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Contribution of land transport emissions to tropospheric ozone on global scale and in Europe

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The land transport sector is an important anthropogenic source of NO_x, CO and non-methane hydrocarbons (NMHCs), which act as precursors for the formation of tropospheric ozone. The formation of ozone is highly non-linear, therefore contributions of land transport emissions to tropospheric ozone cannot be directly derived from the amount of emitted species. Instead complex atmospheric models are necessary, considering atmospheric dynamics, chemistry, sources and sinks of ozone and its precursors (e.g. anthropogenic and natural emissions).

Such a model is the MECO(n) model system, which on-line couples the global chemistry-climate-model EMAC with the regional chemistry-climate-model COSMO-CLM/MESSy. As both models use the same chemical speciation, the boundary conditions provided to the regional model instances are as consistent as possible. This allows a highly consistent model chain from the global to the local scale. To quantify the contribution of the road traffic emissions to the tropospheric ozone budget in Europe we use an accounting system of the relevant reaction pathways of the different species from different sources (called tagging method). This tagging scheme is implemented consistently on the global and on the regional scale. Information of the tagged species at the boundaries of the regional model are consistently provided by the global model.

We present results assessing the contribution of land transport emissions on the global scale (300 km resolution) and for Europe in detail (50 km resolution). Using the global scale model contributions of land transport emissions to ground level ozone during summer of 12–18 % (8–12 nmol mol^{-1}) for North America and 12–14 % (8–10 nmol mol^{-1}) for Europe are simulated. The contribution of land transport emissions over Southeast Asia is lower ($\approx$ 10 %), due to large other anthropogenic emissions. The detailed regional analysis for Europe shows that the largest contributions are simulated in the Po Basin (14–16 %). In this region extreme values (95th percentiles) of up to 24 % are simulated.