

Analysis on the seasonality of the QBO influence on the global circulation by making time-lagged composites

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1. Introduction

The QBO (quasi-biennial oscillation) is a phenomenon which is dominant in the equatorial stratosphere, and has influence on the extratropical circulation by modifying meridional circulation and propagation of the planetary waves (Baldwin et al., 2001). In most of the previous works studying such influences of the QBO, composites for each month have been made according to the QBO phase in the relevant month. In these cases, it is hard to make discussion about continuity of the features obtained for a sequential months. In the present study, therefore, we make time-lagged composite analysis in which the QBO phase in a fixed month is used to make composites for sequential months in order to investigate seasonality of the influence of the QBO on the global circulation.

The ERA40 data (1958-2002) are used in the analysis.

2. Time-lagged composite analysis

After Wallace et al. (1993), the phase of the QBO is defined with the phase angle of PC (principal component) 1 and PC 2 obtained from the EOF (empirical orthogonal function) analysis on the zonal wind in the equatorial lower stratosphere. The probability density function of the phase angles in June for 44 years shows bimodal structure: less frequent around $-\pi/2$ and $\pi/2$ and more frequent around 0 and π . We fix a key month to June in defining two groups "Westerly" and "Easterly", and make composites for sequential months before and after the key month.

3. Results

In the present analysis, a composite obtained for six months before the key month is different from that obtained for six months after the key day, for example.

By extending the period of composite to several years before and after the key month, it is shown that descending of the easterly or westerly winds in the equatorial stratosphere as the QBO starts in a specified phase (in September-October or in December-January, respectively) of the SAO (semiannual oscillation) in the upper stratosphere. It is also shown that the descending speed of the easterly or westerly winds has semiannual variation (fast in May and October).

The composites of the EP (Eliassen-Palm) flux and the residual meridional circulation show variations which are well corresponding to the variation of the descending speed.

References

- Wallace et al., 1993 : J.Atmos.Sci., 50, 1751-1762
Baldwin et al., 2001 : Rev.Geophys., 39, 179-229

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