Geophysical Research Abstracts
Vol. 16, EGU2014-5379, 2014
EGU General Assembly 2014

New Approach for Assessing the Recovery of Stratospheric Ozone and for Mitigating Global Warming

Hiroyasu Nagase and Guy Brasseur
Climate Service Center, Helmholtz-Zentrum Geestacht, Hamburg, Germany (hiroyasu.nagase@hzg.de)

The Antarctic ozone hole will continue to be observed in the next 35-50 years, although the emissions of chlorofluorocarbons have gradually been phased out during the last two decades. The increase of UV-B intensity resulting from ozone depletion is causing harmful effects on living organisms and, specifically on the marine ecosystems in the vicinity of Antarctica. In this presentation, we suggest a geo-engineering approach that will remove substantial amounts of hydrogen chloride (HCl) from the lower stratosphere in fall and hence limit the formation of the Antarctic ozone hole in late winter and early spring. HCl will be removed by ice from the atmosphere at temperatures higher than the threshold under which polar stratospheric clouds (PSCs) are formed if sufficiently large amounts of ice are supplied to produce water saturation. A detailed chemical-climate numerical model, Whole Atmosphere Community Climate Model (WACCM) developed at the U.S. National Center for Atmospheric Research (NCAR), is used to assess the expected efficiency of the proposed geo-engineering method, and specifically to calculate the removal of HCl by ice particles. The size of ice particles appears to be a key parameter: larger particles (with a radius between 10 and 100 μm) appear to be most efficient for removing HCl. Sensitivity studies lead to the conclusions that the ozone recovery is effective when ice particles are supplied during May and June in the latitude band ranging from 70 to 90˚S and in the altitude layer ranging from the 10 to 26 km. Under these conditions, the total column concentration of ozone around 85˚S latitude mean becomes smallest in late September at 124 DU as opposed to about 76 DU without supplying ice. It appears therefore that supplying ice particles to the Antarctic lower stratosphere could be effective in reducing the depth of the ozone hole. In addition, CFCs photodegradation is accelerated when ice is supplied due to enhanced vertical transport of this efficient greenhouse gas.