Reviewer #1

We acknowledge anonymous reviewer#1 for his/her constructive comments. Replies to the reviewer's specific comments are provided in the following (text in blue) after the reviewer's comments (text in black). Line numbers correspond to the manuscript version with tracked changes.

Before replying to the reviewer's comments, we must make a clarification for the used RIs.

The refractive indices that have been used for the analysis in the SW are those by Balkanski et al. (2007), Colarco et al. (2014), and OPAC, and not Balkanski et al. (2007), WMO (1983), and OPAC, as stated in the original version of the manuscript. For the LW, we used the refractive index by WMO (1983) (instead of Colarco et al. (2014)) because Colarco et al. (2014) do not provide the refractive index in the LW. We corrected this mistake and clarified what has been done in Section 2.1 (line 164).

This paper presents optical properties of aerosols under three different spectral-resolved refractive indexes. Two ranges for the aerosol size are used, below 10 μm and below 50 μm. Calculations are made over the desert and over the ocean. Moreover, the shape is considered since calculations are made with spherical and spheroidal shapes. The first part of the manuscript presents the spectral dependence of the extinction, scattering and absorption coefficients. The second part refers to a radiative transfer model and irradiances are calculated for specific situations. The authors emphasise the influence of the particle size and shape on the calculated properties.

The paper is quite detailed and complete since an extensive work has been made. Consequently, it could be published in Atmospheric Chemistry and Physics after the introduction of the following minor changes.

The paper structure should be more detailed at the introduction end. Moreover, since varied situations and conditions are considered, the authors should highlight the most relevant ones. For instance, the authors could select the noticeable results that may be followed in further research. Finally, the authors should note the restrictions of their research.

More discussion (lines 86 - 91) and additional (recent) references have been added in the introduction of the document. Furthermore, in the Summary and Conclusions sections we added more information to point out the weaknesses of our study. In particular:

The first paragraph of the "Summary and Conclusions" section has been modified as follows:

"Our study focuses on quantifying the radiative effect of the underestimation of the size of dust particles and the misrepresentation of their RI and shape in models under different atmospheric and land surface conditions. It must be clear that it is not providing quantitative estimates of the dust radiative effects on a regional or a global scale. Although our findings are not directly comparable with regional or global average DREs, they are meaningful for comparison with actual measurements at related experiments (see e.g. see Otto et al., 2007). As can be also perceived by the findings of other recent studies (e.g., (Li et al., 2022, 2021; Song et al., 2022) the estimates of DRE on larger scales are strongly affected by the inhomogeneities in the characteristics of dust depending on its sources, on changes in its chemical and physical properties as it is transferred, and on the surface and environmental conditions. The present study contributes towards understanding the uncertainties in the estimates of regionally/globally averaged DREs by models, that are commonly based on many assumptions (regarding e.g., the shape, size, and composition of dust). Isolating the effects in a microscale sensitivity study can indirectly help modelers towards understanding the importance of each factor and their combined effects, on determining the input uncertainties and their propagation to the outputs. In addition to the assessment of the regional/global DRE and its modelling

parameterization, studies that are similar to the present are also useful for example, for evaluating satellite-based data or radiative closure studies."

We have also added the following information in lines 649 – 652: "It must be also noticed that the dust shapes are various, and usually irregular, and a single model (e.g., spheres or spheroids) cannot represent accurately the complex shapes of dust (Luo et al., 2022; Connolly et al., 2020; Kalashnikova and Sokolik, 2002). Thus, further research is necessary in order to determine more precisely the effect of shape in RT modelling."

Minor remarks.

1. 88. Revise "aa model".

   done

2. 100. One "considered" must be supressed.

   done

3. 101. One account must be supressed, "accountthe" must be "account the", and "RIRI" must be "RI".

   done

References should follow the journal style. Some of them are quite old.

References have been updated throughout the document.