GUANACASTE: A REGION OF HYDROMETEOROLOGICAL EXTREMES

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INTRODUCTION

Source: ticotimes.net

- 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.

RESEARCH QUESTIONS

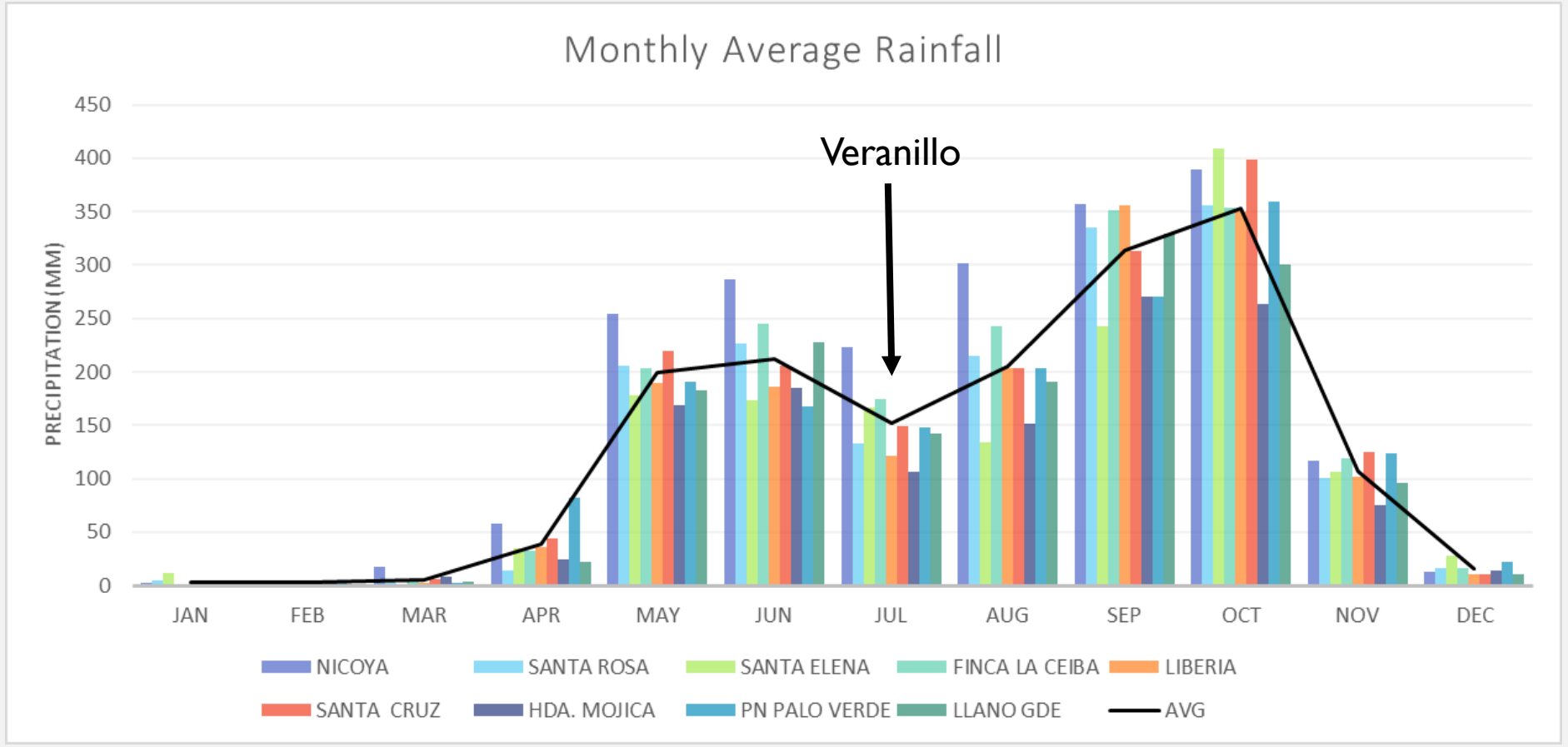
Main objective

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?

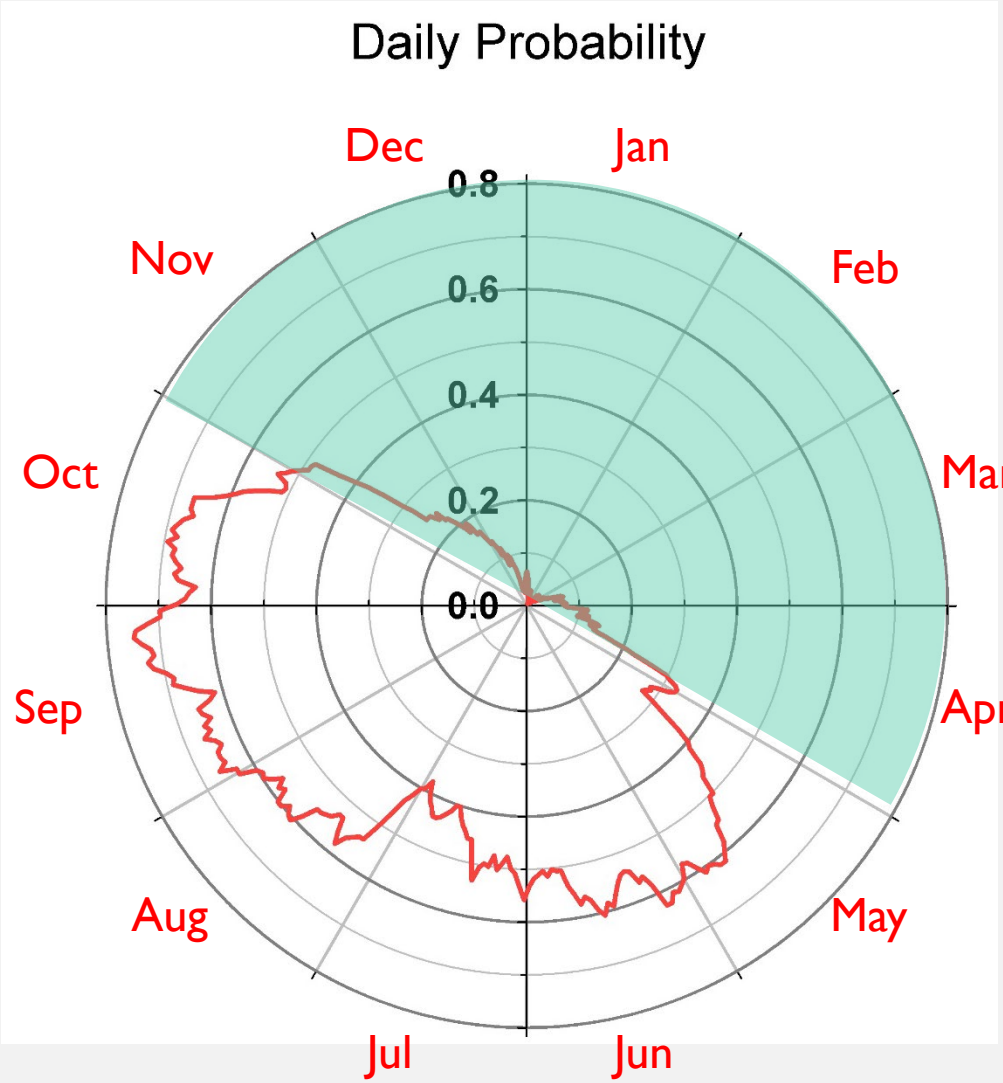
RAINFALL PATTERN FOR GUANACASTE



DRIVERS OF PRECIPITATION:
SOME DEFINITIONS

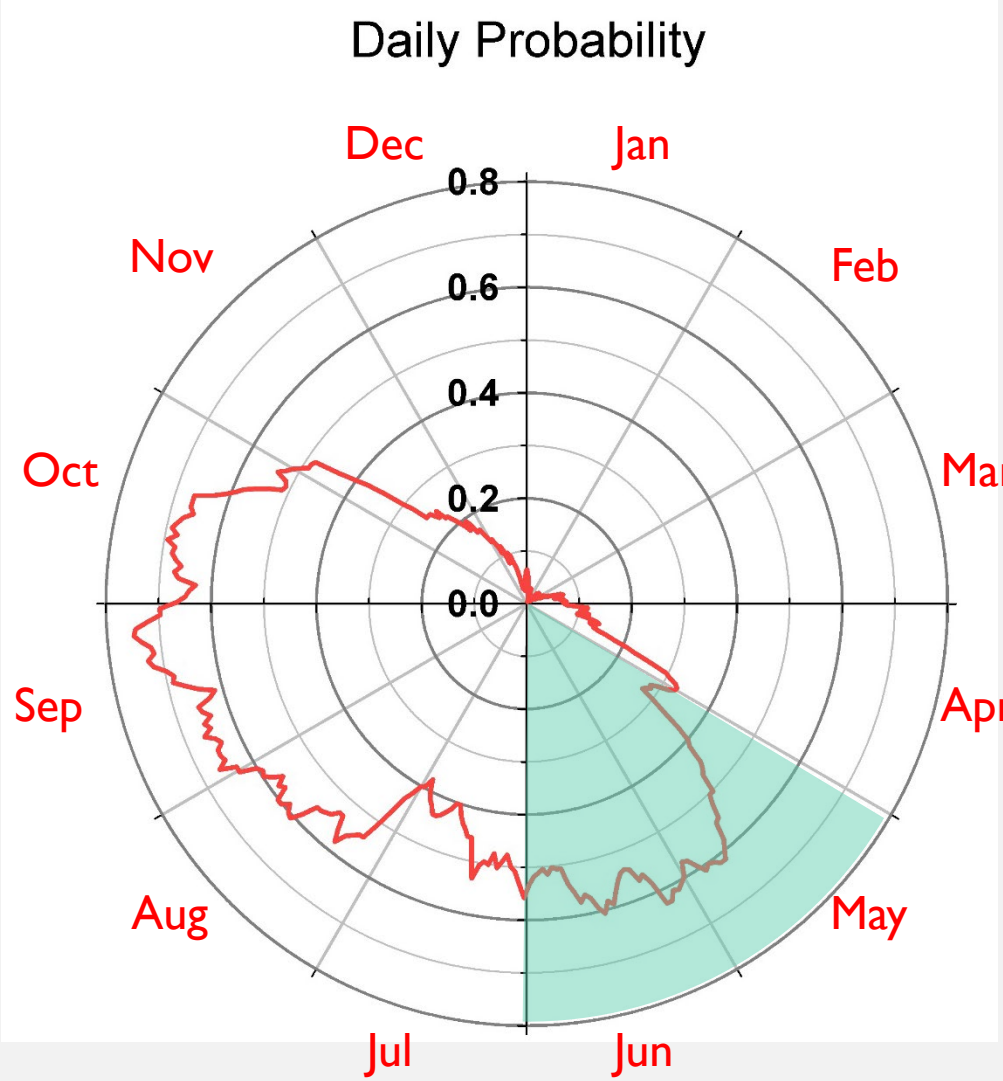
- **Caribbean Low-Level Jet (CLLJ):** Maximum of easterly zonal wind located at 925 hPa over the Caribbean
- **Intertropical Convergence Zone (ITCZ):** A zone near the equator where air masses from the northern and southern hemisphere converge into a low atmospheric pressure bringing rainfall.
- **El 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 40years.

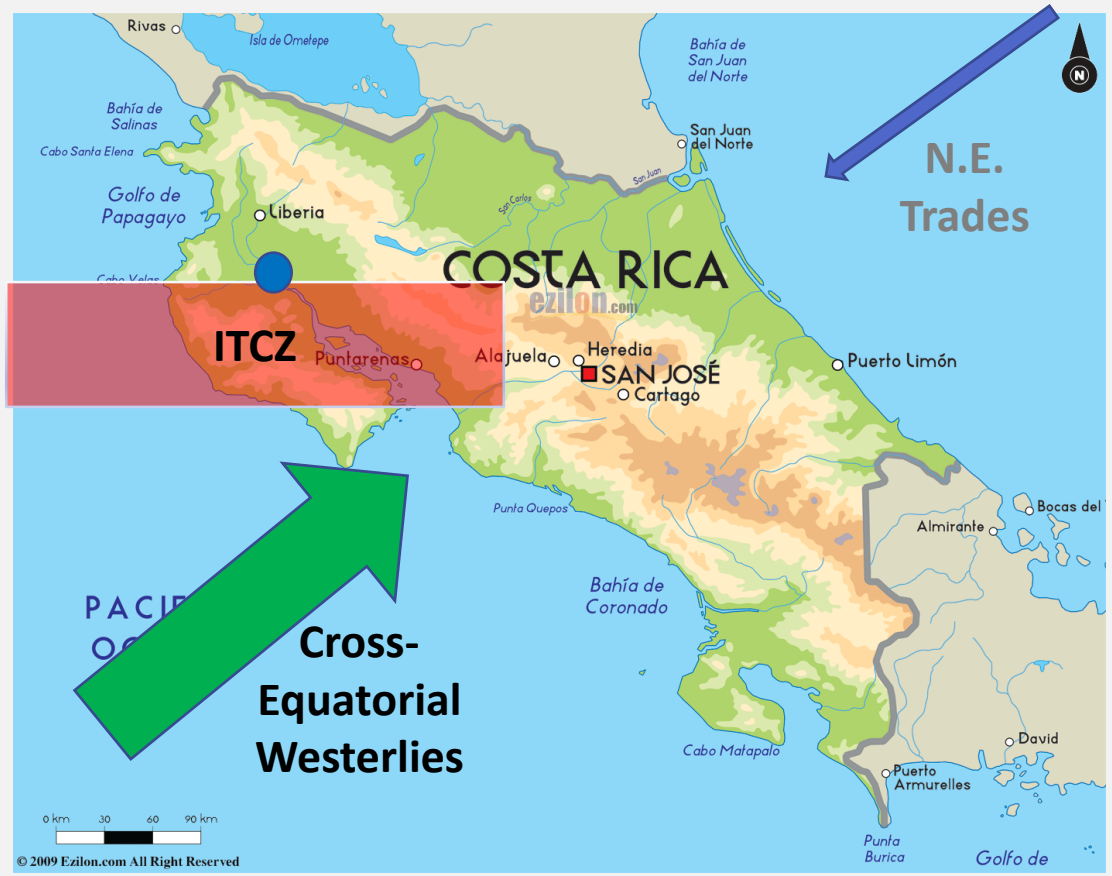
Dry Season – November-April



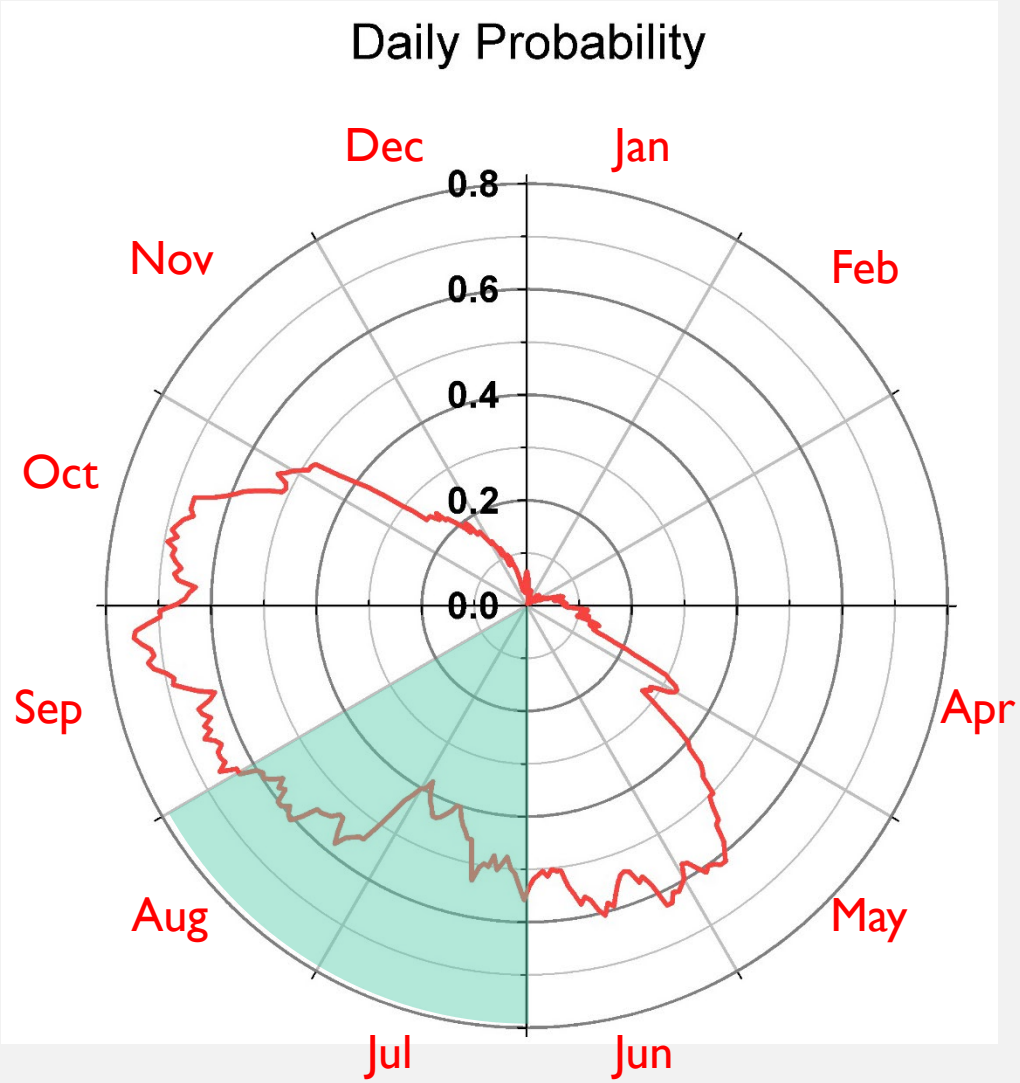
ITCZ

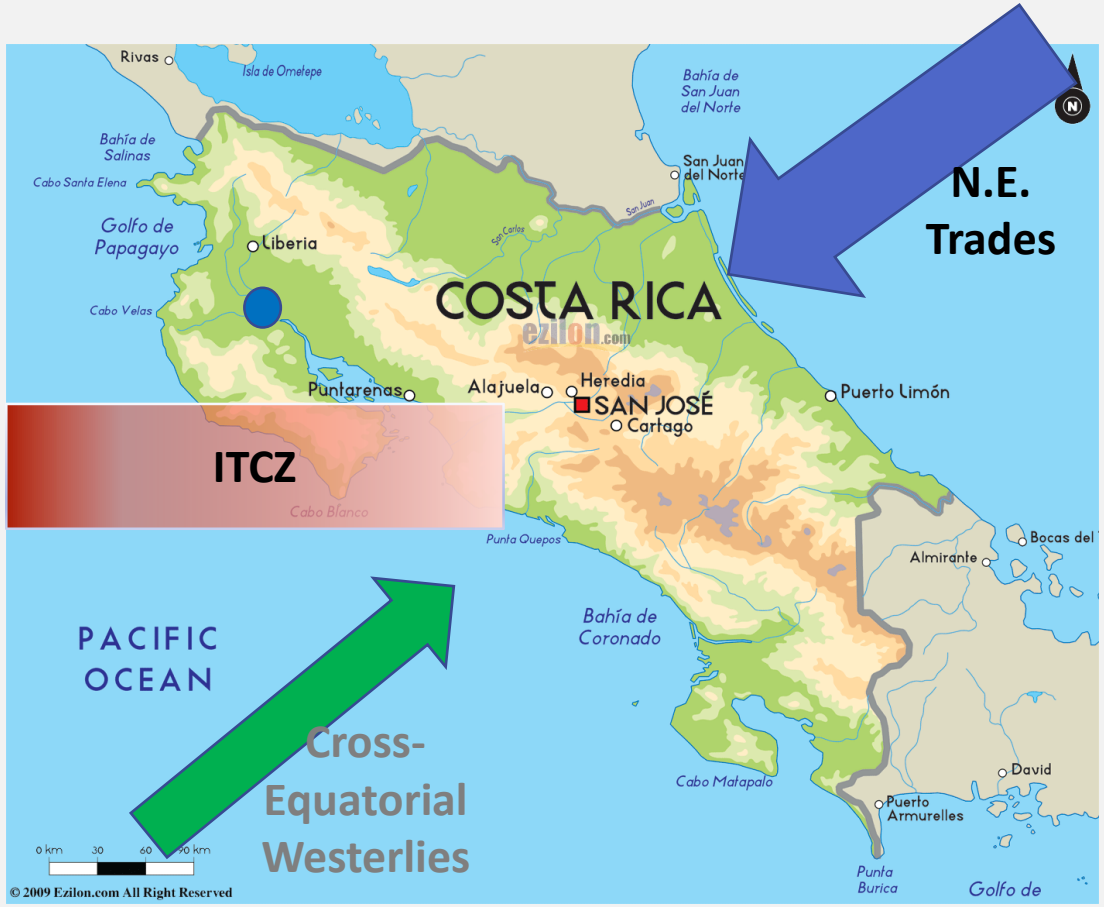
Pre-Veranillos – May -June



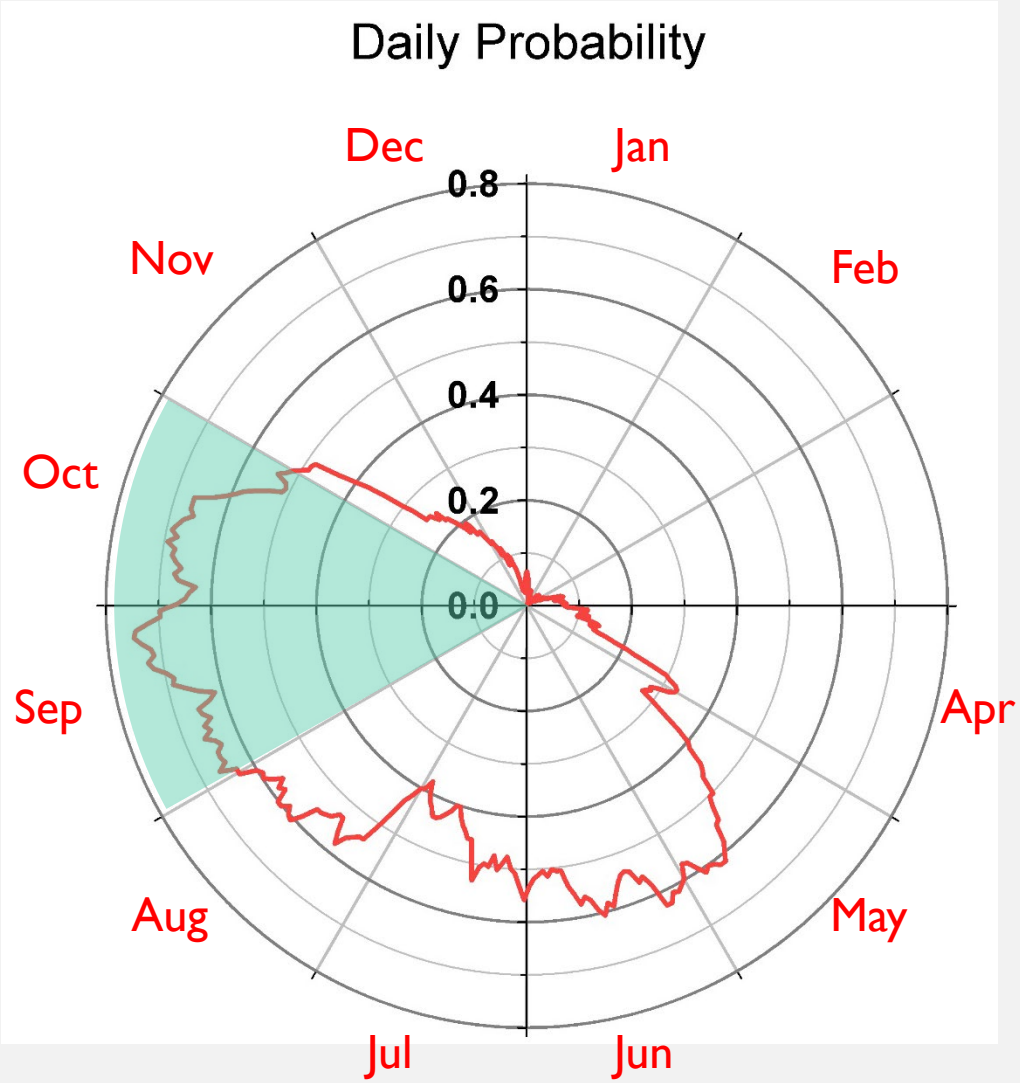


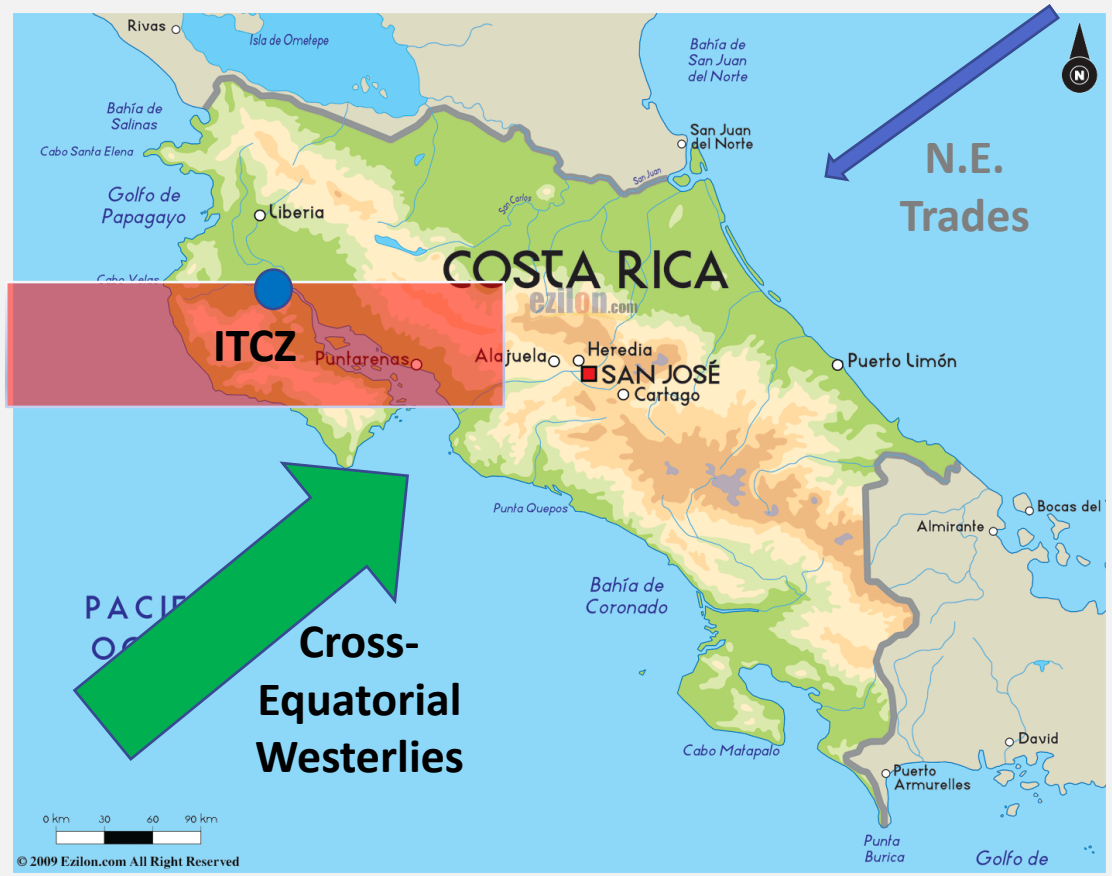
Veranillos– July-August



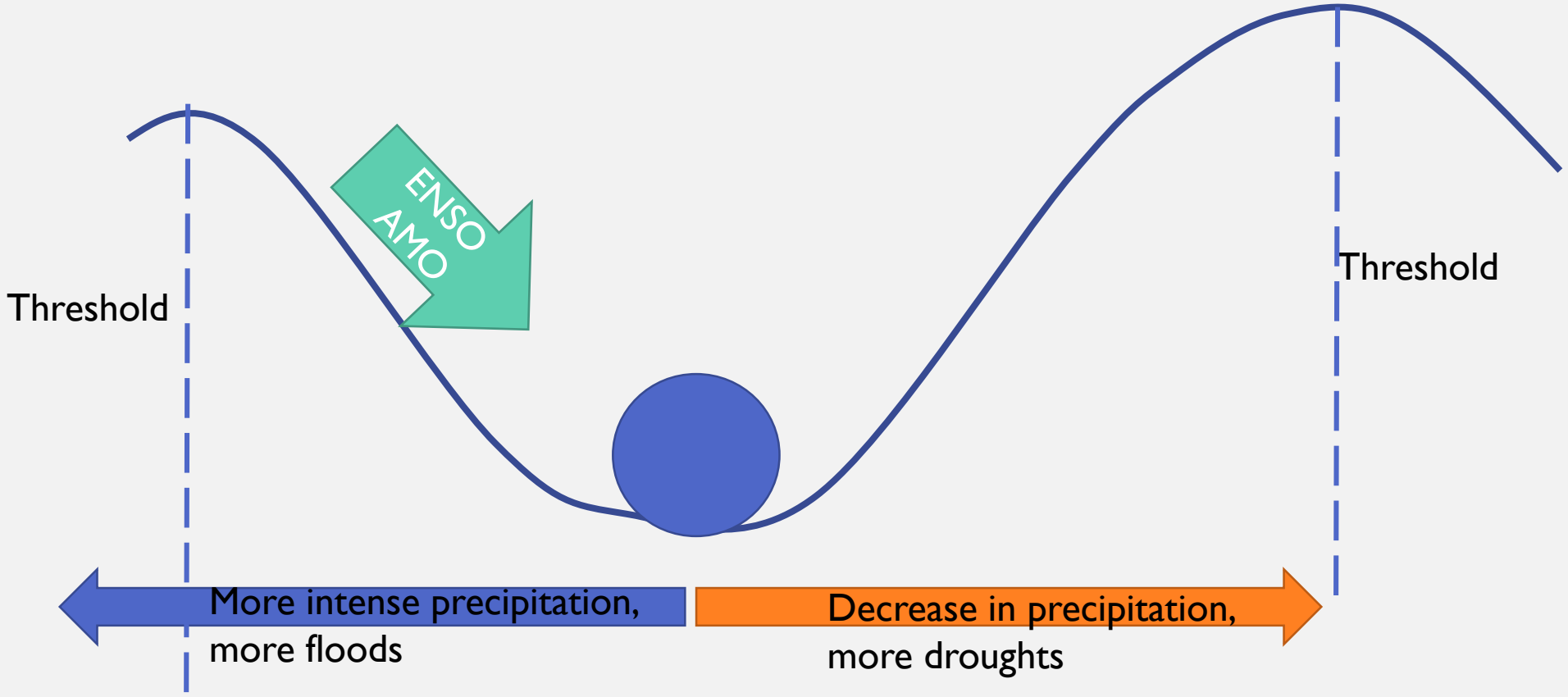


Post-*Veranillos* – September-October





CLIMATE RESILIENCE: WHAT DOES IS LOOK LIKE



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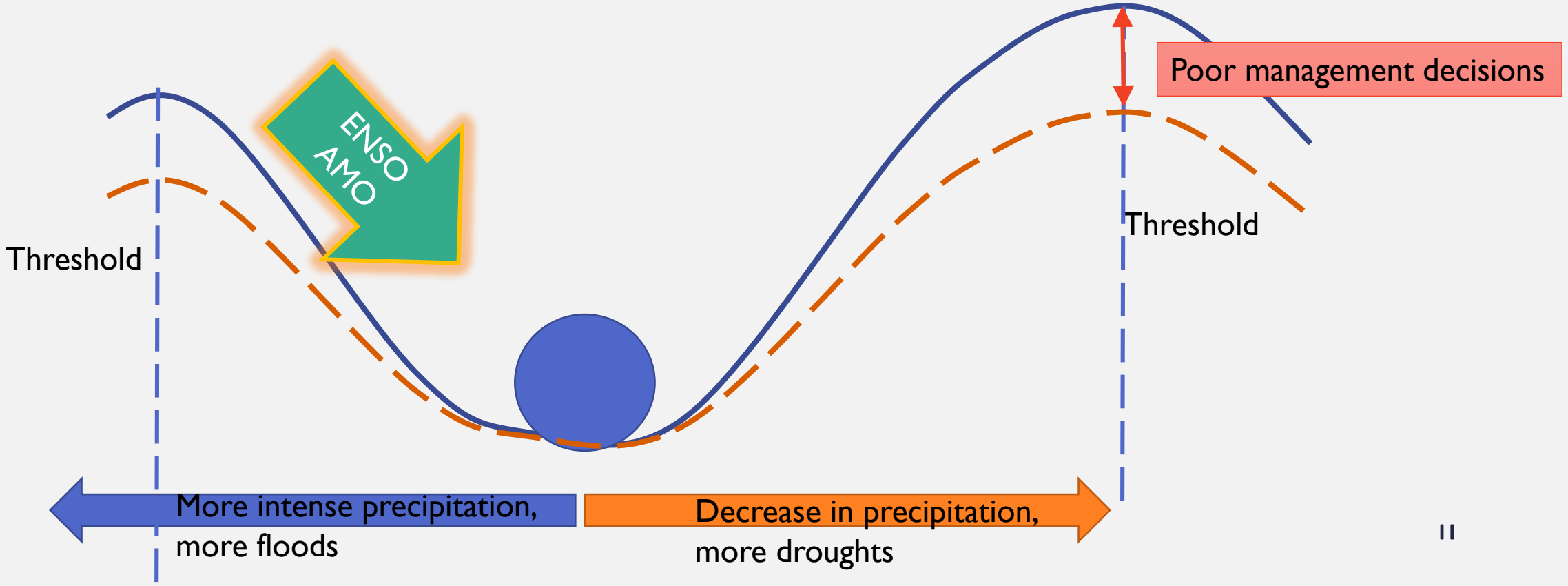
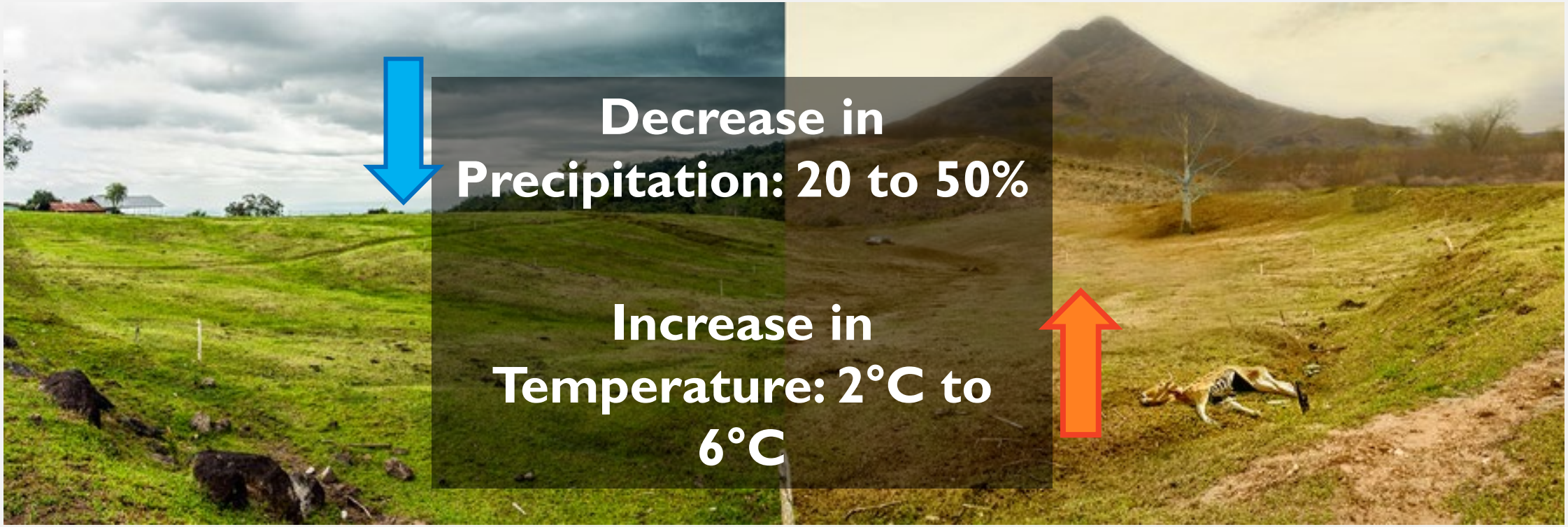


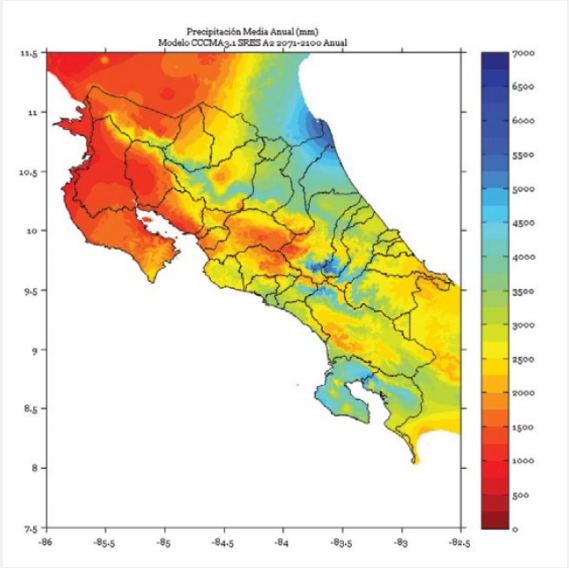


Source: www.nacion.com

CLIMATE CHANGE: CURRENT PREDICTIONS FOR TEMPISQUE

CLIMATE CHANGE CURRENT PREDICTIONS

"The El Niño phenomenon is like a window to the future, where it 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).



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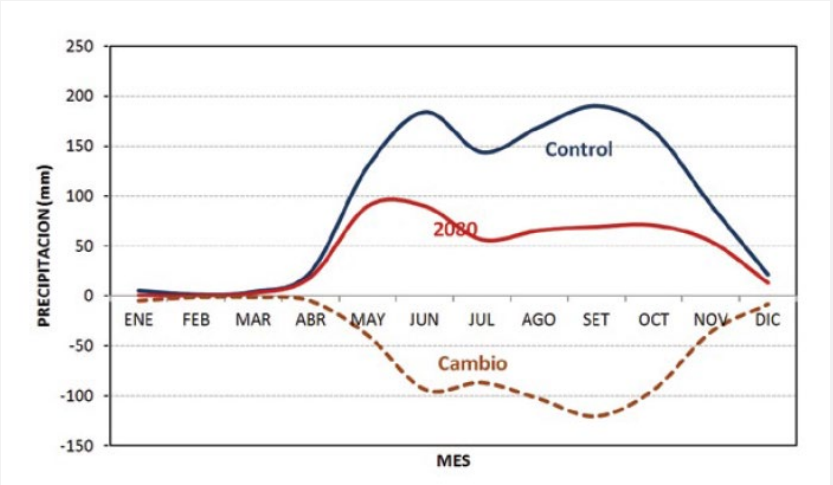
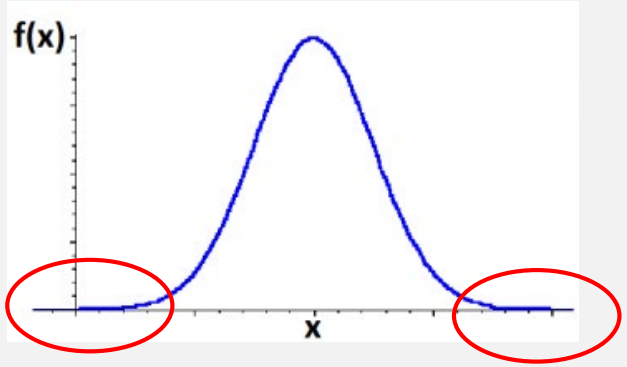


MINAET, IMN, PNUD, & CRRH. (2008).

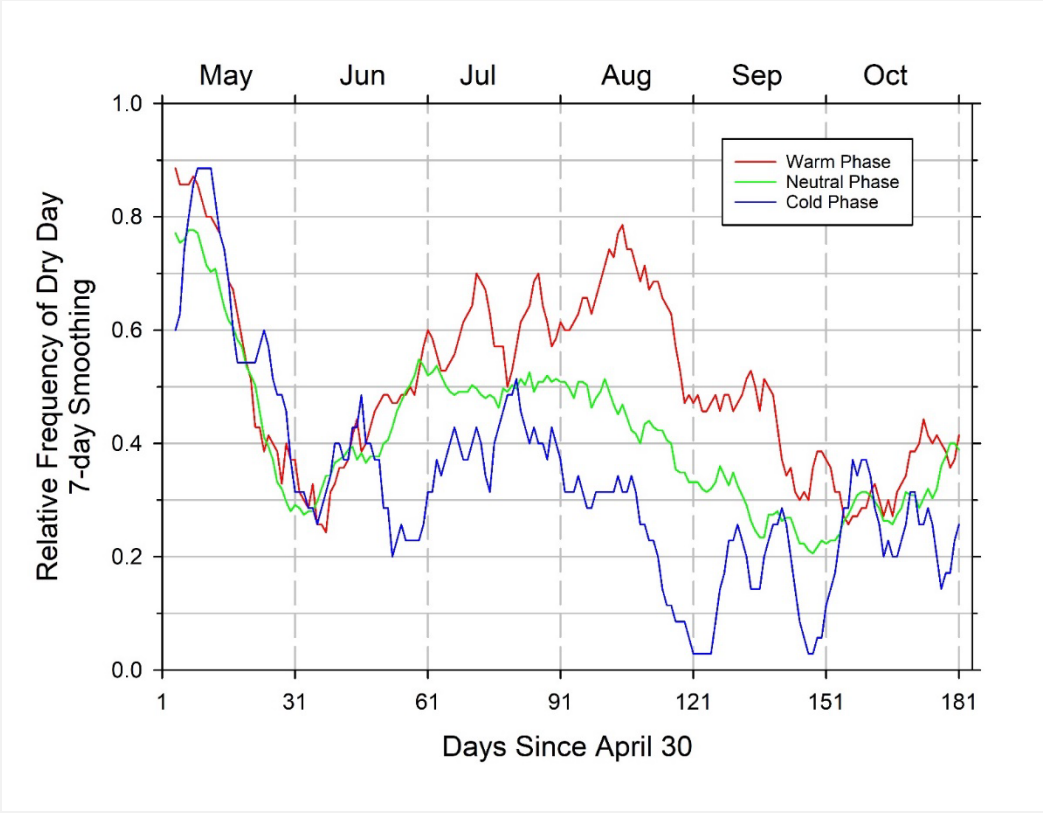
EXTREMES: TOO MUCH AND TOO LITTLE RAIN

Extreme deviation from median of probability distributions (tail of a distribution)



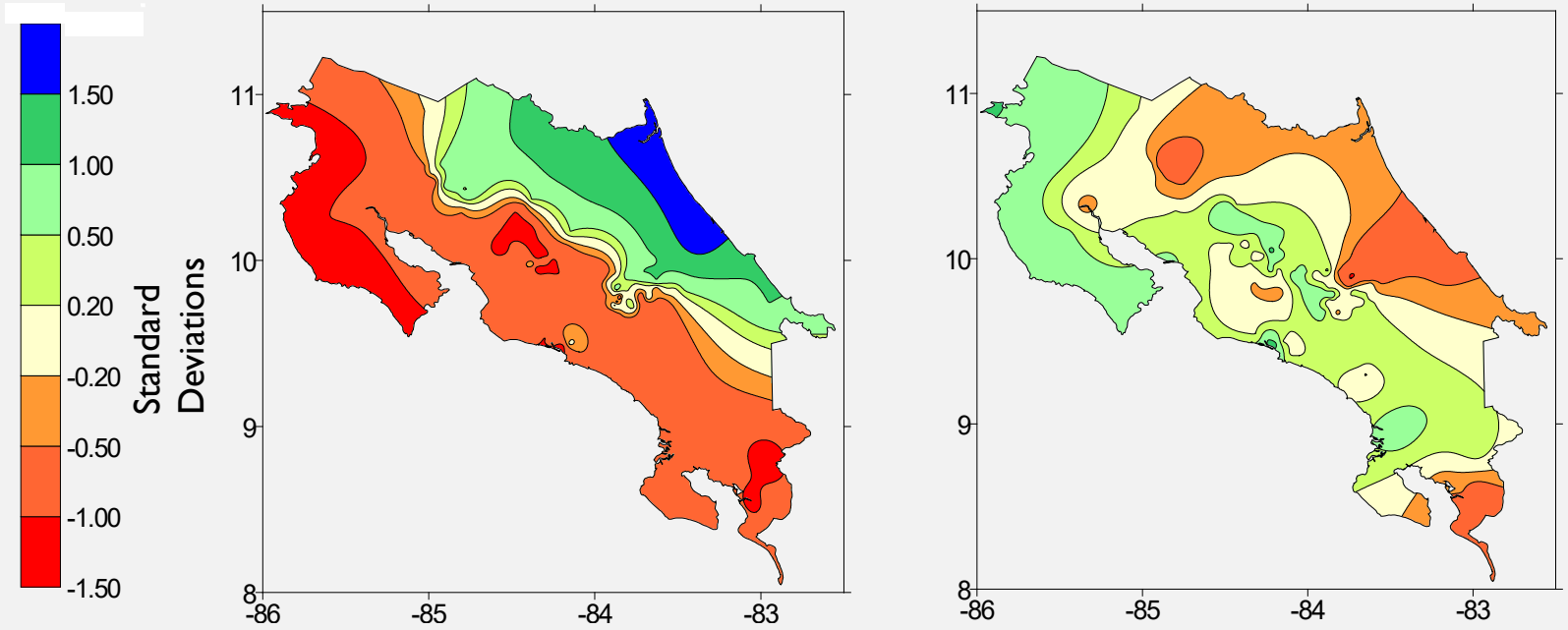
Approaches:

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 → Dry (+)
  - La Niña → Wet (-)
- Atlantic Multidecadal Oscillation (**AMO**) → warmer and cooler signals, dampen and amplify ENSO signal
- Caribbean Low Level Jet (**CLLJ**) →
  - Positive: drier
  - Negative: wetter



Mean Annual Precipitation as standard normal deviate from long-run mean

Warm Phase ENSO (El Niño)

Cold Phase ENSO (La Niña)

P.R. Waylen and M.E. Quesada, 2002.

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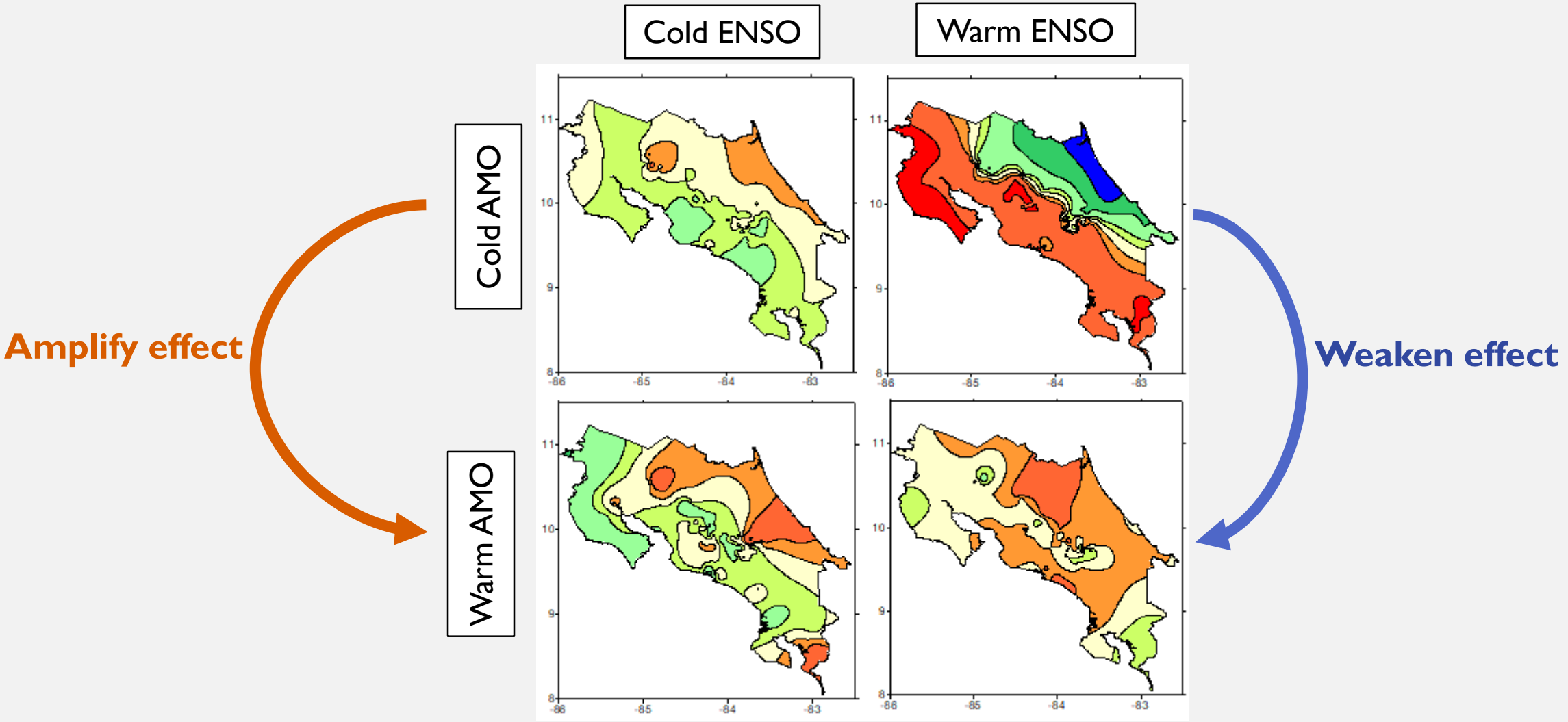
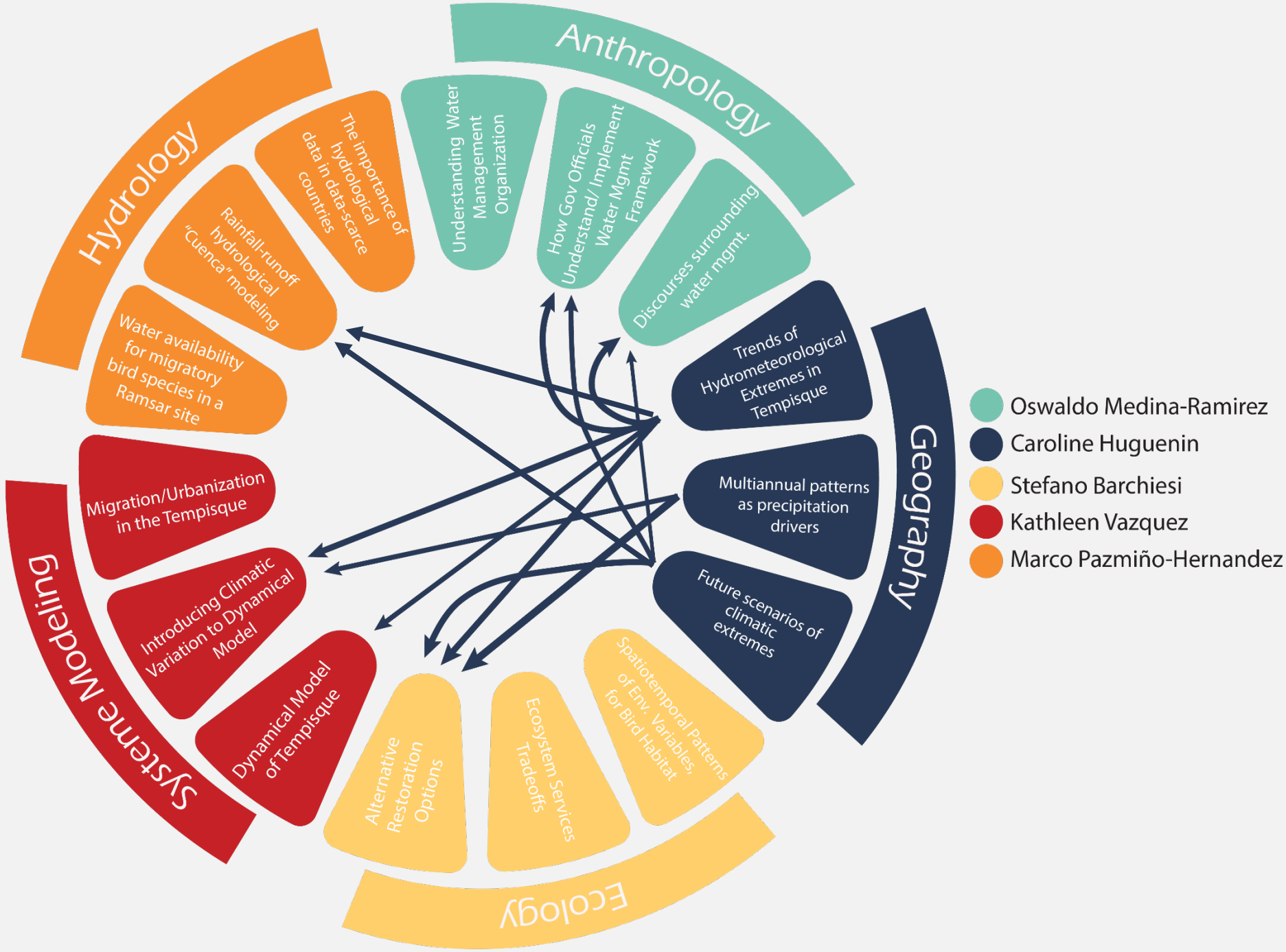


P.R. Waylen and M.E. Quesada, 2002.


Anthropology
Understanding Water Management Organization
How Gov Officials Understand/ Implement Water Mgmt Framework
Discourses surrounding water mgmt.
Geography
Trends of Hydrometeorological Extremes in Tempisque
Multiannual patterns as precipitation drivers
Future scenarios of climatic extremes
Ecology
Spatiotemporal Patterns of Env. Variables, for Bird Habitat
Ecosystem Services Tradeoffs
Alternative Restoration Options
Systeme Modeling
Dynamical Model of Tempisque
Introducing Climatic Variation to Dynamical Model
Migration/Urbanization in the Tempisque
Hydrology
Water availability for migratory bird species in a Ramsar site
Rainfall-runoff hydrological "Cuenca" modeling
The importance of hydrological data in data-scarce countries
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Stefano Barchiesi
Kathleen Vazquez
Marco Pazmiño-Hernandez

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