Ozone radiative feedback in global warming simulations with CO2 and non-CO2 forcing

Dr. Simone Dietmüller[1], Dr. Michael Ponater[2], Vanessa Rieger[1]

[1] DLR (German Aerospace Center)

[2] DLR German Aerospace Center

Michael.Ponater@dlr.de

It has been found that ozone radiative feedback acts to reduce the climate sensitivity in global warming simulations including interactive atmospheric chemistry, if the radiative forcing origins from CO2 increase. The main reason for this is a dynamically induced ozone reduction in the lowermost tropical stratosphere (negative ozone radiative feedback). The climate sensitivity reduction is amplified by a less positive stratospheric water vapour feedback in comparison with a respective simulation without interactive chemistry.

These findings must not be simply transferred to simulations, in which the warming is driven by a non-CO2 radiative forcing. Using an enhancement of surface NOx and CO emissions as an example, it can be demonstrated that tropospheric and stratospheric ozone response include a positive ozone radiative forcing but still a negative ozone radiative feedback. Nevertheless, the climate sensitivity is not necessarily smaller than in a comparable simulation with prescribed ozone forcing but without interactive chemistry. In contrast, chemical feedbacks may interact with physical feedbacks to an extent that the effect of the physical radiative ozone radiative feedback in global warming simulations with CO2 and non-CO2 forcing feedbacks nullifies or even reverses the direct ozone radiative feedback.

We also address some conceptual consequences of adding chemical feedbacks to the common set of physical feedbacks in global warming simulations including interactive chemistry.