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Effect of the Atmospheric Heat Source on the Development and Eastward Movement of the Tibetan Plateau Vortices

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Based on the final analyses data (FNL) of the Global Forecasting System of the National Centers for Environment Prediction (NCEP) and the radiosonde data over the Tibetan Plateau, evolutions of two types of the Tibetan Plateau vortices, moving-off the plateau (Type A) and dying-out on the plateau (Type B), are investigated respectively. Compared to Type B vortices, the large-scale circulations associated with Type A vortices show stronger ridge to the north of the plateau and deeper trough near the Bay of Bengal at 500 hPa, and the southwesterly flow from the trough and the northwesterly flow from the ridge converge more intensively to the east of Type A vortices. Meanwhile, at 200 hPa the divergence on the right-hand side of the upper westerly jet is just over the vortices. The convergence at 500 hPa and divergence at 200 hPa provide favorable conditions for the development and eastward motion of the vortices.

The diagnoses of the potential vorticity (PV) budgets reveal that in the developing stages of the two types of vortices, the vertical distribution of the atmospheric heat source determines both their intensity and the moving direction. In the decaying stage, the maintenance and eastward movement for Type A vortices mainly depend on the convergence of the strong northwesterly and southwesterly to the east of the vortices. For Type B vortices, the vertical PV flux divergence caused by the ascending motion around the vortices reduces the intensity of the vortices and is unfavorable for their eastward motion.