ATS/CIRA Colloquium

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from NCAR

Hosted by Russ Schumacher

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ATS 101 and Zoom

Seasonal Climatology, Variability, Characteristics, and Prediction of the Caribbean Rainfall Cycle

The Caribbean and Central America hydroclimate is understudied and complex in part due to its data sparsity, varied topographies, and multi-faceted interactions with tropical and mid-latitude forcings. A refined and comprehensive understanding of the observed and simulated Caribbean hydroclimate is presented, using a variety of in-situ and satellite precipitation products, reanalysis, and models. The seasonal cycle of rainfall in the Caribbean hinges on three main facilitators of moisture convergence: the Atlantic Intertropical Convergence Zone (ITCZ), the Eastern Pacific ITCZ, and the North Atlantic Subtropical High (NASH). A warm body of sea-surface temperatures (SSTs) in the Caribbean basin known as the Atlantic Warm Pool (AWP) and a low-level jet centered at 925hPa over the Caribbean Sea known as the Caribbean Low-Level Jet (CLLJ) modify the extent of moisture provided by these main facilitators. The Early (ERS) and Late-Rainy Seasons (LRS) are impacted in distinctly different ways by two different, and largely independent, large-scale phenomena, external to the region: a SLP dipole mode of variability in the North Atlantic known as the North Atlantic Oscillation (NAO), and the El Nino Southern Oscillation (ENSO). The seasonal prediction of the Caribbean rainfall cycle is assessed using the identified variables that could provide predictive skill of S2S rainfall characteristics in the region and using the North America Multi-Model Ensemble (NMME). The use of SLP, 850-hPa zonal winds, vertically integrated zonal, and meridional moisture fluxes show comparable, if not better, forecast skill of Caribbean precipitation characteristics than SSTs, with lead times of up to two months. Finally, fully coupled CESM and CMIP6 simulations underestimate precipitation across the Caribbean, with some improvements using high-resolution (<0.5°) simulations. The underestimations are largest during the ERS. Precipitation biases in AMIP experiments are smaller, regardless of their spatial resolution, suggesting precipitation is improved when observed SST is used. These results have important implications for prediction, decision-making, modeling capabilities, understanding the genesis of hydro-meteorological disasters, investigating rainfall under other modes of variability, and Caribbean impact studies regarding weather risks and future climate.

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