A Global TC Development Pathway Climatology

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The development of tropical cyclones (TCs) along pathways that are characterized by non-negligible quasigeostrophic forcings presents a conceptual and predictive challenge to researchers studying TC genesis in the North Atlantic basin. In that region, approximately 50% of storms form following such "non-traditional" pathways, including both weak and strong tropical transitions (TTs). The results of a climatology of North Atlantic TC development based on the NCEP/NCAR Reanalysis are extended to a global domain using the IBTrACS best track database and a linear discriminant analysis. A reclassification of North Atlantic TCs using the new dataset and analysis technique show an 85% correct reclassification rate, suggesting that the simplified approach yields results that are consistent with the original techniques.

Basins outside the North Atlantic are shown to have much higher rates of non-baroclinic (traditional tropical) developments, with a peak near 80% in the western North Pacific Ocean, as might be expected from the predominance of ITCZ-type developments over the broad equatorial Pacific. However, even in the western North Pacific, a secondary "trough induced" pathway suggests that tropical upper tropospheric trough (TUTT) developments are being captured by the climatology. Other basins of particular interest include the southern Pacific whose pathway distribution most closely resembles that of the North Atlantic, and the North Indian Ocean where the pre- and post-monsoon TC development maxima are dominated by different modes of cyclogenesis.

The beginnings of an extension of this climatology to develop a conditional tropical cyclogenesis (CTCG) index is presented. The role of each of the component TCG terms is evaluated in isolation for each development type, allowing for a tailored TCG index for each pathway category. By combining preferred-pathway and genesis potential studies,
it is expected that the CTCG index will out-perform traditional genesis indices that are designed to perform optimally only for non-baroclinic types of development.