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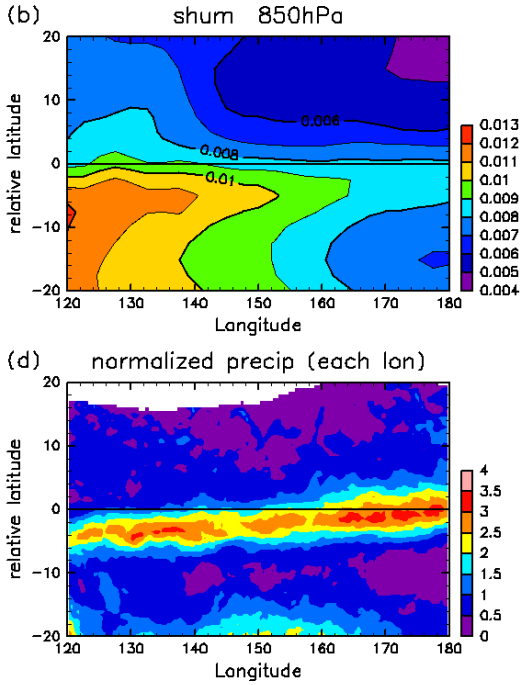
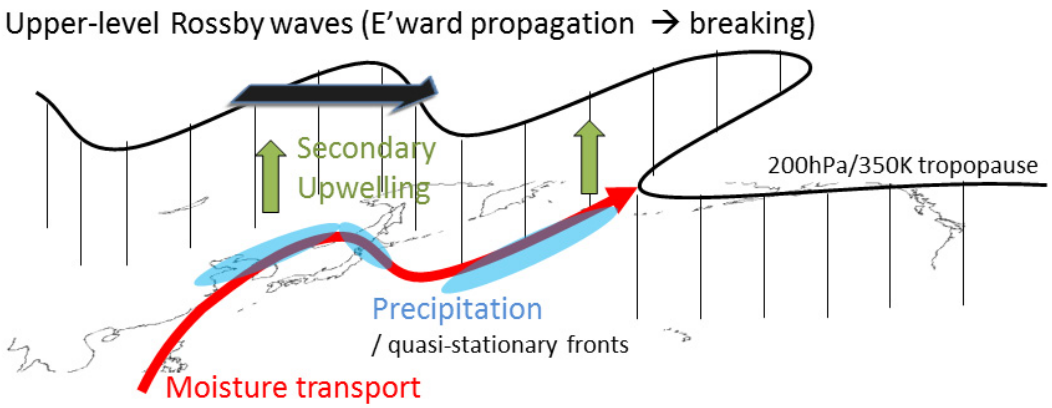


← Figure 1. Composite means taken by shifting positions meridionally with respect to the (northernmost) 1.5 PVU contour on the 350 K isentropic surface. (b) Specific humidity at 850 hPa, and (d) precipitation normalized for each longitude. (two panels from Fig. 4 of the paper)



↓Figure 2. Schematic illustration of the synoptic variability of precipitation and the associated moisture transport at midlatitude from the eastern coastal region of China to the northwestern Pacifc. The upper-level PV contour (thick black curve) is illustrated with vertical lines, together like a curtain, to express that it is elevated.

- By using satellite precipitation and reanalysis data, a clear relationship is found between upper tropospheric isentropic potential vorticity (PV) disturbances, surface precipitation, and lower tropospheric humidity through July and August from the eastern coastal region of China to the northwestern Pacific (Fig. 1); a precipitation band of several hundred kilometers wide and a thousand to several thousand kilometers long is formed frequently on the equatorward and low-PV side of the northernmost 1.5 PVU contours at 350 K (~ 200 hPa).
- A thorough analysis reveals that this vertical association is due the downward forcing from the upper tropospheric Rossby waves; they exert positive forcing to low-level potential enstrophy, induce secondary circulation to initiate precipitation, and affect low-level moisture transport (Fig. 2).
- This study proposes a novel way to diagnose vertical interaction based on the quasi-geostrophic (QG) potential enstrophy defined using the QG PV in which boundary contributions are incorporated.