

Extratropical Impacts on Atlantic Tropical Cyclones

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This study investigates the characteristics of extratropical Rossby wave breaking (RWB) during the Atlantic hurricane season and its impacts on Atlantic tropical cyclone (TC) activity. It was found that RWB perturbs the wind and moisture fields throughout the troposphere in the vicinity of a breaking wave. When RWB occurs more frequently over the North Atlantic, the Atlantic Main Development Region (MDR) is subject to stronger vertical wind shear and reduced tropospheric moisture; the basin-wide TC counts are reduced, and TCs are generally less intense, have a shorter lifetime, and are less likely to make landfalls. A significant negative correlation was found between Atlantic TC activity and RWB occurrence during 1979-2013. The correlation is comparable to that with the MDR SST index, and stronger than that with the Niño 3.4 index.

Further analyses suggest that the variability of RWB occurrence in the western Atlantic is largely independent of that in the eastern Atlantic. The RWB occurrence in the western basin is more closely tied to the environmental variability of the tropical North Atlantic and is more likely to hinder TC intensification or reduce the TC lifetime due to its proximity to the central portion of TC tracks. Consequently, the basin-wide TC counts and the accumulated cyclone energy have a strong correlation with the western-basin RWB occurrence but only a moderate correlation with the eastern-basin RWB occurrence.

The results highlight the extratropical impacts on Atlantic TC activity and regional climate via RWB, and provide new insights into the variability and predictability of TC activity.