The development of the eddy momentum flux divergence during the 2015/2016 Quasi-Biennial Oscillation disruption

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The Quasi-Biennial Oscillation (QBO) has experienced unprecedented disruption during the 2015/2016 winter. We studied the horizontal eddy momentum flux divergence at the equatorial lower stratosphere during the 2015/2016 winter, which is the main driver for the QBO disruption (Osprey et al. 2016, Coy et al. 2017). We found that the eddy momentum flux divergence consists not only the extratropical waves propagating horizontally from the northern mid-latitudes, but also tropical mixed Rossby-gravity waves. These tropical waves are masked by the extratropical waves in the previous analyses based on total eddy fluxes (Osprey et al. 2016, Coy et al. 2017). But as shown in our study, the tropical waves have made consequential contributions to the development of the QBO disruption.

Consistent with the linear theory, most of the extratropical Rossby waves dissipate at the southern flank of the equatorial jet, and hence do not affect the jet core strength. But there is one episode of extratropical waves with strong enough amplitude to create critical lines locally from the passing of the waves, which leads to strong dissipation of easterly waves at the latitude where zonal mean wind is westerly. This particular episode of extratropical waves leads to drastic deceleration, and hence destroys the equatorial westerly jet. On the other hand, the eddy momentum flux divergence from the tropical waves is confined near the equator, and drives a continuous deceleration of the jet core throughout the winter. We also report a strengthening trend in the horizontal eddy momentum flux divergence from the tropical waves since 1979.

Key words: middle atmosphere dynamics, quasi-biennial oscillation, wave-mean flow interaction.

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