Interannual Changes of Stratospheric Ozone and Their Relation with Dynamical Fields

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Stratospheric ozone is produced through photochemical reactions involving the solar ultra-violet absorption mainly in the tropical upper stratosphere, where ozone is in photochemical equilibrium. In the lower stratosphere, ozone behaves as a tracer because photochemical life time of ozone is sufficiently long compared with the characteristic time scale of air motion. Hence, interannual changes of the distribution of stratospheric ozone is influenced by both photochemistry and transport processes. In this study, we make global gridpoint data for ozone volume mixing ratio values derived from Aura MLS data, to clarify observational features of interannual changes of stratospheric ozone since June 2004 to present. Moreover, their relation with dynamical processes is examined by the use of ERA-Interim reanalysis data. It is found that stratospheric ozone in low latitudes, say within 15 degrees, is largely influenced by the equatorial quasi-biennial oscillation (QBO), showing positive correlation with QBO temperature variations below 10 hPa while negative correlation above that level. On the other hand, ozone changes in mid-latitudes are negatively correlated with them in low latitudes, which seems to be reflected by the existence of mean meridional circulations associated with the QBO. However, such influence is limited within 40-50 degrees latitude and it is strongly contaminated by Brewer-Dobson circulations driven by planetary waves in the extratropical stratosphere.

Key words: stratospheric ozone, quasi-biennial oscillation, planetary wave, MLS data