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Chemical composition of the middle atmosphere and its change in the 21st century

Igor Larin
IEPCP RAS, Chemical Physics of the Atmosphere, Moscow, Russian Federation (iklarin@narod.ru)

The chemical composition of the middle atmosphere, including the troposphere, stratosphere and mesosphere, and its change in the 21st century are considered. The data were obtained using the interactive chemical dynamical radiative two-dimensional (2-D) model SOCRATES [1], which allows calculating the altitude profiles of the components with step of 1 km in the latitudinal zone 85 S - 85 N in increments of 5°. The IPCC RCP 4.5 scenario [2] was used as the initial conditions for June and January 2000 and 2100 at a latitude of 50° N. For these conditions, the altitude profiles and the total content of long-lived components N2O, CH4 and CO_2, chlorofluorocarbons CFC-10 (CCl4), CFC-11 (CCl3F), CFC-12 (CCl2F2), CFC-113 (CCl2FCClF2), CFC-114 (CClF2CClF2), CFC-115 (CClF2CF3), halon-2011 (CBrClF2), halon 1301 (CBrF3), HCFC- 22 (CHClF2), acids HF, HCl, HBr, HNO_3, minor atmospheric constituents CH_2O, O_3, O (3P), O (1D), H, OH, HO_2, H_2O_2, Cl, Cl2, ClO, OClO, HOCl, $ClONO_2$ $ClNO_2$, $Cl2O_2$, N, NO, NO_2, NO_3, N2O5, HO_2NO_2, Br, BrO, HOBr, $BrONO_2$, BrCl, $CH3O_2$ and chemical families Ox, HO_x, NO_x, ClOx and BrOx have been calculated. It is shown, in particular, that for June 2100 compared to June 2000, the relative change in the total content of the ClOx family in the stratosphere was -57.5%, family Ox + 4.0%, BrOx -25.7%, NO_x + 13.9% and HO_x -4.1%. For January, the corresponding figures for ClOx were -59.1%, Ox + 7.3%, BrOx -26.2%, NO_x +7.1% and HO_x -3.6%, which is consistent with a change in the precursors of these compounds. Similar comparisons were made for the other components mentioned above. Virtually all chemically active components showed a marked sensitivity to the season change.

References
1. http://acd.ucar.edu/models/SOCRATES/
2. http://tntcat.iiasa.ac.at:8787/RcpDb/dsd?Action=htmlpage&page=welcome