

## Reviewer #2

The study presented in this paper is referring to the real time estimation of surface solar irradiance. Three different methodologies have been used and compared with ground-based measurements to check their performance under different conditions. The method of the multi-regression function (MRF) and the neural network (NN) were also the integrated spectrum for the spectral irradiance is considered additionally (NNS). For both methods (MRF and NN) the outputs are compared with Baseline Surface Radiation Network (BSRN) observations and with the training dataset, created by the libRadtran model. In the comparison, the authors make use of observations from nine stations covering different climatological conditions and latitudes, presenting nicely in the results section the potential of a general applicability of the proposed methods. Furthermore a sensitivity analysis about the impact of the aerosols and cloud optical depth on the GHI is also discussed in detail. The paper is well written and easy to be following by the reader, explaining in an appropriate way all the steps and the limitations of the methodology. All in all the paper is of high interest and suitable for publication on AMT. For completeness, there are few points that can be taking into account in the final version of the manuscript.

- The performance of the methods presented for the estimation of the GHI in real-time are well presented and discussed. The proposed methodology is useful for the estimation of the GHI and other relevant quantities at regions where ground based observations are missing. The paper is focused to methods for real-time estimation of the GHI, thus a potential use of the method for forecasting application can be mentioned in the manuscript.

Author's reply: Since the proposed modelling techniques (MRF, NN and NNS) operate in real-time, the potential applicability for short-term forecasting purposes for the next few hours is feasible. To this direction, the CAMS AOD is already an operational forecast input (Benedetti et al., 2009) with accurate predictions every 1 hour even under high aerosol load conditions (Kosmopoulos et al., 2017). On the other hand, the MSG COT short-term forecasting requires the employment of a cloud motion vector analysis (e.g. Hammer et al., 1999) in high spatial and temporal resolution (5 x 5 km and 15 minutes, which is the MSG/SEVIRI resolution), in order to predict the impact of clouds on SSR for the next 2-3 hours, while under cloudless conditions the SZA and AOD are the main solar irradiance attenuators, and hence are available as input information to the models. The above description was added in the revised paper at the end of the sub-section 2.2.3.

- Paragraph 3.2.1 Cloud effect, line 15: The mentioned regression lines should be included in Figure 8.

Author's reply: Corrected.

- Paragraph 3.2.2 Aerosol effect: The authors present only the comparison between Izaña ground AOD measurements and CAMS model AOD in order to estimate the errors produced by the AOD differences. As the AOD is of high importance parameter for the estimation of the GHI, the authors should stand in the manuscript (maybe in the

conclusion part) that CAMS performance should be checked in case of the application of the methodology to different regions (e.g Eastern Mediterranean-Middle East).

Author's reply: We thank the reviewer for this comment. To this direction we added the following text in the Conclusions section. "The CAMS AOD performance has been tested as well under high aerosol loads (Kosmopoulos et al., 2017) in different regions (Eastern Mediterranean), showing similar results as compared with MODIS. However, its accuracy should be checked in case of application of the methodology to different regions (e.g. Middle East)."

- Figure 9: Units are missing from Standard deviation.

Author's reply: Corrected.

- Figure 10: misspelling at the x-axes title. PRF AOD instead of PFR AOD.

Author's reply: Corrected.

Authors: We thank reviewer #2 for the valuable corrections. We have hopefully addressed all the points that were raised, and we are optimistic that after the reviewer's corrections, the paper has been upgraded.