



## **Nonlinear dynamics of a surface cyclone crossing a zonal jet**

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Many events of rapid cyclone development are encountered when a surface cyclone crosses an upper-tropospheric jet from the south to the north. In order to understand the processes that govern such a growth, nonlinear dynamics of a low-level vortex superimposed on a zonal baroclinic jet are investigated in a quasi-geostrophic two-layer model. Different jet configurations are considered by modifying the horizontal and vertical shears in both layers.

The results show different behaviours according to the position of the initial cyclonic vortex relative to the jet axis. If the vortex is embedded in an environment where the horizontal shear is cyclonic (i.e typically on the north side of the jet), the cyclone evolution exhibits an intense deepening whereas if the horizontal shear is anticyclonic (i.e on the south side of the jet), the cyclone is strongly stretched and characterized by a moderate filling. This behaviour is valid over a wide range of horizontal/vertical shear parameters, and may be interpreted by looking at the overall contributions of the linear and nonlinear terms in the baroclinic model. A systematic analysis using the perturbation vorticity equation is performed to clarify the role of each term involved. It provides in particular some insight about the factors that allow the cyclone to move meridionally and to cross the jet from the anticyclonic to the cyclonic side. This work helps to understand the dynamics of jet-crossing in a simple quasigeostrophic framework.