Dynamical and minor constituent changes related to the anomalous QBO appearance in 2016

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The quasi-biennial oscillation (QBO) is a downward propagating zonal-wind oscillation observed in the equatorial lower stratosphere with an average period of about 28 months. In February 2016, the downward propagation of the QBO easterly shear was unexpectedly disrupted around 20 hPa and an unprecedented easterly jet formed within westerly wind regime below that level (Newman et al. 2016; Osprey et al. 2016). Neither plausible mechanisms to cause such anomalous behavior of the QBO phase transition nor changes of the associated meridional circulation have been fully investigated. Here, we make detailed analyses of the anomalous QBO, using the Japanese 55-year reanalysis data, JRA-55, along with volume mixing ratio data of minor constituents, such as ozone (O3), nitrous oxide (N2O), and hydrogen chloride (HCI), derived from Aura MLS observations. It is found that anomalous distribution of minor constituents concomitantly appeared with the anomalous QBO phase transition, which could be formed by meridional circulation changes associated with the corresponding equatorial temperature modulation. In the presentation, we will also discuss dynamical effects on the anomalous QBO phase transition from mid-latitudes.

Keywords: quasi-biennial oscillation, meridional circulation, minor constituents