# A POSSIBLE MECHANISM FOR THE EYE ROTATION OF TYPHOON HERB

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## Abstrct

We document an elliptical eye which rotated cyclonically with a period of approximately 144 minutes in Typhoon Herb (1996). The elliptical region had a semi-major axis of 30 km and a semi-minor axis of 20 km. Two complete periods of approximately 144 minutes were observed in the doppler radar data. We explore the rotation of elliptical eye in the context of barotropic dynamics at three levels: linear waves on a Rankin vortex, nonlinear Kirchhoff vortex and with a nonlinear spectral model. The linear wave theory involves the existence of both the high (potential) vorticity gradient near eye edge and the cyclonic mean tangential flow in the typhoon. The propagation of (potential) vorticity waves in the cyclonic mean flow makes the elliptical eye rotate cyclonically. The rotation period is longer than the period of a parcel trajectory moving in the cyclonic mean flow around the circumference, because the vorticity wave propagates upwind. The nonlinear theory stems from rotation of Kirchhoff's vortex. Estimates of eye rotation period from both linear and nonlinear theories agree with observations of the eye rotation period when the observed maximum wind from Herb is used. Nonlinear numerical computations suggest the importance of the interaction of neutral vorticity waves which determine the shape and the rotation period of the eye. The calculations also support the rotation of the eye in approximately 144 minutes in the presence of axisymmetrization, vorticity redistribution, wave breaking and vortex merging processes.