

Interactive comment on “Shortwave radiative forcing and efficiency of key aerosol types using AERONET data” by O. E. García et al.

Anonymous Referee #1

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The paper address the study of radiative forcing due to different types of aerosols, using AERONET data obtained in a set of equations distributed around the globe, in this sense the manuscript contents are within the scope of ACP. The paper uses the radiative forcing product delivered by AERONET to perform an original study that defines some sets of stations affected by different aerosol types. The study reaches substantial conclusions in terms of the characterization of aerosol radiative forcing and aerosol radiative forcing efficiency. The paper is well written and presents an appropriate structure. One relevant point concerning the methodology is the way the authors define the radiative forcing concept. Thus in section 2 the authors state: "Direct radiative forcing from atmospheric aerosols, denoted as ΔF , is defined as the difference in the energy levels between a situation where aerosols are present, F_A , and a situation where these atmospheric particles are absent, F_C ". This statement does not reflect the correct

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idea after the shortwave aerosol radiative forcing that represents the change in the net solar radiation associated to the inclusion/exclusion of atmospheric aerosols. The application of this definition to the radiative forcing computed at TOA is compatible with equation (2) in the manuscript, but the computation of the shortwave radiative forcing at BOA does not lead to equation (1) in the manuscript. In fact the radiative forcing at BOA will be equal to equation (1) multiplied by the factor $(1-\alpha)$ with α the surface albedo. This fact needs to be clarified and carefully took into account in any comparison with results derived in other studies. In fact, the use of equation (1) implies an overestimation in the absolute values of radiative forcing strongly dependent on the surface albedo. In order to improve the manuscript the authors must discuss and clarify appropriately this point using a different denomination for the variable defined in equation (1) that as stated above does not correspond to the broadly used concept of aerosol radiative forcing at BOA.

Specific comments: The final statement in the abstract must be reworded otherwise it reads a little bit confusing. "Adding" or "summing up" will be more appropriate because although greenhouse gases and the aerosol over high reflectivity areas lead to Earth-Atmosphere system warming, both mechanism are really different.

Pag 32649. Line 2. "Radiation variation" is not clear enough. "Change in the radiative balance" is more appropriate.

Pag 32649. Lines 13-15 . The statement: "...indirectly, by acting as nuclei of cloud condensation, modifying their own properties (albedo, reflectivity, life time, precipitation efficiency,...)" must be reworded in order to improve readability".

Page 32649, lines 18. The statement "...favoring unstable conditions..." is too ambiguous.

Along the manuscript the number of decimal figures must be revised, it has no sense to state an uncertainty or standard deviation with more than two decimal figures when the more significant figures is larger than 2.

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