

## ***Interactive comment on “Impact of Saharan dust on North Atlantic marine stratocumulus clouds: Importance of the semi-direct effect” by Anahita Amiri-Farahani et al.***

### **Anonymous Referee #2**

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The radiative impact of Saharan dust on North Atlantic stratocumulus clouds (SCs) was estimated in this study by integrating A-train satellite constellation observations, MACC reanalysis and ERA-interim data together. The first indirect effect and combination of the second indirect effect and semi-direct effect were also quantified following the methods of Quass et al. (2008) and Chen et al. (2014). It is interesting to study dust aerosol effect on cloud according to observation and theoretical assumption. However, there are still some specific questions and methods should be addressed.

1. P1, line 7, the authors conclude that two methods yield similar results for the annual mean aerosol-cloud radiative effect. Actually, there is a big difference in standard deviation except for similar mean value.

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2. P1, Line 17, “Semi-direct effect can result in negative (absorbing aerosol lies above low clouds) and positive (absorbing aerosol lies within low clouds)”. It is confused that how to tell from the aerosol layer position above or within low clouds. As shown the author’s statistic results, the 50-90

3. P4, Line 16, the same question as above, how did the authors quantify how much dust is within or even below clouds using CALIPSO? According to my understanding, most aerosols within and below clouds cannot be detected by CALIOP. If the clouds with cloud optical thickness less than 4 are excluded as described by authors, the aerosols within and below clouds will never be detected.

4. Suggest to give reader much more specific explanation about how to select SCs in the study area. More reader as me will confuse the connection between marine SCs regime and CERES cloud properties. Because authors told us that the SCs regime are defined only according to vertical velocity and LTS from ERA-Interim data. The definition exactly increase the convenient of selecting SCs, but we cannot understand how to obtain SCs cloud properties from CERES data and how to screen the effect of ice cloud at multilayer cloud system in this study. Because the calculation of planetary albedo according to function (2) ignores the contribution of ice clouds. Despite SCs are warm clouds, the ice cloud above SCs should be also screened according to such as cloud top pressure or cloud top temperature and so on.

5. P2, Line 5, please refer the following paper about dust semi-direct effect. Huang, J., P. Minnis, B. Lin, T. Wang, Y. Yi, Y. Hu, S. Sun-Mack, and K. Ayers, Possible influences of Asian dust aerosols on cloud properties and radiative forcing observed from MODIS and CERES, *Geophysical Research Letters*, 33 (6) (2006), L06824, doi:10.1029/2005GL024724.

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