11B.5 - Large-Scale Environmental Control of Tropical Cyclone over Lifetime Maximum Intensity Projections

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2:45 PM - 3:00 PM

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Abstract

Future projections of tropical cyclone (TC) intensity is an important yet complex problem. While the potential intensity (PI) theory provides a foundation for how TC maximum potential intensity would change in future climates, how the actual maximum intensity that a TC can attain changes in the future is still inconclusive due to potential offsets in large-scale environmental conditions as well as potential feedback between TCs and ambient environment. In this study, high-resolution downscaling of two CMIP5 future scenarios from CESM simulations is used to investigate the role of large-scale environment along TC tracks on future projections of TC lifetime maximum intensity (LMI) in the Northwestern Pacific basin. By analyzing 20-year distributions of the mid- and end of the 21st century simulations, we show that the along-track local PI has no statistically significant changes in both future periods, yet the LMI increases in both scenarios. Our PI analyses show that the insignificant changes in the along-track local PI are due to the increase in enthalpy at both the surface and the atmospheric lowest layer, resulting in little change in the surface disequilibrium. In contrast, despite more adverse conditions in the future including higher values of the ventilation index and a more stable troposphere, LMI increases due to the occurrence of more long-lived TCs in the open ocean, thus allowing TCs to reach higher intensity during their lifetime. This increase in LMI is ultimately linked to changes in the Western Pacific Subtropical High. These results reveal the importance of considering the role of the environment along TC tracks in projections of TC intensity beyond what basin-wide PI changes can capture.

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