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Radiative forcing since preindustrial times due to ozone change in the troposphere and the lower stratosphere

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Abstract. Changes in atmospheric ozone have occurred since the preindustrial era as a result of increasing anthropogenic emissions. Within ACCENT, a European Network of Excellence, ozone changes between 1850 and 2000 are assessed for the troposphere and the lower stratosphere (up to 30 km) by a variety of seven chemistry-climate models and three chemical transport models. The modeled ozone changes are taken as input for detailed calculations of radiative forcing.

When only changes in chemistry are considered (constant climate) the modeled global-mean tropospheric ozone column increase since preindustrial times ranges from 7.9 DU to 13.8 DU among the ten participating models, while the stratospheric column reduction lies between 14.1 DU and 28.6 DU in the models considering stratospheric chemistry. The resulting radiative forcing is strongly dependent on the location and altitude of the modeled ozone change and varies between 0.25 Wm⁻² and 0.45 Wm⁻² due to ozone change in the troposphere and -0.123 Wm⁻² and +0.066 Wm⁻² due to the stratospheric ozone change.

Changes in ozone and other greenhouse gases since preindustrial times have altered climate. Six out of the ten participating models have performed an additional calculation taking into account both chemical and climate change. In most models the isolated effect of climate change is an enhancement of the tropospheric ozone column increase, while the stratospheric reduction becomes slightly less severe. In the three climate-chemistry models with detailed tropospheric and stratospheric chemistry

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the inclusion of climate change increases the resulting radiative forcing due to tropospheric ozone change by up to 0.10 Wm^{-2} , while the radiative forcing due to stratospheric ozone change is reduced by up to 0.034 Wm^{-2} .

Considering tropospheric and stratospheric change combined, the total ozone column change is negative while the resulting net radiative forcing is positive.

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