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Potential impact of aviation emissions on chemical composition of the UTLS and global circulation – GEM-AC model simulations

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Perturbation of the chemical composition in the UTLS region can impact physical and dynamical processes that can lead to changes in cloudiness, precipitation, radiative forcing, stratosphere-troposphere exchange and global circulation.

The objective of the present study is to investigate the potential impacts of aviation emissions on the upper troposphere and lower stratosphere. In order to assess the impact of the aviation emissions, we will focus on changes in atmospheric dynamic due to changes in chemical composition in the UTLS. We will assess perturbations in the distribution of wind, temperature and pressure fields in the UTLS. Also, we will present changes in the mixing ratios of chemical species and families in the region. Analysis of zonal and monthly averaged vertical profiles and cross-section of chemical species and families for current, and future climate will be presented. Modelling results will include four 10-year climate runs with and without aviation emissions. Current and future aircraft emissions are from the database developed by the Federal Aviation Administration (USA), AEDT-2006.

We use the GEM-AC (Global Environmental Multiscale with Atmospheric Chemistry) chemical weather model where tropospheric and stratospheric chemistry processes are implemented on-line and are interactive with radiation. In vertical, the model domain is defined on 70 hybrid levels with model top approx. 65 km with 500 m vertical resolution in the UTLS region. The gas-phase chemistry includes detailed reactions of O_x, NO_x, HO_x, CO, CH_4, ClO_x and BrO. Also, the model can address aerosol microphysics and gas-aerosol partitioning.