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Multi-Model Simulations of the Impact of International Shipping on Chemistry and Climate in 2030

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Seagoing ships emit various exhaust gases and types of particulate matter into the marine boundary layer. Emissions from international shipping contribute significantly to the total budget of anthropogenic emissions. The global impact of shipping on air quality and climate is quantified from an ensemble of 8 state-of-the-art atmospheric chemistry models using a pre-defined set of emission data. The analysis is performed for present-day conditions (year 2000) and for two future ship emission scenarios (year 2030). The first emission scenario for the year 2030 assumes that ship emissions will remain constant at 2000 levels whereas the second emission scenario is a non-proliferation scenario in which emission factors are unchanged and emissions increase with an annual growth rate of 2.2 % per year between 2000 and 2030. The change of geographical distribution of tropospheric ozone and corresponding radiative forcing due to emissions from shipping are investigated for each of the different scenarios by comparing the model results obtained from a model run taking into account emissions from shipping and a second model run without emissions from shipping. Results from individual models as well as the multi-model mean show significant changes in surface ozone and surface NO2. The first key question addressed by this study is how the emissions of international shipping might influence atmospheric chemistry, in particular tropospheric ozone, in the next 25 years, if these emissions were unabated and business is going on as usual. The second major issue is to examine the range of results given by the individual models compared to the ensemble mean to give a first estimate of the uncertainties introduced by different modelling approaches.

This work is part of a larger study coordinated by the European Union project ACCENT ('Atmospheric Composition Change: the European NeTwork of excellence'; http://www.accent-network.org).