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High resolution dynamical-climate modeling of the upper troposphere and lower stratosphere region over Europe: GEM-AC simulations for current climate with and without aviation emissions.

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Upper troposphere and lower stratosphere (UTLS) region is a thin layer around the Tropopause. Perturbation of the chemical composition in the UTLS region can impact physical and dynamical processes which can lead to changes in cloudiness, precipitation, radiative forcing, stratosphere-troposphere exchange and zonal flow.

The objective of this study is to investigate the potential impacts of aviation emissions on the upper troposphere and lower stratosphere (UTLS). In order to assess the impact of the aviation emissions we will focus on changes in chemical composition as well as on transport processes in the UTLS over the Europe. Specifically, we will assess perturbations in ozone, halogens, reactive nitrogen species and wind in the UTLS. Our study will based on high resolution dynamic-climate model simulations for two scenarios - with and without aircraft emissions.

The tool that will be used in our study is the GEM-AC (Global Environmental Multiscale with Atmospheric Chemistry) chemical weather model where air quality, free tropospheric and stratospheric chemistry processes are on-line and interactive in an operational weather forecast model of Environment Canada. In vertical, the model domain is defined on 70 hybrid levels from the surface to ∼60km. The gas-phase chemistry includes detailed reactions of Ox, NO_x, HO_x, CO, CH4, NMVOCs, halocarbons, ClOx and BrO. Also, the model can address aerosol microphysics and gas–aerosol partitioning. Aircraft emission will be taken from the AEDT 2006 database developed by the Federal Aviation Administration (USA).

Results from model simulations on a global variable grid with ∼50 km uniformresolution over Europe will be presented.