Geophysical Research Abstracts
Vol. 21, EGU2019-2347-1, 2019
EGU General Assembly 2019

Representation of ozone mini-holes in the GEM-AC model– chemical and dynamic analysis

Magdalena Kossakowska (1), Jacek W. Kaminski (1), Joanna Struzewska (2), and Janusz Krzyscin (1)

(1) The Institute of Geophysics, Polish Academy of Sciences, Warsaw, Poland (mkossakowska@igf.edu.pl), (2) Warsaw University of Technology, Warsaw, Poland

The ozone mini-holes are defined as a synoptic-scale phenomenon that leads to a rapid drop of total column ozone followed by a complete recovery after a few days. Unlike the Antarctic ozone hole, the ozone mini-holes are mostly driven by dynamical processes in the atmosphere rather than the chemistry. They occur between autumn and spring seasons with the peak during the winter. Latest studies have shown that the amount of ozone over the northern mid-latitudes is decreasing with the trend of -4 %/decade. Although, most of the ozone mini-holes occur in winter and early spring there is still a number of events during early autumn, increasing the amount of solar ultraviolet radiation reaching the surface. It is crucial to understand better the processes that lead to the formation of ozone mini-holes, how the climate changes influence the number of the ozone mini-holes and if there is a shift between those processes during the last decades.

One of the best tools to analyze the changes in the ozone mini-holes and their influence on the other atmospheric processes are interactive chemical-dynamical models, that would be able to capture the regional variations in the radiation and chemical processes in the atmosphere due to ozone mini-holes. In this study, we examine the ability of the GEM–AC (Global Environmental Multiscale with Atmospheric Chemistry) model in a climate mode to reproduce the ozone mini-holes from September 2010 to April 2011. The ozone mini-holes events during the chosen period were already well described in the literature, which allows us to compare our results with different models results (ensemble approach), reanalysis and measurements.

The GEM-AC is chemical weather model where air quality, free tropospheric and stratospheric chemistry processes are on-line and interactive in a weather forecast model of Environment Canada. For this study, we set the model domain with the horizontal resolution of 1.5 x 1.5 lat-long and 70 hybrid levels with the model top at $\sim$60km, and vertical resolution in the lower stratosphere $\sim$500m. The gas-phase chemistry includes detailed reactions of Ox, NO_x, HO_x, CO, CH4, ClOx and BrO. Also, the chemical module includes the aerosol microphysics and gas-aerosol partitioning.