the paper from Lefevre et al. (2013) describing McClear. Periods are not similar but one may expect to find similar figures for McClear in both papers. It happens that the mean values (called "averages" in Tables 4, and 6) in direct and global McClear DSSF presented in Lefevre et al. are significantly greater than those given in this paper. For direct DSSF, Carpentras: 465 (this paper) versus 505 W/m2 (Lefevre et al.); Sede Boqer: 527 versus 667 W/m2; Tamanrasset: 511 versus 653 W/m2. This may be explained if the data set in this paper contains not-so-clear cases. This is supported by a further analysis of the McClear RMSE in both papers. If one focus on the direct DSSF, one may expect a decrease in McClear RMSE for 30 min

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data in this paper compared to the McClear RMSE for 1 min given in Lefevre et al. This is not the case at all and McClear RMSE given in this paper are similar or greater than those in Lefevre et al. An example is Tamanrasset where the RMSE for direct DSSF is 48 W/m2 in Lefevre et al. and 82 W/m2 in this paper. Again, this may be explained by the inclusion of not-so-clear cases in the data set and this casts shadow on the conclusions. Using clearness indices will clearly help in this matter. Maybe the authors should restrict their selection of clear-sky conditions and perform the same comparison with this restricted data set.

In Table 6, the authors discuss mainly the RMSE (p. 8368, line 3). The RMSE is a quadratic combination of the bias and the standard-deviation. Given the low bias compared to McClear, and the fairly similar RMSE between McClear and SIRAMix, this would mean that the standard-deviation is greater for SIRAMix than for McClear. This may be discussed. In addition, I'd like to see a discussion on the correlation coefficient for the diffuse component (Table 6) which is greater for McClear than SIRAMix, except Toravere. It is possibly linked to the greater standard-deviation.

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