

Advancing Precipitation Modeling in the Yucatán Península: Integrating Ice-Nucleating Particle Data into RegCM5

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Abstract

This research focuses on refining precipitation modeling accuracy in the Yucatán Peninsula by integrating region-specific observational data on ice-nucleating particles (INPs) into cloud microphysics parameterizations of regional climate models (RCMs). By calibrating these parameterizations to reflect real-world INP concentrations, the study seeks to improve the representation of heterogeneous ice nucleation—a pivotal mechanism in ice crystal formation and subsequent precipitation dynamics. Initial experiments using the RegCM platform reveal significant sensitivity of simulated rainfall to adjustments in cumulus and microphysical schemes, highlighting the potential for localized parameter tuning to capture tropical precipitation variability better. While these early results underscore the importance of INP-driven processes in cloud development, the study emphasizes the necessity of expanded, region-specific analyses to quantify the full impact of such parameterizations on climate projections for tropical zones like the Yucatán. This work aims to advance model fidelity, supporting more reliable predictions for climate resilience planning in vulnerable regions.