

Stratosphere-troposphere exchange of ozone and carbon monoxide over the northern Pacific Ocean in northern winter using two chemical reanalysis data sets

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Stratosphere-troposphere exchange (STE) is one of the important factors that determine the distribution of constituents in the troposphere and stratosphere. Two-way air mass exchange between the lower stratosphere and the troposphere occurs in association with mid-latitude weather disturbances, with the net transport from the stratosphere to troposphere. In this study, we analyze the STE over the northern hemisphere Pacific Ocean in northern winter, focusing on transport of ozone and carbon monoxide (CO) using two chemical reanalysis data sets, the Tropospheric Chemical Reanalysis version 1 (TCR-1; Miyazaki et al., 2015) and the Monitoring Atmospheric Composition and Climate (MACC; Inness et al., 2013). The TCR-1 is a 10-year chemical reanalysis data set for the period from 2005 to 2014, while the MACC is for 2003 to 2012. Both reanalyses assimilate major satellite chemistry data during the respective periods. We calculate the amount of CO transported from troposphere-to-stratosphere (TST) and ozone transported from stratosphere-to-troposphere (STT) on the 350-K isentropic surface, by using 4 PVU potential vorticity to evaluate irreversible transport across the tropopause (e.g., Homeyer and Bowman, 2013). Results from the analysis of TCR-1 data are as follows. The amount of ozone transport per case maximizes in November and minimizes in February, and that in years 2005-2008 is significantly smaller than that in years 2009-2014 with the maximum in the 2010 winter (i.e., from November 2010 to March 2011). The amount of CO transport per case maximizes in March and minimizes in November, and that in years 2005-2009 is significantly larger than that in years 2010-2014 with the maximum in the 2009 winter. In the presentation, we will show the seasonal dependence and 10-year changes of the ozone and CO transport, as well as intercomparison of the two different data sets.

Key words: ozone, carbon monoxide, stratosphere-troposphere exchange

References

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