Decay processes of short and long extreme stratospheric polar vortex events

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To investigate decay processes of weak and strong extreme events of the wintertime stratospheric polar vortex, those events are classified into short (less than 10 days) and long (no less than 20 days) extreme events, then their composite maps are made respectively. Long weak (strong) vortex events tend to accompany longer enhancement (suppression) of upward-propagating planetary wave into the stratosphere, while short weak (strong) events tend to accompany its shorter enhancement (suppression), and its suppression (enhancement) follows. The decay of weak (strong) events accompany divergence (convergence) anomaly of Eliassen-Palm (E-P) flux that accelerate (decelerate) zonal-mean zonal wind irrespective of their duration. The E-P flux divergence anomaly is dominated by its meridional divergence in short weak vortex events, which suggests barotropic instability, while the vertical divergence dominates in the other extreme events. Upper tropospheric height anomalies over the western North Pacific tend to be cyclonic (anticyclonic) just before onset of both short and long weak (strong) vortex events. In short events, however, the anomalies change their sign into anticyclonic (cyclonic) soon after the onset, and cyclonic (anticyclonic) anomalies are observed over the Northern Europe. While long strong vortex events accompany tropospheric cyclonic anomalies over the western North Pacific at the decaying, particular anomalies are not observed in association with long weak vortex events. It is suggested that negative vertical zonal wind shear anomaly associated with the weak vortex suppresses upward planetary wave propagation, which recover the anomalous vortex.

Key words: stratospheric sudden warming, vortex intensification, planetary wave