Project: **777**

Project title: **Evaluating the Climate and Air Quality Impacts of Short-Lived Pollutants (ECLIPSE)**

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Report period: **1.1.2017 – 31.12.2017**

The report period has seen the finishing of remaining papers from the ECLIPSE project.

A main result was the assessment of the effect of black carbon aerosol on clouds via the potential ability to serve as cloud condensation nuclei. We conducted simulations in which we scaled the cloud condensation nuclei concentration by the mass of all soluble aerosol but removing the mass fraction of hydrophilic black carbon. 50-year coupled simulations were conducted. Fig. 1 shows that the modification had a substantial effect on the cloud droplet concentration, as expected. Most other cloud responses, and also the top-of-atmosphere radiation response were noisy (Cherian et al., 2017). An interesting result further was to assess the total effect from black carbon (cf. Baker et al., 2015) vs. only the "indirect effect" assessed here (Fig. 2): the precipitation response is very similar, but the temperature response changes sign.

Also the remaining simulations for the assessment of the transient radiative forcing were conducted, leading to a reference paper that is highly useful for impact studies (Myhre et al., 2017).

References

*Baker, L. H., W. J. Collins, D. J. L. Olivié, R. Cherian, Ø. Hodnebrog, G. Myhre, and **J. Quaas**, Climate responses to anthropogenic emissions of short-lived climate pollutants, Atmos. Chem. Phys., 15, 8201-8216, doi:10.5194/acp-15-8201-2015, 2015.*

Cherian, R., J. Quaas, M. Salzmann, and L. Tomassini, Black carbon indirect radiative effects in a climate model, Tellus, 69, 1369342, doi: 10.1080/16000889.2017.1369342, 2017.

*Myhre, G., W. Aas, R. Cherian, W. Collins, G. Faluvegi, M. Flanner, P. Forster, Ø. Hodnebrog, Z. Klimont, J. Mülmenstädt, C. Lund Myhre, D. Olivié, M. Prather, **J. Quaas**, B. H. Samset, J. L. Schnell, M. Schulz, D. Shindell, R. B. Skeie, T. Takemura, and S Tsyro, Multi-model simulations of aerosol and ozone radiative forcing for the period 1990-2015, Atmos. Chem. Phys., 17, 2709-2720, doi:10.5194/acp-17-2709-2017, 2017.*

Figures

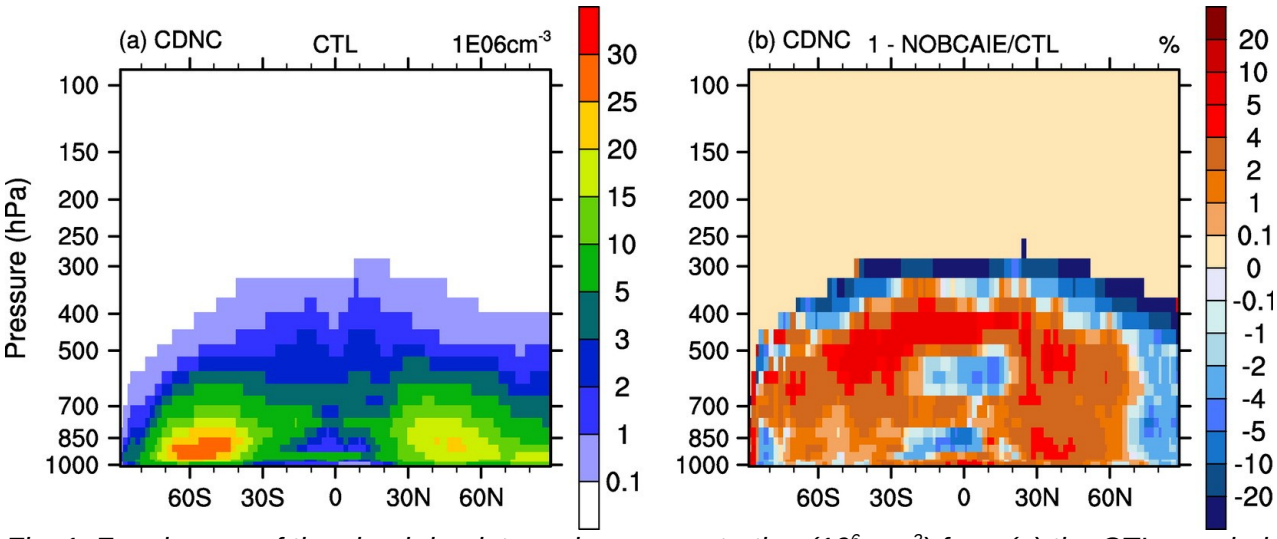

Fig. 1: Zonal mean of the cloud droplet number concentration (10^6 cm^{-3}) from (a) the CTL-coupled model simulation and (b) the percentage responses from the NOBCAIE run (1-NOBCAIE/CTL), in which black carbon was removed from the cloud condensation nuclei concentration.

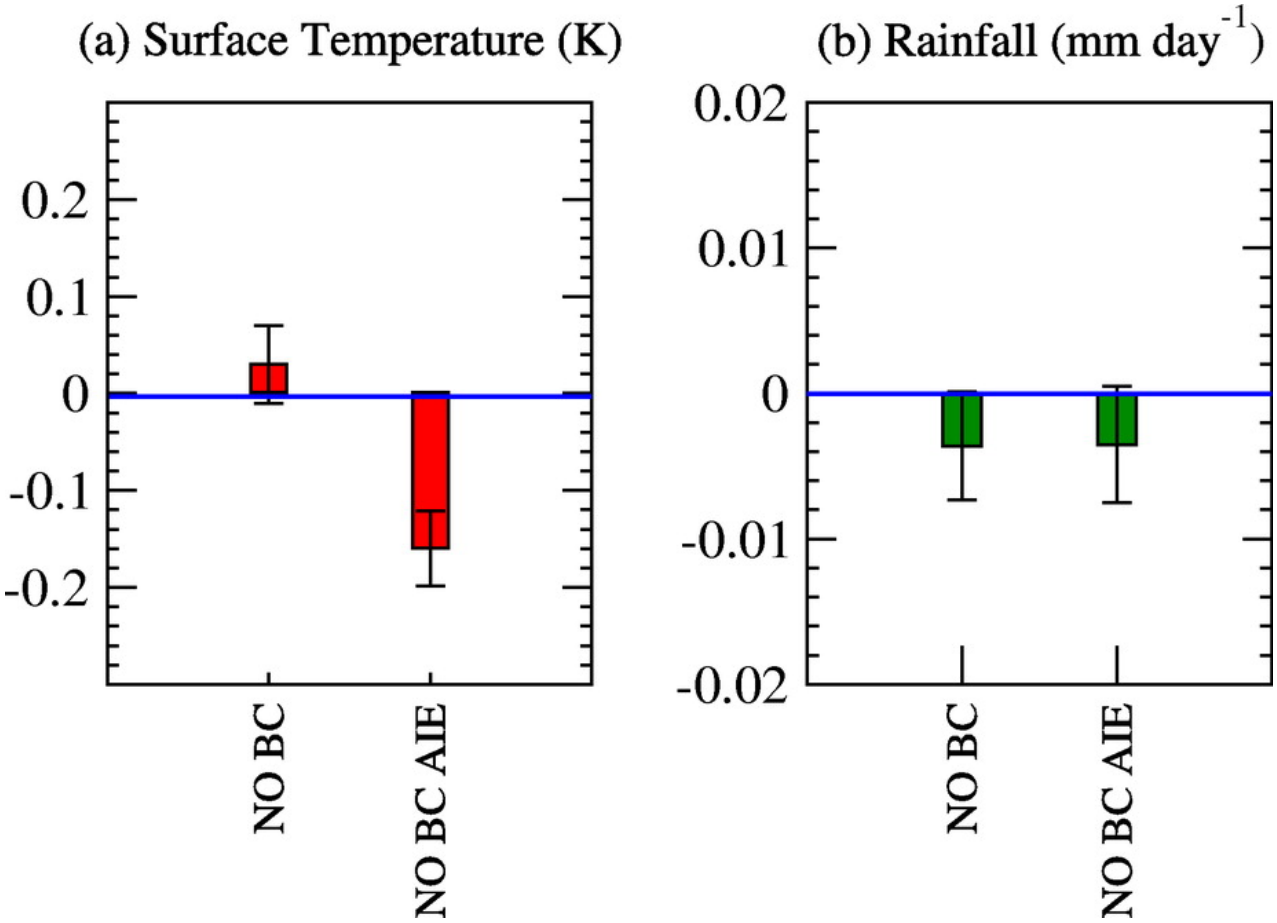

Fig. 2: Global mean annual average changes in (a) surface temperature (K), and (b) rainfall (mm day^{-1}) from the coupled model simulations. "No BC": simulation without any black carbon minus CTL; "No BC AIE": simulation without black carbon aerosol indirect effects, i.e. with black carbon removed from the cloud condenstation nuclei concentration. Error bars indicate the 95% confidence interval on the error in the mean.