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The Combined QBO and ENSO Influence on Tropical Cyclone Activity over the North Atlantic Ocean

Alejandro Jaramillo, Christian Dominguez, Graciela Raga, and Arturo I. Quintanar

Universidad Nacional Autonoma de Mexico, Instituto de Ciencias de la Atmósfera y Cambio Climático, Department of Atmospheric Sciences, Mexico City, Mexico (ajaramillo@atmosfera.unam.mx)

The Quasi-Biennial Oscillation (QBO) and the El Niño-Southern Oscillation (ENSO) largely modulate the zonal wind in the tropics. Previous studies showed that QBO phases produce changes in deep convection through an increase/decrease in the tropopause height over the tropics and subtropics. This study investigates the combined effects of QBO and ENSO on tropical cyclone (TC) activity by modulating tropopause height. We found that tropopause height increases over the Gulf of Mexico, the Caribbean region, and the Western North Atlantic Ocean during La Niña + QBOW, allowing deeper tropical convection to develop over those regions. As a consequence, TC activity over those regions is not only increased in number but also enhanced in intensity. Conversely, during El Niño + QBOE, most deep tropical convection is inhibited over those same regions due to the decrease in tropopause height over the subtropics. We conclude that QBO effects on TCs and deep convection should be studied in combination with ENSO. Since TCs are among the most dangerous natural hazards, causing severe economic losses and high mortality, this signal of the QBO+ENSO on TCs could be key for planning activities before the beginning of the season, which might help reduce disaster risk and economic impacts on society, enhancing resilience.