Referee #1

The authors would like to thank Reviewer 1 for the comments and ideas. We addressed each comment (black) below in blue in detail. Respective text changes in the manuscript are also indicated.

1) The paper provides very interesting smoke observations (SAGE III, OMPS). As a suggestion, one could try to compare the observations with respective lidar observations (Hu et al., ACP, 2019, Haarig et al., ACP, 2018, CALIOP from September 2017 to March.

We like the idea of comparing our satellite-based analysis with ground-based LiDAR measurements, which would make the study even more robust. However, both Haarig et al. and Hu et al. work with LiDAR measurements from Europe (France and Germany). The measurements in this study, which cover that region are shown in Fig. 1B. Unfortunately, with only 30 measurements per day, the SAGEIII data set does not provide a profile close enough to Europe end of August for any comparison.

2) Regarding the simulations: In Haarig et al. (2018), they show a size distribution (the soot showed a pronounced aged accumulation mode, but no coarse mode) and they found single scattering values of 0.74 (355nm), 0.8 (532nm), and 0.83 (1064nm). In your simulation you use SSA of 0.9-0.93. This is quite high for soot! Any comment? Maybe, another simulation with SSA of 0.8-0.85?

The interval SSA= [0.90-0.93] has been chosen, consistently with past observations/modelling of the evolution of fire plume optical properties (cited in our manuscript, see Sect. 4), as to mimic an aged fire plume. In this case, the plume is expected to be composed of "sulphate-covered soot" rather than pure soot. This is generally associated to SSA >0.9 rather than 0.80-0.85. Please note that our radiative calculations have been based on a plume 2-3 week older than the plume sampled in the work described by Haaring at el. (2018). Please also note that our hypothesis on SSA is quite consistent with Ditas et al. (2019), mentioned by Referee #1 (see comment 3). See in particular Fig. S12b of this latter paper. Basing on these considerations, we don't feel that a SSA of 0.80-0.85 would be representative of the plume at the conditions discussed in our manuscript; we also feel that adding the estimations based on a further group of simulations in the discussion of the radiative forcing of this plume, with pure-soot optical properties, would just be confusing for the Reader. If the Referee #1 still thinks that it can be useful, we might carry out new simulations and add this to Sect. 4. In any case, we added the reference to these observations of the plume in the revised manuscript: "This points at the presence of less absorbing features with respect to fresh biomass burning soot because of the progressive coating of condensed sulfates and/or organics (Ditas et al., 2019 and references therein). In addition, SSA for boreal forests fires have, on average, a higher SSA than tropical forests fires (Wong and Li, 2002). The optical properties of this fire plume have been observed with a ground-based LiDAR, on 22 August in Europe, by Haarig et al. (2018). They report a SSA of 0.80 in the visible spectral range, which is typical of pure-soot particles. Nevertheless, our radiative simulations are representative of a plume at least 2 weeks older than the one sampled by Haarig et al. (2018) and with quite likely less absorbing (in terms of *absorption to scattering ratio) sulphate/organics-covered soot particles. Ditas et al (2019) have shown that SSA, for a biomass burning aerosol plume, is strongly dependent on the coating thickness of core black carbon particles. For aged fire plumes, a particle-to-core ratio of 4 or bigger was observed with in-situ aerosol observations on aircraft platforms (Fig. S12a of Ditas et al. (2019)). In these cases, the particles SSA has values of 0.90 or bigger (Fig. S12b of Ditas et al. (2019)). Therefore, we select 0.90 to 0.93 as the interval of SSA for the particular aged fire plume investigated in our paper".*

3) Please also check the paper of Ditas et al. (PNAS, 2018/19) concerning their simulation of the impact of soot on the radiation field.
Ditas et al. is a very interesting study and relevant to this work. We added some discussion on our choice of SSA, which is supported by the findings of Ditas et al

Page 2 line 9: "Above southern France the plume was observed at altitudes up to about 20 km (Khaykin et al., 2018). Multiple studies have analyzed the fire plume above western/central Europe with LiDAR observations (Khaykin et al., 2018; Ansmann et al., 2018; Peterson et al., 2018). The general impact on the radiative balance and climate of aerosol plumes from wildfires in the lowermost stratosphere has recently been discussed in Ditas et al. 2018; they found that the global average direct radiative forcing at the top of the atmosphere (TOA) of biomass burning aerosols from wildfires may reach -0.20 W/m2 (including biomass burning plumes and biomass burning-affected background atmosphere, and including absorbing and scattering aerosol components) "

Page 10 line 31: "From the TOA RF calculations for the fire plume and ATAL, it can be concluded that the regional climate impact of the fire plume is up to 4 times (late ATAL, our estimation) and 2 times (peak ATAL, estimation by Vernier et al. (2015)) larger than the one of the ATAL. Our RF estimation for the fire plume is consistent with the estimated RF for biomass burning from wildfires of Ditas et al. (2019). The fire plume TOA RF estimated here in the tropical UTLS has the same order of magnitude as a moderate volcanic eruption. For example, Haywood et al. (2003) have estimated the mean RF…"