Reviewer #2

This is a case study of a dust event that occurred in the Eastern Mediterranean during 30 January and 3 February 2015, and its impact on the solar radiation received at the surface. Used are observations from a variety of sources such as AERONET, MODIS, CALIPSO, a radiative transfer model and a chemical transport model and the 1-day ahead forecasts from the Copernicus Atmosphere Monitoring Service. It is reported that such a dust event can result in attenuation of the global radiation by as much as 40-50%, and a decrease of 80-90% in the direct component.
The approach used in this study follows methodologies implemented in numerous previous studies on the impact of dust on the reduction of solar radiation at the surface (and/or at the TOA). As such, the results obtained are to be expected. Some references to previous relevant work are included here.

- The actual value of the analysis to forecasting such impacts is not obvious since in real time, all the information that was available in this case in hindsight, will not be available in real time. Therefore, such impacts on solar energy planning will have to be estimated from previous knowledge of anticipated reduction.

Author's reply: The 1-day ahead CAMS aerosol forecasts can provide the basic model input information in order to predict with accuracy (within 10% as compared to the MODIS hindsight data) the AOD values in an operationally good temporal and spatial resolution (1-hour, 0.4 degrees). The other critical input is the solar zenith angle which can be pre-calculated, so the whole real time approach is feasible in terms of pre-calculated and forecasted input data to the RTM. As a result, the main output can be operational maps (like in Fig. 10) of GHI, DNI and percentage attenuation. We have now added this additional information to the text as to briefly describe the real time possibilities.

- Since the case was well documented with information from numerous sources (no validation at the surface was attempted), perhaps a brief communication on this case with a substantially reduced number of figures would be appropriate.

Author's reply: This dust case was the most extreme events in the last 5 years for the specific area, so we decided to not only study the energy impact which is the main scope of this paper, but to investigate from an observational point of view its intensity and characteristics. We believe that this complementary approach was highlighted throughout the text.

- The bibliography provided is very selective. Some relevant publications:

a. Tegen, Ina, Lacis, Andrew A., Fung, Inez Nature, 1996. The influence on climate forcing of mineral aerosols from disturbed soils. Apr 4, 380, 6573, ProQuest pg. 419.
b. Li, F, Vogelmann AM, Ramanathan V., 2004. Saharan dust aerosol radiative forcing measured from space. Journal of Climate. 17:2558-2571.
c. Diaz, J. P., F. J. Exposito, J. Torres, F. Herrera, J. M. Prospero, and M. C. Romero, 2001. Radiative properties of aerosols in Saharan dust outbreaks using ground-based and satellite data: Applications to radiative forcing. J. Geophys. Res., 106, 18 403– 18 416.
d. Haywood, J. M., P. N. Francis, M. D. Glew, and J. P. Taylor, 2001. Optical properties and direct radiative effect of Sharan dust: A case study of two Saharan dust outbreaks using aircraft data. J. Geophys. Res., 106, 18 417–18 430.

e. Kaufman, Y. J., A. Karnieli, and D. Tanre, 2000. Detection of dust over the desert by EOS-MODIS. IEEE Trans. Geosci. Remote Sens., 38, 525–531.
f. Kaufman, Y.J., D. Tanre, O. Dubovik, A. Karnieli, and L. A. Remer, 2001. Absorption of sunlight by dust as inferred from satellite and ground-based remote sensing. Geophys. Res. Lett., 28, 1479– 1482.
g. Pandithurai, G., et al., 2008. Aerosol radiative forcing during dust events over New Delhi, India, J. Geophys. Res., doi: 10.1029/2008JD009804.
h. Miller, R. L., I. Tegen, and J. Perlwitz, 2004. Surface radiative forcing by soil dust aerosols and the hydrologic cycle, J. Geophys. Res., 109, D04203, doi: 10.1029/2003JD004085.

Author's reply: We thank the reviewer for these additional references. It will be a valuable addition, so we included them in the revised paper.

- When providing information on outliers, indicate the % of total number of points available.

Author's reply: The outliers represent less than 0.5% of the data (250 points) of total coincident values. We thank the reviewer for mentioning this omission. We added this information in the revised version.

- Since the paper deals with the Eastern Mediterranean, examples of CSP installation in that region should be mentioned (instead of a facility in Western Med).

Author's reply: We added some relevant CSP installations for the Eastern Mediterranean as well, since the whole Mediterranean region is often affected by Saharan dust plumes.

- Acronym and references should be provided the first time used (e.g., P. 2, L. 25: libRadtran).

Author's reply: We want to thank the reviewers for all the careful remarks. We have now corrected all the structural issues.

- P. 3, L. 23, stated: "In this paper MODIS Aqua C6 L2 is used". There are differences between Terra and Aqua. Why Aqua was selected?

Author's reply: The present study investigates the impact of dust aerosols during an extreme dust event on surface solar radiation. In the framework of the study and in order to describe the dust event both passive and active satellite remote sensing instrumentation (MODIS and CALIOP) are utilized. Indeed the reviewer is right, the anomalously high aerosol load recorded between the 30th of January and the 3rd of February 2015 over the domain of eastern Mediterranean Sea is captured both by Aqua MODIS and Terra MODIS. There are differences between Terra and Aqua. Both Terra and Aqua are sun-synchronous, near-polar circular orbit satellites. Terra crosses in descending node the equator at approximately 10:30 A.M. local time. On the contrary, Aqua crosses in ascending node the equator at approximately 1:30 P.M. local time. Both Aqua-MODIS and Terra-MODIS spectroradiometers image the same domain on the Earth's surface with a difference of approximately three hours. The dust event, having a duration of three days, is captured well by both MODIS sensors. The selection of Aqua-MODIS in the present study is related to the orbit of Aqua which meets the needs of providing the 3-dimentional overview and description of the dust event. Aqua, being part of the A-Train

constellation of earth observation satellites, flies in formation with CALIPSO. Consequently, the synergy of Aqua-MODIS and CALIPSO-CALIOP results in the horizontal and vertical description of the dust event, hence on the 3-dimensional overview. This could not have been achieved if focusing on the Terra-MODIS retrievals. For this clarification, we added the above brief description in the revised paper.

- P. 4, L. 19, stated: "The final analysis data (FNL) of the National Center for Environmental Protection (NCEP) are used for the assessment of the meteorological conditions". Later on, on P. 4, L. 27: Stated: "COSMO-ART is a regional atmospheric model which couples online meteorology and chemistry and is used". Some explanation is needed why both are needed.

Author's reply: The FNL are meteorological reanalysis data at 1x1 resolution and are used to represent the synoptic scale conditions during this period. Also FNL is part of the GDAS data assimilation system that we used to drive the HYSPLIT runs and as seen in Figures 1a,b both datasets confirm the favorable conditions for the transport of Saharan dust towards the Aegean.
On the other hand, COSMO-ART is a more complex prognostic model and it is used for the numerical simulation of the interactions between atmospheric chemistry and meteorology at regional scale. The model solves all relevant equations at every time step (30 sec), so that the aerosol (in our case, dust particles) effects on the earth radiative budget are estimated accordingly (e.g. Figures 11 and 12).

- P. 11, L. 28, stated: "Surprisingly, further inland in the Balkan peninsula, where the surface is less affected by the dust plume during the dust event. This means that the interaction of dust particles with the atmosphere leads to a positive feedback on solar radiation at the area north of the plume." The connection between these two statements requires clarification.

Author's reply: We realize that the connection between the position of the dust plume tongue and the direct radiative effects is not evident, because of the structure of the relevant paragraph. In short –and as already described in previous relevant studies (e.g. Stanelle et al., 2010), the interactions between dust aerosol and radiation creates a thermal gradient in the atmosphere, which causes a shift of the dust tongue towards the south. In other words, when the interaction is on (base-case run) more amounts of direct solar radiation are received at ground further inland the Balkan peninsula, due to the aforementioned mobility of the dust plume from north to south. In order that this is clearer in the revised document, a restructuring in the relevant paragraph is performed.

- P. 12, L.17, stated: "This study reconfirms and quantifies high dust aerosol load impact on surface solar radiation." Since this study only "reconfirms" what is already known, it is recommended to condense it to a short communication.

Author's reply: We thank the reviewer for this comment in order to clarify the significance of the communication followed in this paper. Actually, by concluding in this way we wanted to "reconfirm" such quantified aerosol impacts on SSR, adding a perspective on operational energy planning using a synergy of CAMS AOD forecasts and pre-calculated inputs like the SZA. This knowledge will enable the evolution of accurate near real time, nowcasting and forecasting SSR estimation models and systems as to provide already know information at the right time and not as post processing reanalysis data. At the same time, since this dust case was one of the most intense of last 5 years, it is useful for the

readers to follow our proposed methodology with reference to a recent case study. As a result, we highlighted the multifaceted approach covering the model simulations from RTM and CTM in conjunction with the predicted AOD from CAMS, its validation against MODIS data and the 3D observational dust plume description. We strongly believe that this study forwards the quantification of the PV and CSP losses from dust events and it will be a step to the right direction of the energy related policies.

Authors: Once again, we thank the reviewers for their constructive comments and we believe that after the proposed revisions this study was overall upgraded.