



The Response of Tropical Cyclone Intensity to Changes in Environmental Temperature

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Tropical cyclone (TC) activity is changing. Some changes have already been detected in the historical record and further changes are suggested by theory and numerical modeling. Why are these changes taking place and what further changes should we expect? The rising costs of tropical cyclone damages also means risk managers are heavily invested in finding answers. In collaboration with the reinsurance industry, we focus specifically on the response of TC intensity to changes in environmental temperature.

Theory indicates that TC intensity should respond to environmental temperature change near the surface and in the TC outflow layer. While the sensitivity of TC intensity to sea surface temperature is well understood, less is known about the role of temperature in the upper troposphere and lower stratosphere. Our observational analysis and idealized modelling agree that historical global environmental temperature changes coincide with higher TC intensities. Observations additionally suggest the response depends on the TC intensity itself. Hurricane-strength storms have intensified at twice the rate of weaker storms per unit surface and upper-tropospheric warming. We also find faster warming of low-level temperatures in hurricane environments than the tropical mean environment.

We set up idealized model experiments to probe the response of TC intensity to various changes in the thermal profile. We find that thermodynamic disequilibrium drives much of the TC intensity change among various imposed thermal profiles, with thermodynamic efficiency contributing very little. This limited contribution by thermodynamic efficiency is explained by a nearly constant outflow temperature across the range of imposed thermal profiles.

This project was made possible because of a mutual interest among scientists and the reinsurance industry in finding an answer. I shall close with a broader discussion of my experience collaborating with the reinsurance industry, describing the way it can enrich fundamental research while creating usable results.

Thursday, 8 September 2022, 2:00pm

Refreshments 1:45pm

Please also join colleagues for refreshments and informal discussion after the seminar until 3:30pm

NCAR-Foothills Laboratory, 3450 Mitchell Lane
FL2-1022, Large Auditorium

Seminar will also be live webcast

<https://operations.ucar.edu/live-mmm>

Participants may ask questions during the seminar via Slido.