UNIVERSITY of WISCONSIN
UWMILWAUKEE
Department of
Mathematical Sciences

Master's Thesis Defense

Michael Vossen

MS Graduate Student

Under the Supervision of Clark Evans

Friday, August 6th 2021 @ 3:00pm

Hybrid: Online via. Microsoft Teams and In-Person at GLRF, Room 3093

Mr. Michael Vossen

An Investigation Into the Thermodynamics of Overland Tropical Cyclone Intensity Change in Weakly/Non-Baroclinic Environments

There are two leading theories regarding how tropical cyclones can maintain or increase their intensity over land in weakly to non-baroclinic environments. In the first, tropical cyclones are maintained overland by enhanced upward surface enthalpy fluxes facilitated by the tropical cyclone's rains, whereas in the second, tropical cyclones are maintained by enhanced enthalpy fluxes under inflowing trajectories at larger radii from the cyclone's center. These theories have yet to be rigorously tested, however. To rigorously test these hypotheses, this study uses a quasi-idealized version of the Weather Research and Forecasting model lacking parameterized radiation to test the sensitivity of overland tropical cyclone intensity to the underlying land surface's characteristics. In these simulations, the coldest initial land surfaces result in the strongest simulated tropical cyclones after landfall as they are associated with a negative sensible heat flux that creates a nighttime-like near-surface temperature inversion. This nighttime-like inversion suppresses tropical cyclone rainband activity, preventing lower equivalent potential temperature air from the midtroposphere from being mixed into the inflowing near-surface trajectories by convective downdrafts. The results do not fully support either of the two leading hypotheses and further investigations are needed to address shortcomings in the applicability of this study's findings to observed events.

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