We thank Anonymous Referee #1 for his/her constructive comments on the manuscript. Point-by-point responses to the comments are provided below. The referee comments are written in *italic* font and our responses in normal font. The comment numbers have been added by the authors.

Comment: *1. Limitations of the present study (which are discussed in Section 6.2) include the fact the authors are not able to quantify the rapid adjustments, which have been shown to be very important for the climate impacts (e.g., Stjern et al. 2017). See also*

Smith, C. J., Kramer, R. J., Myhre, G., Forster, P. M., Soden, B. J., Andrews, T., et al. (2018). Understanding rapid adjustments to diverse forcing agents. Geophysical Research Letters, 45, 12,023– 12,031. https://doi.org/10.1029/2018GL079826

Response: We will add a bit more discussion about the rapid adjustments in the beginning of Section 6.2 of the revised manuscript, also citing the paper by Smith et al. (2018).

Change in the manuscript:
Modified version of the first paragraph of Sect. 6.2: "This study has focused on the instantaneous RF of BC only, including dirRF and snowRF. The problem with this is that for BC, the instantaneous RF is, in fact, not a very good predictor of the ensuing climate response. Previous studies have shown that the climate response to BC dirRF may depend strongly on the spatial distribution of BC, and especially its vertical profile (Hansen et al. 2005, Ban-Weiss et al. 2012, Flanner, 2013, Ocko et al. 2014, Samset and Myhrew 2015). In particular, Samset and Myhre (2015) demonstrated that while dirRF is largest when BC is located at high altitudes, the temperature response is largest for BC close to the surface. The disconnection between temperature response and dirRF is related to rapid adjustments in atmospheric stability, humidity and cloudiness. In general, for a realistic global distribution of BC, these adjustments act to make the BC effective radiative forcing (ERF) smaller than the instantaneous dirRF, thereby leading to a reduced global-mean temperature response (Hansen et al. 2005, Stjern et al. 2017, Smith et al. 2018, Richardson et al. 2019). In contrast, high efficacy has been reported for BC snowRF (Hansen and Nazarenko 2004, Hansen et al. 2005, Flanner et al. 2007) due to albedo feedbacks associated with accelerated snowmelt and reduced atmospheric stability."

Comment: *2. L130 "the semidirect effect of BC cannot be included". Shouldn't this be more general, i.e., rapid adjustments cannot be included? Semi-direct effects traditionally refer to clouds alone, but there are several rapid adjustments including those associated with the clouds.*

Response and change in the manuscript: We agree. The term "rapid adjustments" will be used in the revised manuscript.

Comment: *3. Section 2.3 In the context of BC emissions, the two main sources are fossil fuel and biomass burning. In contrast to fossil fuel BC emissions, biomass burning BC emissions are likely less easily controlled to mitigation policies. Is there any utility in separating the two? Probably beyond the scope of this work, but perhaps the authors could comment.*

Response: In principle, biomass burning BC emissions are also relevant for mitigation considerations, because they are partly anthropogenic. For example, a large fraction of forest fires are caused by humans, either intentionally or unintentionally. At any rate, from the point of view of aerosol modeling, the reason for treating fossil-fuel and biomass burning BC emissions separately in the aerosol scheme is that BC particles from these sources are processed somewhat differently in the atmosphere (e.g., biomass burning BC is typically emitted at higher altitudes than fossil-fuel BC, the particles are larger, and they experience different mixing processes with other aerosols).

Change in the manuscript: We agree with Anonymous Referee #1 that the question of mitigation of fossil-fuel vs. biomass burning aerosols is beyond the scope of our paper. Therefore, no change is made to the manuscript.

Comment: *4. L200. In the context of convective lofting, see also:*

Park, S., and Allen, R. J. (2015), Understanding influences of convective transport and removal processes on aerosol vertical distribution, Geophys. Res. Lett., 42, 10,438– 10,444, doi:10.1002/2015GL066175.

Response and change in the manuscript: A reference to Park and Allen (2015) will be included in the revised manuscript.