Evidence for Nonlinear Processes in Fostering a North Pacific Jet Retraction

by

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The North Pacific jet stream regularly affects the weather over the United States, by influencing the development and propagation characteristics of cyclones and anticyclones. The breakdown of the typically strong, zonal North Pacific jet is associated with higher forecast errors in numerical weather prediction models. To better understand the processes involved in this jet transition, we introduce a diagnostic method for calculating local geostrophic wind tendencies in a piecewise manner within the quasi-geostrophic framework. The method is applied to a case study of a North Pacific jet retraction that occurred in February 2006, and suggests that nonlinear interactions, which are dependent upon the phasing between potential vorticity anomalies and height anomalies, can lead to a weakening of the jet. The synoptic context in which nonlinear advection weakens the jet is presented, revealing that a positively-tilted wave train situated north of the jet is conducive to retraction. This circumstance is consistent with conditions associated with barotropic energy extraction in which the growth of eddies occurs at the expense of the kinetic energy of the mean state.