Geophysical Research Abstracts
Vol. 16, EGU2014-15073, 2014
EGU General Assembly 2014

Role of Methane in Antarctic Stratospheric Ozone Recovery

Natalia Calvo (1), Douglas E. Kinnison (2), Daniel R. Marsh (2), Rolando R. Garcia (2), and Froila Palmeiro (1)
(1) Facultad Ciencias Fisicas (UCM), Dpto. Fisica de la Tierra II, Madrid, Spain (nataliac@fis.ucm.es), (2) Atmospheric Chemistry Division, National Center for Atmospheric Research, Boulder, USA.

Observational and modeling studies have shown the impact of changes in Antarctic stratospheric ozone on tropospheric climate in austral spring and summer. In the future, effects of increasing greenhouse gases and ozone depleting substances oppose each other. Projections show potential impact of ozone recovery on precipitation, carbon uptake in the Southern Hemisphere ocean, Antarctic ice sheets and Southern Hemisphere sea ice. In order to quantify properly the tropospheric impacts of ozone recovery, future Antarctic ozone changes in the upper troposphere lower stratosphere region and the role (if any) of increasing greenhouse gases in ozone recovery need to be evaluated. To do so, we use the National Center for Atmospheric Research′s Community Earth System Model, CESM, with the high-top version of the atmospheric component, CESM(WACCM), which is a fully coupled chemistry climate model. Three climate change scenarios (RCP2.6, RCP4.5 and RCP8.5) of 3 simulations each from 2005 to 2065 are analyzed.
In scenario RCP2.6, the largest ozone recovery is simulated in October and November at 50hPa and it is followed by the largest response in temperature in November and December at 70hPa. While the response in RCP4.5 in ozone and temperature is almost identical to that in RCP2.6 in the upper troposphere and lower stratosphere region, scenario RCP8.5 shows significantly stronger ozone recovery and warming than the other two scenarios, particularly in November and December at 70hPa in ozone and 100hPa in temperature. We show that this is due to larger amounts of methane in RCP8.5 compared to the other two scenarios, which reduces catalytic ozone loss locally. Differences across scenarios in advection of ozone from the source region in the tropical stratosphere do not play a significant role.