**Assessing the drivers of extreme dry spells across the Tempisque-Bebedero River Basin, Costa Rica**

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**Abstract**

El Niño, the warm phase of the El Niño Southern Oscillation (ENSO), brings dry conditions to the Pacific coast of Central America. During the last strong El Niño in 2015, these dry conditions lead to drought in northwestern Costa Rica, and the Tempisque-Bebedero River Basin suffered great losses to its main economic activity, agriculture and cattle. In its latest report, the Intergovernmental Panel on Climate Change (IPPC) recognizes Central America as a region that will experience a decrease in mean precipitation and an increase in extreme precipitation. The projected changes to precipitation will bring added stress to social, economic, and environmental systems, and reshape prospects for food, water, and health security across Central America. Thus, climate events that influence extreme precipitation like the 2015 El Niño can be viewed as a window to the future. To predict how climate extremes will change in the near future, it is important to first understand both the nature and drivers of variability in the historic record.

The main goal of this study is to characterize the spatial and temporal variability of dry spells in northwestern Costa Rica’s Tempisque-Bebedero River Basin. Here, we define a dry spell as the number of days without precipitation. We compute dry spells for daily rainfall records of at least 18 years in length at six meteorological stations distributed across the basin. To quantify extreme dry spells, which correspond to meteorological drought, we use a point process approach, which allows for modeling the frequency of exceeding a high threshold and the magnitude of threshold excesses. To evaluate the inter and intra-annual drivers of extreme dry spells, we include non-stationary into the point process approach by incorporating climate indices such as the Oceanic Niño Index (ONI, representative of ENSO), Atlantic Multidecadal Oscillation (AMO) and Caribbean low-level jet (CLLJ) as covariates in our model fits. Results from this research will help identify the main drivers of extreme dry spells in the area, which could help to improve the management and decision-making process involving water allocation and ecosystem services.

This research is part of a larger interdisciplinary project aiming to understand the resilience of the coupled human-natural system of the Tempisque-Bebedero River Basin. The main economic activity of the area is agriculture such as sugar cane, rice, cantaloupe, Tilapia farms and cattle, which has suffered from poor management and extreme droughts and floods. Since water plays an important role in the livelihood of the people and the environment in this region, the variations in precipitation can help understand how the system changes and reacts to shocks such as droughts.