

## ***Interactive comment on “Impact of Isolated Atmospheric Aging processes on the Cloud Condensation Nuclei-activation of Soot Particles” by Franz Friebel et al.***

### **Anonymous Referee #2**

Received and published: 4 September 2019

The manuscript reports a laboratory study of CCN activity of soot particles during their atmospheric aging processes and implementation of the lab results into a global aerosol-climate model. The aging processes mainly consider the heterogeneous ozone oxidation at atmospherically relevant condition. The combination of chamber work with an aerosol-climate model is major strength of this study, as it highlights the importance of accurate CCN treatment in a GCM. The paper is well written overall, so I only have some minor comments for the authors to address.

1. The study only considers the heterogeneous ozone oxidation as the aging pathway. However, in the real atmosphere, the formation of SOA or secondary inorganics can be

C1

more complicated than that. Hence, it is questionable how representative the knowledge gained in this study is when we try to parameterize the aging in a global model. More discussions about the caveats of the results are needed here.

2. It is unclear how the soot aging is treated in the standard ECHAM6.3? Do BC particles move from the externally mixed Aitken model to the accumulation mode during the aging, like the other models do (Wang et al., J. Adv. Model. Earth Syst. 10(10), 2514-2526, 2018)? The enhanced aging will also result in a shorter lifetime of BC in the atmosphere. Is this effect considered in the model of this study?

3. By providing additional source of CCN, how does the new parameterization of BC aging in the ECHAM6.3 affect the radiative forcing of aerosol-cloud interactions in that model?

4. Fig. 5. It surprises me that India which emits lots of BC does not exhibit a strong increase in either CCN or CDNC? Also, for central and southern Africa, why CDNC doesn't respond in spite of the significant increases in CCN?

5. The marked changes in the soot optical properties and radiative forcing during the aging processes should also be fully discussed in the introduction part (i.e. Peng et al., Proc. Natl Acad. Sci. USA, 113(16), 4266-4271, 2016).

---

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-504>, 2019.

C2