The authors greatly appreciate the constructive comments from the reviewer #2. The reviewer maintains that the methodology described in the paper is a good and a reasonable strategy, already, introduce by Scarnato et al., 2013. The peculiarity of methodology combines particle shape observations to numerical simulations, and it is of relevance for both climate and remote sensing applications. The reviewer also recommended publication of the paper after considering the following suggestions and minor corrections. We revised our manuscript in a number of locations in response to the reviewer's comments. The specifics are listed below.

1. Because the subject is relevant for climate modelling and remote sensing, it would be convenient for readers working in these fields to compare the optical properties calculated here with such based on approximations commonly applied in climate models and inversion algorithms, e.g., to results from Mie calculations for spherical particles with volume equivalent radius.

We convene with the reviewer, that BC particles are typically assumed to be spherical in both climate models and (depending on the aerosol type) in remote sensing retrievals. The authors provided equivalent volume Mie-simulations for BC aggregates with similar characteristics in Scarnato ACP (2013) and China et al., (2015), so we added the references and modified the text in the following way:

"Large differences in both magnitude and spectral dependency are found in optical properties of BC aggregates compared to equivalent volume spherical particles, the biases and their relevance for radiative forcing estimates with different surface albedo are discussed in Scarnato et al., 2013 and China et al., 2015".

Dust particles morphology assumptions may vary in remote sensing retrieval algorithms. AERONET retrieval assumes dust particles to be spheroidal, while MISR retrieval (16+) uses spheroidal, grain, plate shapes. Our paper discusses a subset of those shapes, such as plates and spheroidal particles. The text has been modified in the following way:

"Both orbital and ground based remote sensing techniques use a pre-selected library of aerosol types in the analysis of radiometric data. The computations of optical properties for the library often make use of spherical shape assumptions.

The assumptions of mineral dust particles shape may vary in the retrieval algorithms. AERONET retrieval assumes mineral dust particles to be spheroidal (Dubovik et al, 2006), while MISR retrieval (version 16+) uses spheroidal, grain, plate and spherical shapes (Kalashnikova et al., 2013).
The retrieval algorithms select an aerosol type based on the best fit to radiance measurements [i.e.](Deuze et al., 2001, Hasekamp et al. 2011)."

2. Introduction, end of 1st paragraph: further studies considering core-shell particles (and combinations of internal and external mixing) in global climate models:

Kim, D., C. Wang, A. M. L. Ekman, M. C. Barth, and P. J. Rasch (2008), Distribution and direct radiative forcing of carbonaceous and sulfate aerosols in an in- teractive size-resolving aerosol–climate model, J. Geophys. Res., 113, D16309, doi:10.1029/2007JD009756.

Klingmüller, K., Steil, B., Brühl, C., Tost, H., and Lelieveld, J.: Sensitivity of aerosol radiative effects to different mixing assumptions in the AEROPT 1.0 submodel of the EMAC atmospheric-chemistry–climate model, Geosci. Model Dev., 7, 2503-2516, doi:10.5194/gmd-7-2503-2014, 2014.

The references have been added, thanks for the suggestions.

3. Technically, the generation of the synthetic BC aggregates is not outlined in detail. What code is used? Is it publicly available? If yes, this would improve the traceability of the results

The aggregate generation code has been developed by Dr. Richard Denis, as stated in the acknowledgment section. The code has been described and used by Scarnato ACP, 2013 and Richard et al. 2008 and 2011 (the latter for applications in Lunar science). The aggregates have been in detail characterized by several morphological descriptors. Any available aggregate generation model can be used to reproduce aggregates with the specifics described in the paper.

4. The aspect ratio of the synthetic dust particles is given, but what is the relation between all three side lengths/diameters of the rectangular prisms and ellipsoids? The terms "spheroid" and "ellipsoid" seem to be used synonymously here. However, if in fact spheroids are used (ellipsoids with two of three diameters being equal) as stated in l 6, p. 2496, this should be made clear in Table 1 and also, if they are oblate or prolate. Accordingly, please check the consistent usage and appropriateness of the term "rectangular prism".

The aspect ratio is kept constant at 1.75 for all 3 axes. The spheroids are oblates and the optical properties discussed are averages over 1000 random orientations. The text has been modified accordingly in Table 1.

5. In Fig. 1, BC and dust should be clearly distinguishable, e.g., by using different colour tints or markers.

We marked the BC particles with red circles on top the dust particles.

6. In Fig. 4, the results are indistinguishable. Colours could help.

As described in the text, the assembles of BC aggregates are characterized by MEC, MAC and MSC values of very similar magnitude and spectral dependency, resulting in little or no sensitivity to aggregate size, therefore lines are very close. Different colors and symbols have been not found to help, so the plots are left as submitted. Where differences on optical properties are more significant (i.e. Fig. 5), the black color used to identify BC aggregates does not create an issue in the readability of the plots.

7. In Fig. 8 (a) for BL2S3 the MAC seems to be plotted instead of the MEC. Generally, Fig. 8 is confusing because some curves and symbols are hard to identify; also the sub-captions only refer to the internally mixed case.

We checked and plots are consistent. The sub-caption has been modified with a) MEC b) MAC c) MSC

The only option to reduce the clutter in figure 8 would be to plot the three coefficient into two separate sets, one for larger and one for smaller particles, but that will make the comparison less direct, so we prefer to keep the plots as they are.

8. In Fig. 9, the results for S3 and S5 are drastically different from the results for S1 and S2. Because S2 and S3 differ only by a (moderate) change in the size of the dust particles, at first sight this looks surprising, however the discussion in the last paragraph of p. 2503 is vague. Is it possible to provide a simple qualitative explanation (e.g., does in l 26 "small particles sizes (small size parameter)" indicate that combining small BC particles and big dust particles to big internally mixed particles simply removes all particles from a size range of efficient extinction, analogously to the range 2 pi r / lambda ~ 4 for spherical particles)?

The difference in size between the cases S2 and S3 is not moderate considering the short spectral range (as a matter of fact the size parameter at 300 nm is almost 6 for case S2 and 16 for case S3). One should also consider the small ratio between the size of the internally mixed particle and the BC of 1.8 for BL2S1 and 2.8 for BL2S2, compared to 5 for BLS3 and 10 for BL2S5.

The authors modified the text after the sentence:

[…] We found that for smaller particles (cases S1, S2, BL2, BL2S1, BL2S2) external and internal mixtures predict similar values of Cabs, scat, ext in the entire spectral range, with ratios respectively of 1.09±0.06, 0.96±0.05 and 1.02±0.07.

in the following way:

"The latter might be due to the combination of 1. small electromagnetic interactions between the BC aggregate and the mineral dust particle, due to the small size parameter and, 2. the small difference in size between BC and mineral dust particles (with a mixture/core size ratio < 2.8).
While, we found for larger particles (with larger size parameters) larger differences in $C_{ext, abs, scat}$ values, depending on the parametrization of the mixing configurations (such as external, cases BL2+S3, BL2+S5, BL2S3, and internal BL2S3 and BL2S5). For those cases, simulations using external mixture representations give smaller Cabs values compared to internal mixtures (with average ratio of 0.87±0.30) for wavelengths shorter than 550 nm, while larger values (average ratio of 1.35±0.49) for wavelengths larger than 550 nm. Further, Cscat values for external mixtures are smaller than internal mixtures in most of the spectral range studied (and similarly for Cext values) with average ratios of 0.59±0.30 and 0.49±0.27 for wavelength shorter and larger than 550 nm. Internal mixture might lead to larger values in Cscat (and similarly for Cext) values because of larger scattering interactions and electromagnetic coupling between mineral dust and BC, which might lead to an increase in scattering compared to the external mixtures, similar results were found in Scarnato et al., 2013"

9. Table 5 and Fig. 11 are not explicitly referenced in the text (p. 2500, l 27 should probably refer to Table 5, not 4).

Thanks for noticing; we changed the Table number accordingly

10. Some typos are in the text, e.g.:
p. 2489, l 24: "indeces" should read "indices"
p. 2492, l 14: "same" should read "some"

p. 2495, l 24: "randomly" should read "random"
p. 2496, l 21: "indeces" should read "indices"
p. 2498, l 7: "Califonia" should read "California"
p. 2500, l 20: "asymmeter" should read "asymmetry"

We thank the reviewer for pointing out the typos, they have all been corrected.