

Modeling and Simulation of the Spatial and Temporal Response of Precipitation to El Niño/Southern Oscillation (ENSO) phenomenon – The Case of Western Colombia

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Abstract. Modeling the spatial and temporal distribution of regional precipitation is one of the most challenging tasks in hydrometeorology. In tropical South America, and specifically Colombia, the Intertropical Convergence Zone (ITCZ), the dynamics of Pacific and Atlantic oceans, the Amazon jungle, and the orographic barriers of the Andes Mountains, among others, affect hydroclimatological behavior. The interactions among these factors at different space and time scales are extremely complex and non-linear and make the region of western Colombia, one of the rainiest regions of the world. In addition, inter-annual precipitation variability in this region is dominated by the presence of the El Niño/Southern Oscillation (ENSO) phenomenon, recognized as the dominant mode of the inter-annual climate variability in and over the Tropical Pacific. This study explores the skill of a physically based model to capture the impact of the ENSO phenomenon on precipitation response in western Colombia. CSU's Regional Atmospheric Modeling System (RAMS) is used for this purpose. Simulations of precipitation of six months for two periods, 1989 considered as a cold phase and 1992 belong to a warm phase are done. CSU-RAMS has been implemented using a nested set of two grids. The coarsest grid focuses on the tropical pacific region having Colombia as a center and the finest grid focuses on Colombian Mountain region. Both grids are centered at 5°N of Latitude and 75°W of Longitude. Input data for initial and lateral boundary conditions are from National Center for Environmental Prediction (NCEP) reanalysis products. Matching between simulation results and observed data for both periods illustrates the benefits of using physically based models in forecasting Colombian precipitation tendency at least with six months ahead. Results of this work illustrate this methodology as a potential tool to increase our understanding of hydroclimatic patterns that can be used for regional and local socio-economic planning and policy making in the contexts of hazard mitigation and optimal use of water resources in Colombia.

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