



UNIVERSITY OF MIAMI **ROSENSTIEL SCHOOL of** MARINE, ATMOSPHERIC & EARTH SCIENCE

Background

What is known

- form from instability of the African Easterly Jet
- development in the Atlantic basin¹
- has been looked at, but no widely accepted conclusions^{2,3}
- Some studies have suggested AEWs are not necessary for TC genesis⁴
 - development⁵

Goals

environmental conditions to determine:

- **1.** Causes of seasonal variability in AEW activity and TC activity
- patterns such as ENSO

Data

ECMWF ERA5 data spanning from 1979 to 2022

AEW Tracking

- AEWs are tracked using the Lawton 40°N et al. (2022) track database, which
- This database has been validated against other wave trackers and is able to capture the majority of **AEWs and accurately represent** their climatology



- **Developers:** AEWs that develop into TCs
- Non-Developers: AEWs that do not develop into TCs

Year Groupings & Environmental Conditions

- & La Niña years
 - (MDR)

 - Index historical records
- them



AEW Statistics

- All AEW statistics plots show a probability density function (PDF)
- center

Investigating the Predictability of Tropical Cyclogenesis through a **Comparison of African Easterly Wave Seasons** Brooke J. Weiser¹, Quinton A. Lawton¹, and Sharanya J. Majumdar¹

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Non-Developing AEWs

- Max AEW strength was higher in active years • Active years driven by a few
- stronger AEW cases
 - High values of mid-level moisture in MDR may support development of AEWs during active years

- Mean strength was higher during active years for nondevelopers
 - Equatorward shift of AEJ during inactive years More northern
 - AEJ during active years







Figure 11: Difference in 600-700 hPa u (AEJ) between La Niña and El Niño years.

Summary

- Active years more muddled than ENSO on if they correspond with stronger waves
- Influence of ENSO on wave activity as an indicator of tropical cyclogenesis

Future Work

- Expand scope of environmental conditions analyzed to include vorticity for insight of AEW vertical structure
- Combine AEW plots with environmental condition plots
- Better understand relationship between environmental conditions and developers at point of genesis and non-developers
- Conduct analysis for more year groupings to gather more data on tropical cyclogenesis trends related to AEWs and environmental conditions

References and Acknowledgments

- Lett., 44, 587–595, doi:10.1002/2016GL071236
- Brammer, A., & Thorncroft, C. D., 2015: Variability and evolution of African easterly wave structures and their relationship with tropical cyclogenesis over the Eastern Atlantic Monthly Weather Review., **143(12)**, 4975-4995. Hopsch, S. B., C. D. Thorncroft, K. Hodges, and A. Aiyyer, 2007: West African Storm Tracks and Their Relationship to Atlantic Tropical Cyclones. J. Climate, 20, 2468-
- 2483, https://doi.org/10.1175/JCLI4139. Lawton, Q. A., and S. J. Majumdar, 2023: Convectively Coupled Kelvin Waves and Tropical Cyclogenesis: Connections through Convection and Moisture. Mon. Wea.
- Rev., **151**, 1647–1666, https://doi.org/10.1175/MWR-D-23-0005.1
- Núñez Ocasio, K. M., A. Brammer, J. L. Evans, G. S. Young, and Z. L. Moon, 2021: Favorable Monsoon Environment over Eastern Africa for Subsequent Tropical Cyclogenesis of African Easterly Waves. J. Atmos. Sci., 78, 2911–2925, https://doi.org/10.1175/JAS-D-20-0339.1
- Lawton, Q. A. et al., (2022): The Influence of Convectively Coupled Kelvin Waves on African Easterly Waves in a Wave-Following Framework, Monthly Weather
- *Review*, **150**, 2055-2072, https://doi.org/10.1175/MWR-D-21-0321.
- permitting model. Geophysical Research Letters, 49, e2022GL100590. https://doi.org/10.1029/2022GL100590



- stronger non-developing AEWs
- **Conclusions and Future Work**
- Possibility for AEW strength to be an additional ENSO teleconnection
- Influence of environmental conditions on attributes of developing **and** non-developing AEWs

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- Danso, D. K., Patricola, C. M., & Bercos-Hickey, E. (2022). Influence of African easterly wave suppression on Atlantic tropical cyclone activity in a convection-