A Most Excellent Global Climatology of Baroclinically Influenced Tropical Cyclogenesis

Ron, Tom (Jr), Lance, Rich and Olivia

Tropical cyclogenesis is generally considered to occur in regions devoid of baroclinic structures; however, an appreciable number of tropical cyclones (TCs) form in baroclinic environments each year. A global climatology of these baroclinically influenced TC developments is presented in this study. An objective classification strategy is developed that focuses on the characteristics of the environmental state rather than on properties of the vortex, thus allowing for a pointwise ``development pathway'' classification of reanalysis data. The resulting climatology shows that variability within basins arises primarily as a result of local surface thermal contrasts and the positions of time-mean features on the subtropical tropopause.

The pathway analyses are sampled to generate a global climatology of 1948-2010 TC developments classified by baroclinic influence: non-baroclinic (70%), low level baroclinic (9%), trough induced (5%), weak TT (11%) and strong TT (5%). All basins other than the North Atlantic are dominated by \nb events; however, there is extensive inter-basin variability in secondary development pathways. Within each basin, subregions and time periods are identified in which the relative importance of the development pathways also differs. The efficiency of tropical cyclogenesis is found to be highly dependent on development pathway. The peak efficiency defined in the classification subspace straddles the boundary, suggesting that the optimal environment for TC development includes a baroclinic contribution from an upper-level disturbance. By assessing the global distribution of baroclinically influenced TC formations, this study identifies regions and pathways whose further study could yield improvements in our understanding of this important subset of TC developments.