



Climatology and a dynamical investigation of tropical cyclogenesis

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In general, observation has indicated that only a small fraction of the easterly waves occur in a single hurricane season contribute to tropical cyclogenesis. However, this small fraction includes a large portion of named storms. In addition, it has recently been shown that named storms in the Atlantic and eastern Pacific basins are almost all associated with a cyclonic Kelvin cat's eye of a tropical easterly wave critical layer, located equatorward of the easterly jet axis. Therefore, to better understand the dynamics involved in tropical cyclogenesis, it is desirable to investigate the flow characteristics and the physical mechanism for an easterly wave to form a cat's eye.

We have chosen the simplest of all scenarios to present the fundamental concepts of tropical cyclogenesis in a tropical wave critical layer. Our methodology involves performing a climatological study of developing easterly waves covering the 1998-2001 hurricane seasons using ERA-Interim 6-hourly reanalysis data. Spatial and temporal filtering is applied to decompose the desired fields, and time-lagged composites are obtained in a translating reference frame following the disturbances. The stability analysis of the basic state flow has been investigated. The composite basic state zonal wind profiles indicate a cyclonic critical layer at cat's eye formation region. Composite perturbation potential vorticity showed a wave-like pattern, which is in agreement with typical characteristics of easterly waves. Statistical analysis is also used to determine the levels of confidence in the composite fields to assess the reliability of the results. In addition, the total potential vorticity diagnostics show a closed pattern only for one of the easterly wave troughs within the domain, the one associated with the tropical storms, and seem to be a better approach to distinguish developing vs. non-developing disturbances.