INTRODUCTION

• Global warming.
• Changes in magnitude, frequency and timing of extreme events.
• Understand drivers of extremes in the present and past.
• Water crucial to natural and human systems.
• Future changes in drivers will help anticipate system changes and reactions to shocks, leading to improved decision-making and overall resilience.

Source: ticotimes.net
Main objective

Model the variability of extreme hydroclimatic events in the Tempisque basin using Extreme Value and Crossing Theory.

Research Questions

• **Q1.** What are the current properties of hydroclimatic extremes?

• **Q2.** How are the drivers of inter- and intra annual variability affecting hydroclimatic extremes in the Tempisque basin?
RAINFALL PATTERN FOR GUANACASTE

Monthly Average Rainfall

Veranillo
DRIVERS OF PRECIPITATION:
SOME DEFINITIONS

- **Caribbean Low-Level Jet (CLLJ):** Maximum of easterly zonal wind located at 925 hPa over the Caribbean.
- **Intertropical Convergence Zone (ITCZ):** A zone near the equator where air masses from the northern and southern hemisphere converge into a low atmospheric pressure bringing rainfall.
- **El Niño Southern Oscillation (ENSO):** Climate pattern over the Tropical Pacific affecting sea surface temperatures every 3 to 7 years.
- **Atlantic Multidecadal Oscillation (AMO):** Sea surface anomaly over the North Atlantic Ocean with a period of 20 to 40 years.
Dry Season – November-April

Daily Probability

N.E. Trades

ITCZ
Pre-Veranillos – May -June

Daily Probability

ITCZ

Cross-Equatorial Westerlies

N.E. Trades
Veranillos – July-August

[Diagram showing the daily probability of certain events over the months of the year, with a map of Costa Rica showing the ITCZ and cross-equatorial westerlies.]
Post-Veranillos – September-October

Daily Probability

ITCZ

Cross-Equatorial Westerlies

N.E. Trades

COSTA RICA

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CLIMATE RESILIENCE:
WHAT DOES IT LOOK LIKE

- Decrease in precipitation, more droughts
- More intense precipitation, more floods

Graph showing the impact of ENSO and AMO on climate resilience:
- Threshold
  - More intense precipitation, more floods
  - Decrease in precipitation, more droughts
CLIMATE RESILIENCE: WHAT DOES IT LOOK LIKE

- More intense precipitation, more floods
- Decrease in precipitation, more droughts
- Poor management decisions
Decrease in Precipitation: 20 to 50%

Increase in Temperature: 2°C to 6°C

Source: www.nacion.com

CLIMATE CHANGE: CURRENT PREDICTIONS FOR TEMPISQUE
"The El Niño phenomenon is like a window to the future, where its impact gives a hint of the climate that will be felt more frequently in the years to come" Andrea Suárez, director of Centro de Recursos Hídricos para Centroamérica y el Caribe (Hidrocec).

MINAET, IMN, PNUD, & CRRH. (2008).

Source: www.nacion.com
Extreme deviation from median of probability distributions (tail of a distribution)

Approaches:
1. Generalized Extreme Value (GEV) – Block Maxima
2. Threshold models- Generalized Pareto Distribution (GPD)
WHAT ARE THE DRIVERS OF SUCH EXTREMES?

- **El Nino Southern Oscillation (ENSO):** ONI index
  - El Niño $\rightarrow$ Dry (+)
  - La Niña $\rightarrow$ Wet (-)

- **Atlantic Multidecadal Oscillation (AMO) →** warmer and cooler signals, dampen and amplify ENSO signal

- **Caribbean Low Level Jet (CLLJ) →**
  - Positive: drier
  - Negative: wetter

P.R. Waylen and M.E. Quesada, 2002.
WHAT ARE THE DRIVERS OF SUCH EXTREMES?

P.R. Waylen and M.E. Quesada, 2002.
Thank you!

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