Multidecadal Trends in Tropical Cyclone Behavior within Tropical North Atlantic Sub-basins

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This project investigated the relationship between long-term trends (1980-2017) in tropical cyclone (TC) intensity and the TC wind speed evolution within the Western Tropical Atlantic (WTA) and Central/Eastern Tropical Atlantic (CETA) sub-basins, as well as the combined tropical Atlantic (TA). The identification of the manifest ways in which TCs change over time and their connection with environmental factors, determined using linear regression statistical t-tests, revealed how they are related to long-term changes in climate. Long-term TC trends in intensity, intensification time, and wind variability for the CETA were generally more significant than those for the WTA. TC intensity levels, as measured by lifetime maximum wind speeds and the power dissipation index (PDI) normalized by storm hours, exhibit no long-term trends in either sub-basin. Average intensification rates over the TA have been decreasing, just as the trend in intensification time suggests that the multi-decadal trend favors longer intensification periods before lifetime maximum intensity. The average period of intensification before the peak in TC intensity increases on average 0.33 h per year in the combined TA sub-basin. A TC wind variability index (WVI) calculated over 72-h intervals of the TC lifecycle decreases for the WTA over the decades, while in the CETA, the 72-h intervals with the greatest wind speed fluctuations grow increasingly variable. A correlation analysis suggests that warmer sea surface temperatures (SST) and greater moisture favors longer intensification and greater WVI. In contrast, greater 850-200 hPa vertical wind shear is associated with shorter intensification periods and lower WVI.

Awards Won:
Third Award of $1,000