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A decadal simulation of the tropospheric composition with TM5 using the IPCC AR5 emissions

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We present tropospheric chemical simulations for the period 2000-2009, performed with the global atmospheric chemistry and transport model TM5. The chemistry module has been coupled to the modal, size-resolved aerosol micro-physics scheme M7 including sulphate, nitrate, ammonium, black carbon, particulate organic matter, sea salt and mineral dust. An additional module is applied to calculate radiative properties of the aerosols as a function of wavelength. The meteorological fields have been compiled from the reanalysis project ERA-Interim by ECMWF. For both emissions of gas phase constituents and aerosol components, the data sets provided for the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) have been integrated into the model, while the set for the Representative Concentration Pathway (RCP) 4.5 is used in this study. For natural and biogenic emissions these are supplemented with data sets that were produced in the course of the project Monitoring Atmospheric Composition and Climate (MACC). We analyse this decadal run to investigate the ability of the model towards capturing both the inter-annual variability and long-term changes in tropospheric ozone, carbon monoxide and the aerosol distributions. To this end, we compare gas-phase and aerosol simulation results to 1) ground based measurements, air-borne data, sondes and satellite observations and to 2) a similar decadal TM5 simulation using different emissions for anthropogenic, biogenic and biomass burning sources (RETRO, REAS, GFEDv2). We put a special focus on the regions North America and Asia during the year 2000, where significant differences in total regional annual emissions occur.