# Compound dry and hot extremes in the Orinoco basin

Paola A. Arias*, Alejandra Fernández, Valeria Bedoya, Yurani Acevedo, and J. Alejandro Martínez
Grupo GIGA, Escuela Ambiental, Facultad de Ingeniería, Universidad de Antioquia, Medellín, Colombia

*paola.arias@udea.edu.co

9th GEWEX Open Science Conference

## 1. Introduction

Compound dry and hot extremes (CDHE) have acquired relevance due to the increase in their frequency and the severity of their impacts on natural and human systems. The Orinoco basin is particularly vulnerable to these compound extremes because its extensive savannahs in the northern region (NORI) are highly prone to high temperatures and fire events.

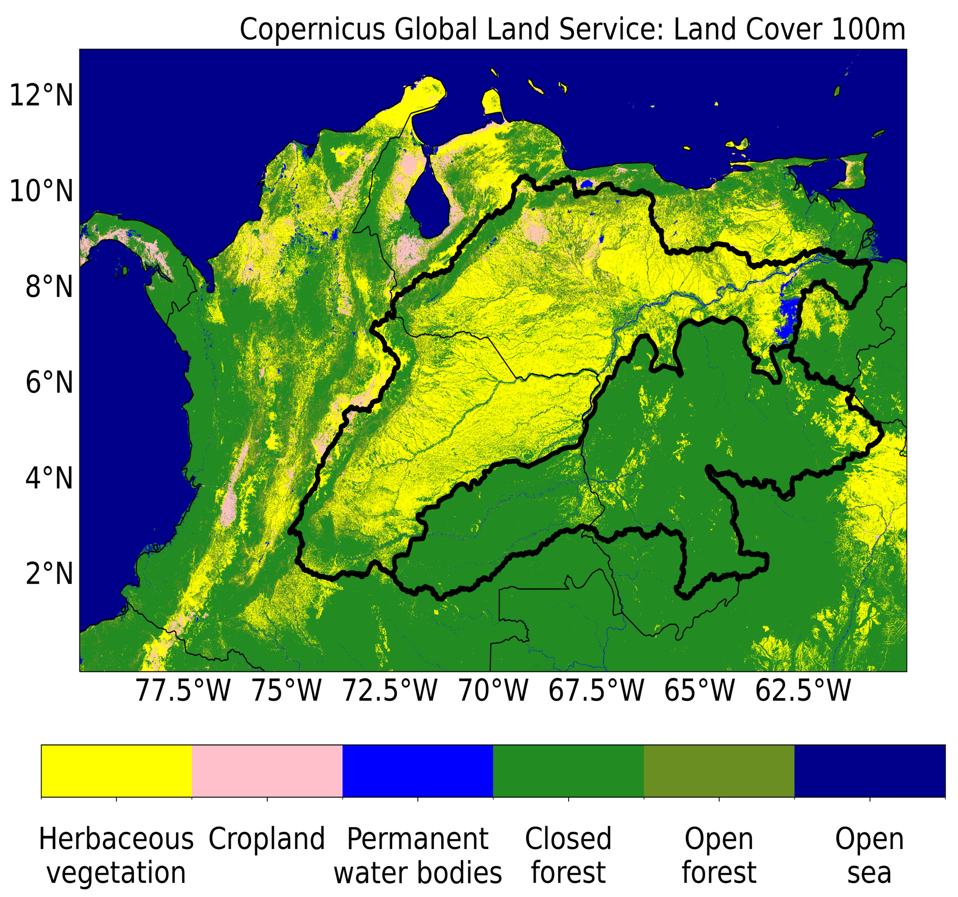


**Figure 1.** Land cover of the northern (NORI) and southern (SORI) Orinoco basin (black outlines). Data from Copernicus Global Land Service.

## 2. Research objectives

- Identify compound dry and hot extremes (CDHE) in the Orinoco basin during the recent decades.
- Identify the typical atmospheric patterns associated with CDHE.
- Analyze fire activity during CDHE.

## 3. Methodology

**Droughts (SPI)**

**02/2009-04/2010,** 10/2013-06/2014
**04/2015-04/2016,** 11/2018-08/2019
**02/2020-08/2020**

**ERA5**

**CDHE Identification:** SPI drought + 90th Percentile of Tmax
**Characterization:** TCWV, Winds (850 and 500hPa), RH500, Z500, precipitation

**ERA5-Land**

**Soil Moisture (SM):** Surface soil (0-7cm) Deep soil (7–289 cm)

**Intensity**: Tmax Composites

**Frequency**: TX90p Index

**Severity**: STI

**Fire Activity**: MODIS

## 4. Soil moisture deficit

Stronger soil moisture (SM) deficit during CDHE.

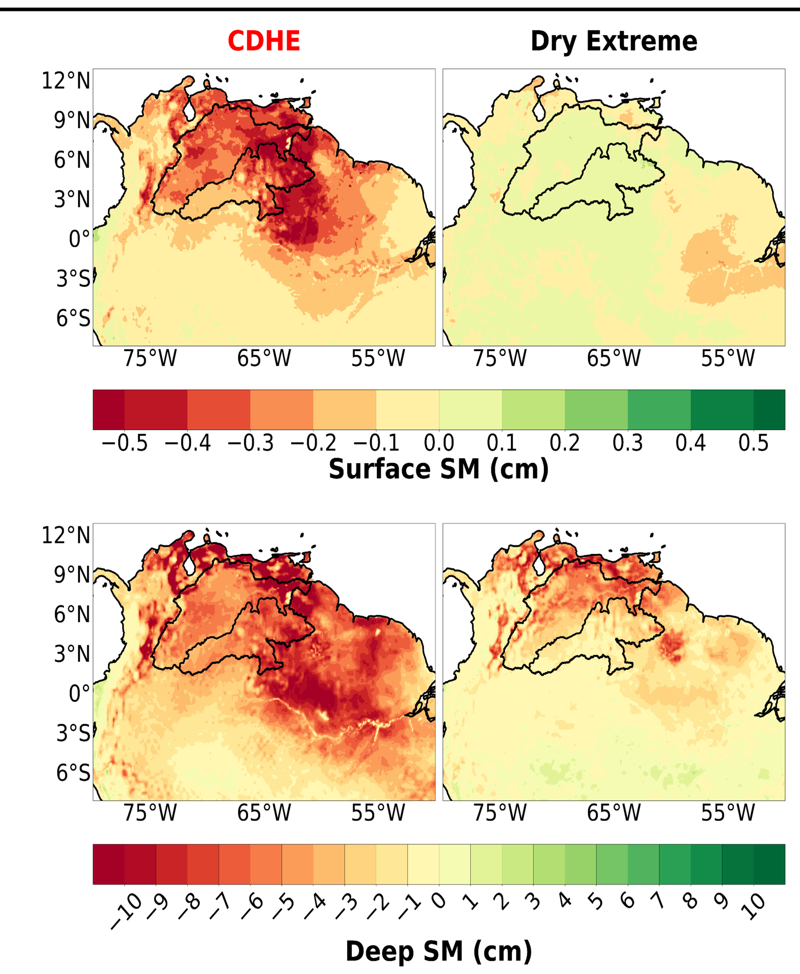


**Figure 4.** SM anomalies for surface soil (top) and deep soil (bottom) during CDHE and dry extremes. Data from ERA5-Land.

## 5. Typical atmospheric patterns

Deficit of Total Column Water Vapor (TCWV) and weakening in the moisture flux from the north Atlantic due to weaker Trade Winds and Orinoco Low-level Jet (OLLJ).

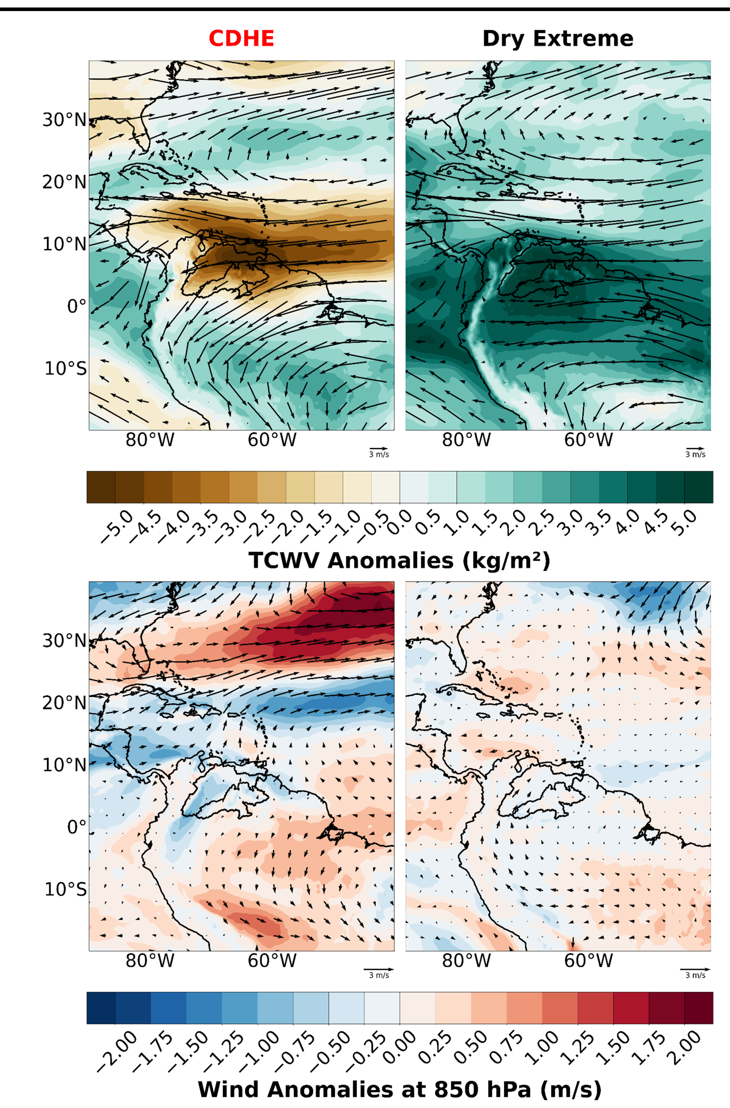


**Figure 2.** Anomalies of TCWV (top) and 850hPa wind (bottom) during CDHE and dry extremes. Data from ERA-5.

Strengthening of a high-pressure system in the north Atlantic and the Caribbean that enhances the transport of dry air masses and contributes to the increase in the RH deficit at 500hPa.

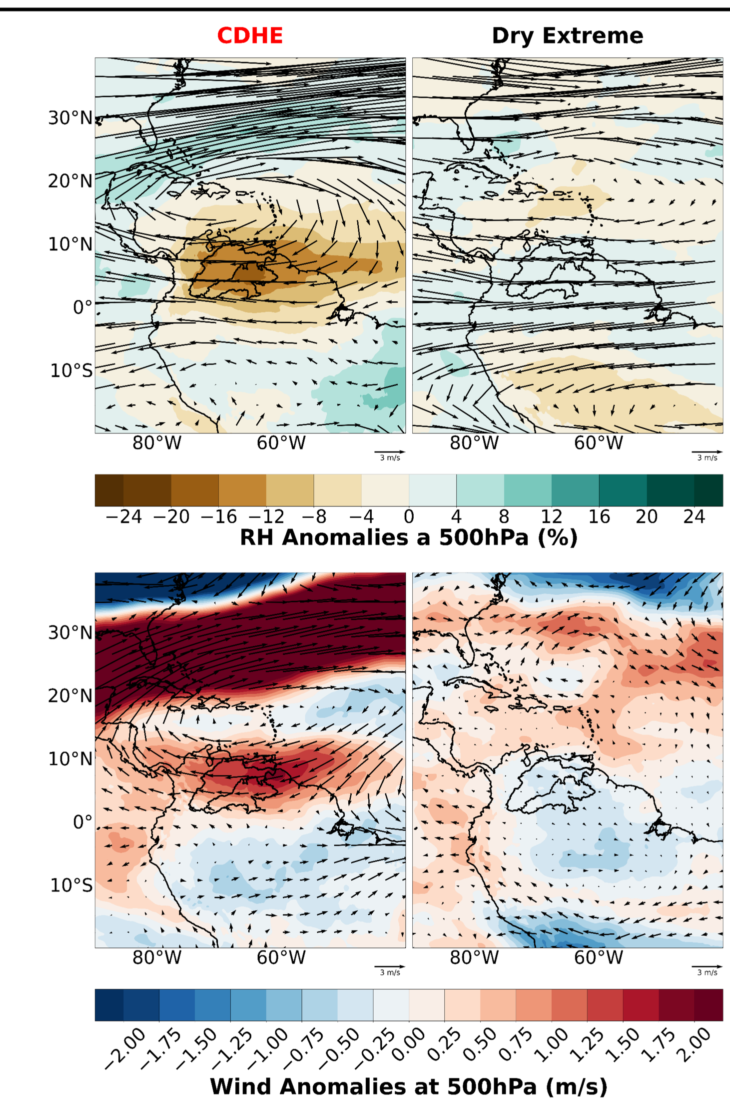


**Figure 3.** Anomalies of 500hPa RH (above) and 500hPa wind (bottom) during CDHE and dry extremes. Data from ERA5.

## 6. Hot extremes frequency

The months with the highest frequency of hot extremes within a drought are January, February, and March (dry season in the Orinoco).

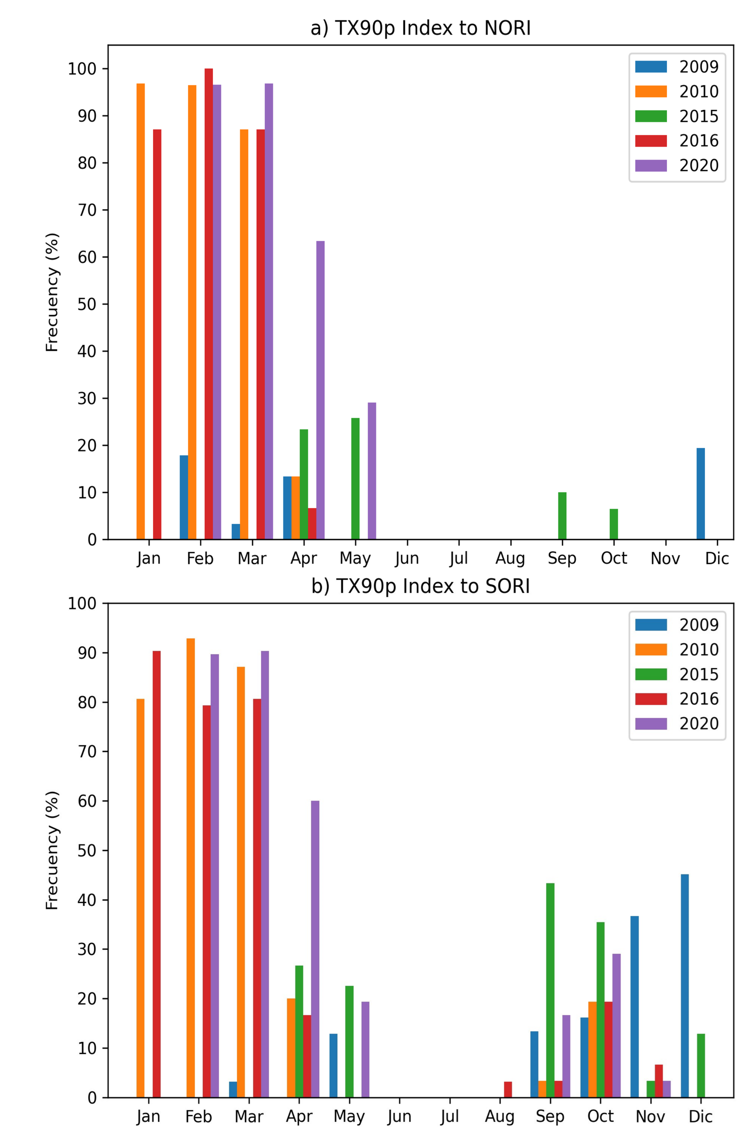


**Figure 5.** Frequency of hot extremes during each considered drought (colors) over (a) NORI and (b) SORI.

## 7. Fire activity

The occurrence of CDHE favor a larger number of fires in the Orinoco.

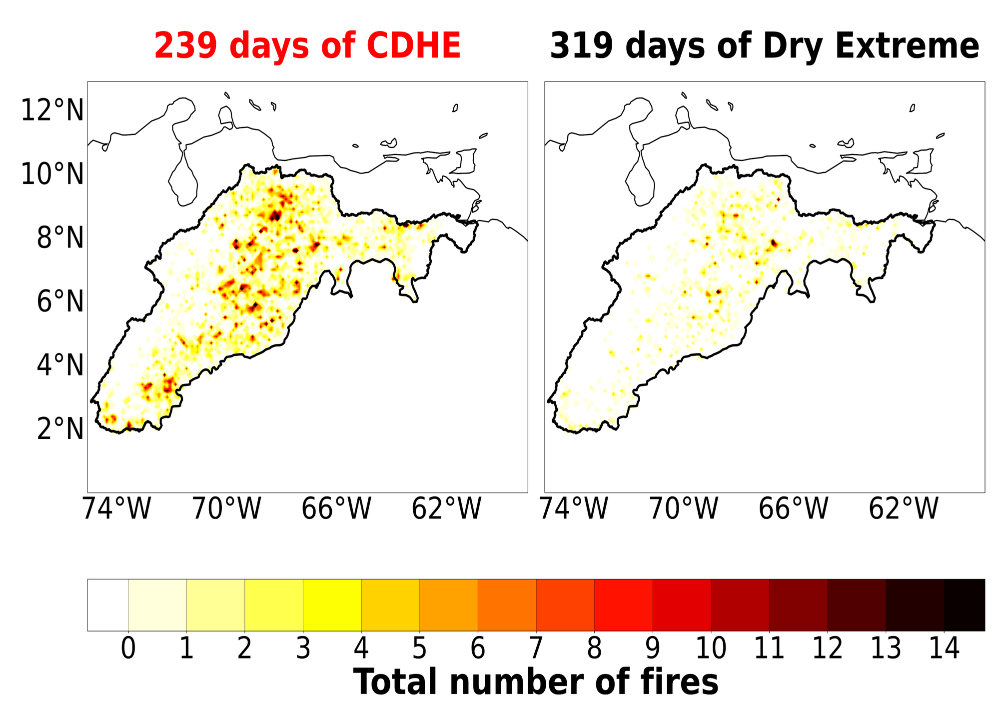


**Figure 6.** Total number of fires during CDHE and dry extremes. Data from MODIS.

## 8. Conclusions

- Greater precipitation deficit during CDHE.
- Weaker trade winds and OLLJ.
- Increase TCWV and 500hPa RH deficit.
- Stronger high-pressure system at 500hPa over the North Atlantic and the Caribbean.
- Increased occurrence of hot extremes during January, February, and March.
- Enhanced extreme temperatures (+3°C anomaly) during CDHE in NORI.
- CDHE favor fire activity in this region, increasing fire severity.

## Acknowledgments

This work is funded by Universidad de Antioquia through the grant CODI TEM2022-55390.