M.S. Defense Announcement
Ting-Yu Cha
Wednesday, July 11, 2018 at 10:00am

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Defense
ATS Large Classroom (101 ATS)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Michael Bell (Advisor)
Kristen Rasmussen
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Eyewall Replacement Cycle of Hurricane Matthew (2016) observed by Doppler radars

An eyewall replacement cycle (ERC) can cause significant changes to the intensity and structure of a tropical cyclone, but the physical mechanisms involved in the ERC process are not fully understood due to a lack of detailed observations. Hurricane Matthew was observed by the NEXRAD KAMX, KMLB, and KJAX polarimetric radars and NOAA P-3 airborne radar when it approached the southeastern United States during an ERC event. The radar observations indicate that Matthew's primary eyewall was replaced with a weaker outer eyewall, but unlike a classic ERC, Matthew did not reintensify after the inner eyewall disappeared.

The evolution of Matthew's ERC was analyzed by examining the observations from the airborne and ground-based radars near the Florida coast. Triple Doppler analysis was performed by combining the NOAA P-3 airborne fore and aft scanning with KAMX radar data during the period of secondary eyewall intensification and inner eyewall weakening from 19 UTC 6 October to 00 UTC 7 October. Four passes of the P-3 aircraft show the evolution of the reflectivity, tangential winds and secondary circulation as the outer eyewall became well-established. Further evolution of the ERC is analyzed through reflectivity and tangential wind derived from the single ground-based Doppler radar observations for 35 hours with high temporal resolution every 6 minutes from 19 UTC 6 October to 00 UTC 8 October using the Generalized Velocity Track Display (GVTD) technique. The single-Doppler analyses indicate that the inner eyewall decayed a few hours after the P-3 flight, while the outer eyewall contracted but did not reintensify and the asymmetries increased episodically. The analysis suggests that the resilient outer eyewall was influenced by both environmental vertical wind shear and an internal vortex Rossby wave damping mechanism during the ERC evolution.