



Synoptic-scale dual structure of precipitable water along the eastern Pacific ITCZ

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Using the 10-yr high-resolution satellite and reanalysis data, the synoptic-scale dual structure of precipitable water (PW), in which the southern and northern bands straddled at the ITCZ produce zonally-propagating meridional dipoles, is observed over the eastern Pacific during boreal summer and fall. The composites indicate that the PW dipole, concurrent with the dipole-like filtered divergence, has a shift to the west of the anomalously cyclonic circulation. The vertical structure of filtered meridional wind is characterized by a wavenumber-one baroclinic mode, and the vertical motion has two peaks situated at the lower and upper level, respectively. To the east of the PW dipole, the shallow convection is embedded within the deep convection, forming a multilevel structure of meridional wind on the ITCZ equatorward side. To the west of the PW dipole, the deep convection tends to be suppressed due to the invasion of midlevel dry air advected by northerly flows. The generation and propagation of dual PW band can be attributed to the divergence and advection terms related to specific humidity and three-dimensional wind.

By comparison, the PW anomalies over the western North Pacific, only exhibiting a single band, coincide with the centers of synoptic disturbances with a barotropic vertical structure. Due to the weakening of lower-level divergence, vertical motion and horizontal gradient of PW, the synoptic-scale PW signal is reduced significantly. The typical cases and statistics confirm that the strong meridional dipoles and westward-propagating disturbances are closely associated with the distortion and breakdown of ITCZ over the EP.