Response to reviewer (RC1)

We thank the reviewer for taking the time to provide us with helpful comments that we believe have substantially improved our paper. We address each concern of the reviewer on a point-by-point basis as follows:

1) The descriptions on the iteration procedure for calculating mixed soot particles are difficult to understand. How many iterations are necessary to obtain Wr=20? What is the relationship between relative humidity and Wr? What is the relative humidity in Figs. 7-9?

Reply: To produce V_r~20 particles, we started from the state of bare soot ($V_r = 0$) and the result of particle shape was outputted when V_r exceeded 20. As described in Eq. (3), ~2 % of the surface points defined in the grid space are adhered as WS material for one iteration (including two steps). Approximately, 1000 (2000) iterations were applied for making the V_r~10 (V_r~20) particle. A sentence was added in the text (Page 5 Line 13-14). The relative humidity is a parameter to determine the refractive index of water soluble (WS). We used the results of refractive index at relative humidity 50% for the plots of section 3. For the dataset of light scattering properties, we calculated the optical properties of particles for 4 cases of relative humidity (0%, 50%, 90%, 98%). The values of relative humidity and refractive indices were mentioned in the text (Page 7 Line 8-9) and in the caption of Table 1.

2) Lidar ratio values should be discussed in more details. Lidar ratio values at 355 nm and 532 nm reported in observational studies should be summarized. In my understanding, the observed lidar ratio at 355 nm was smaller than 532 nm in forest fire cases. It looks the wavelength dependence in Fig. 8 is opposite for small Wr. However, it looks good for large Wr, for example, A-7 Wr=20. The depolarization ratios are also close to the observation, in this case. Considering the lidar ratio values, it may be more appropriate to consider large Wr, even if the depolarization ratios are not well reproduced. Lidar ratios calculated with MG and CS should be also presented.

Reply: Results of lidar ratios for MG and CS were added (Fig.8-9). We also

added a short discussion about the results of lidar ratio (Page 8 Line 18-25, Page 9 Line 13-21) including the results of depolarization ratios. As the reviewer pointed out, lidar ratio at 355 nm can be smaller than that at 532 nm depending on the size and mixing condition of the particle.