Future Changes in Ozone Quasi-Biennial Oscillation with Increasing GHGs and Ozone Recovery in CCMI Simulation

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The future quasi-biennial oscillation (QBO) in ozone in the equatorial stratosphere is examined by analyzing future simulation (1960-2100) in a climate change due to increasing greenhouse gases and decreasing ozone-depleting substances under the Chemistry-Climate Model Initiative activities. The simulation is conducted using the Meteorological Research Institute Earth System Model, which constitutes of the atmosphere, ocean, sea-ice, aerosol, and ozone models. Our major findings are that the climate change would significantly impact on the evolution of ozone QBO. The ozone QBO between the past and future climates is characterized by the significant increase in its amplitude in the upper stratosphere as well as at around 15, and 70 hPa and characterized by the significant decrease at around 40 hPa. The increased amplitude at around 70 hPa is reflected from upward advection of the increased anthropogenic tropospheric ozone; the reduced amplitude around 40 hPa is caused by the enhanced mean tropical upwelling; the enhanced amplitude at 5 hPa can be explained by the increase in the upward transport of rich ozone from the below. Qualitatively, the future change in the ozone QBO amplitude between 1960-1985 and 2040-2070 accounts for the decrease by 20-30% at 20-50 hPa and the increase by around 20% at 4-7 hPa. These results indicate that although temperature-dependent photochemistry plays an important role in the ozone production, the strengthened tropical mean upwelling plays a dominant role in the future change in the ozone QBO.

Key words: ozone QBO, quasi-biennial oscillation, chemistry-climate model initiative

References

Hasebe, F., 1994: *J. Atmos. Sci*., **51**, 729-745.
Shibata, K. and M. Deushi, 2005: *Geophys. Res. Lett*., **32**, L24802.
Shibata, K. and M. Deushi, 2012: *InTech*, 355-386.