[JJ] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-AS Atmospheric Sciences, Meteorology & Atmospheric Environment

[A-AS07]Stratosphere-troposphere Processes And their Role in Climate

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The Stratosphere-troposphere Processes And their Role in Climate (SPARC) is one of the major projects of the World Climate Research Programme (WCRP), and is characterized by its focus on chemical and dynamical coupling in the stratosphere and troposphere. In this session, we welcome presentations on various processes in the stratosphere and troposphere.

[AAS07-P08]GHG dependence of low ozone event calculated by a large ensemble simulation

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Dependence of ozone concentration on ozone depleting substances (ODSs) has been shown clearly by many observations and model simulations for the ODS-increasing period (before late 1990s). However, the dependence on greenhouse gases (GHGs) is not as obvious as that on ODSs, because GHGs do not directly destroy ozone molecules but have effects on ozone through the changes in temperature and transport, which are caused by the changes in radiation transfer and wave propagation in the atmosphere. Thus, the effects of GHGs on ozone are subtle and more complicated, especially in the Northern Hemisphere, where ozone concentration is more affected by transport than that in the Southern Hemisphere. Chemistry-climate model simulations for the future project that stratospheric cooling and acceleration of Brewer-Dobson circulation leads to stratospheric ozone increase at mid and high latitudes as well as the ODS decrease does. However, as shown by the severe Arctic ozone depletion in 2011, when ODS concentration was lower than the maximum around 2000, large ozone depletion may occur in the future associated with GHG increase.
To investigate the dependence of GHGs on ozone concentration, a result from a large ensemble simulation using the CCSRNIES-MIROC3.2 chemistry-climate model is presented. In this simulation, concentrations of greenhouse gases (GHGs) and ozone depleting substances (ODSs) are specified to the observation values in the past and future values in the RCP6.0 scenario. The results indicate that extremely low ozone concentrations defined by the criteria of total ozone less than 220 DU occur in the polar regions in the high GHG and ODS concentrations, although the frequency is low. The circulations, temperature, and distributions of chemical species in the low ozone ensemble members are examined and compared with those of the ensemble means.