ENSO's Impact on Amazon Basin

Assessing the Relationship between Climate Anomalies and Regional Precipitation Variability

Tyrannosaurus_Tango_Dolce

Climatematch Academy

Credits: Adam Śmigielski

INTRODUCTION

ENSO’S IMPACT

Extreme Events

El Niño: A significant **increase in the frequency and intensity of extreme droughts is expected**, leading to a decrease in river levels and loss of wetlands (Phillips et al., 2009).

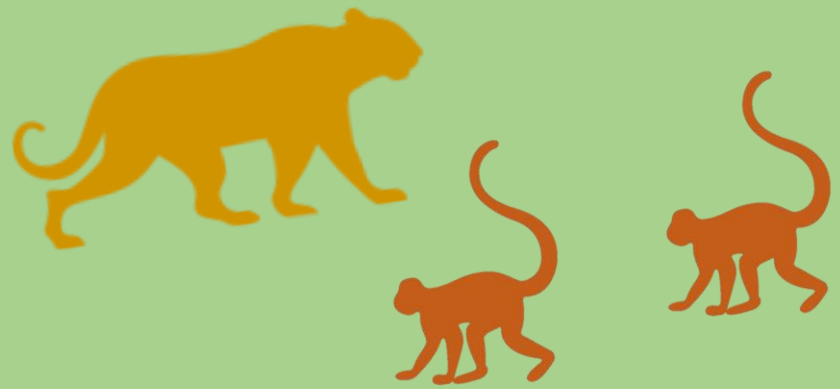
La Niña: Is usually associated with **increased precipitation in the Amazon basin**, which can result in flooding, increased river flows and expansion of wetland areas (Posada et al., 2009).

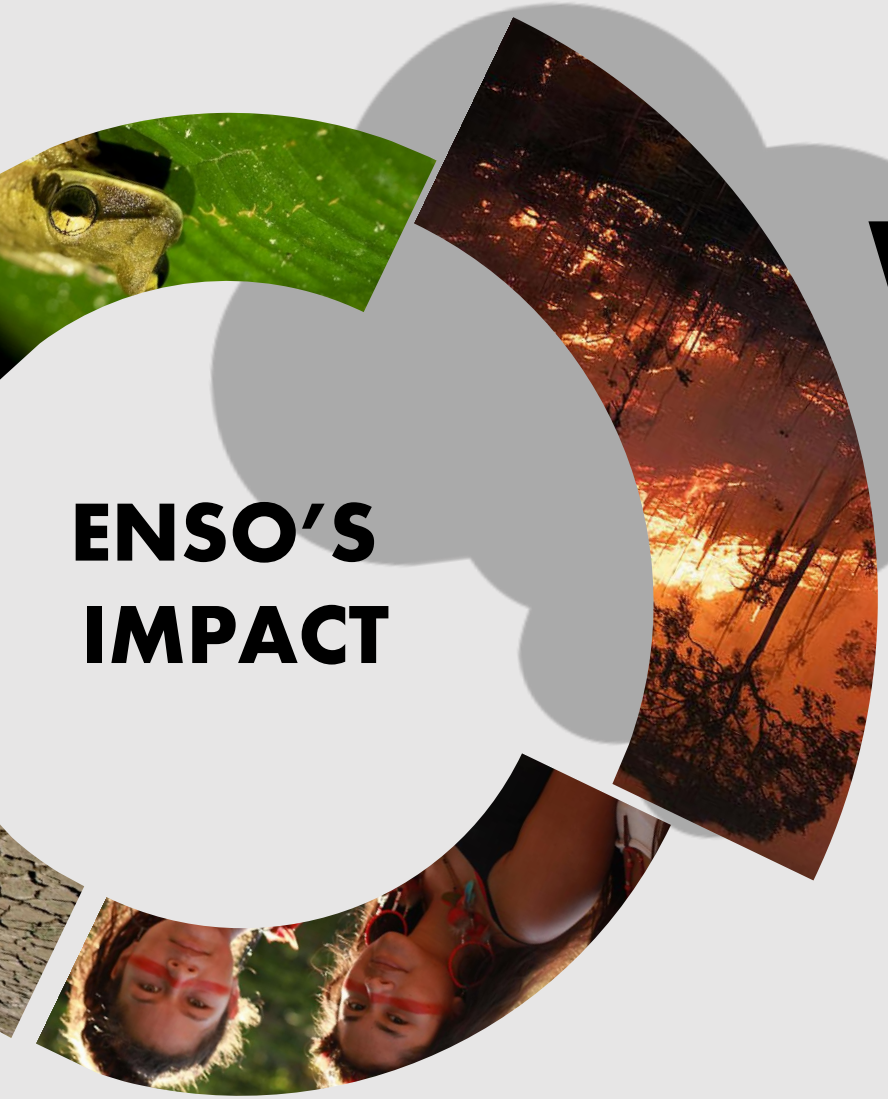
ENSO'S IMPACT

Alteration of biodiversity

El Niño: The Amazon basin is highly sensitive to **El Niño phenomenon**, as it can induce an increase in regional temperature, **which disturbs ecosystems and affects biodiversity** in the region (Malhi et al., 2010).

La Niña: **Fluctuations in rainfall patterns and water levels** can **affect the distribution and behavior of species** in the Amazon, especially birds and mammals (Zanuncio et al., 2010).





ENSO’S IMPACT

Wildland fires

El Niño: The intensification of forest fires and the reduction in the regeneration capacity of vegetation following the El Niño phenomenon are important factors affecting forest cover (Nepstad et al., 2004).

Impact on indigenous and local communities

El Niño & La Niña:

The ENSO's phenomenon affects indigenous communities in the Amazon basin through floods, droughts and changes in natural resources, impacting their food security, housing and traditional ways of life (Coe et al., 2013).

Area: Amazon Basin (South America)

Reference: BBC News Mundo, 2020.

Hypothesis:

Rainfall variability in the Amazon basin is correlated to the SST of Niño 3-4. It is expected that some regions are strongly correlated to the ENSO, whereas other regions have no correlation.

Knowledge gap:

Relate extreme events in the Amazon basin to the ENSO phenomenon for a series of previously defined sub-regions.

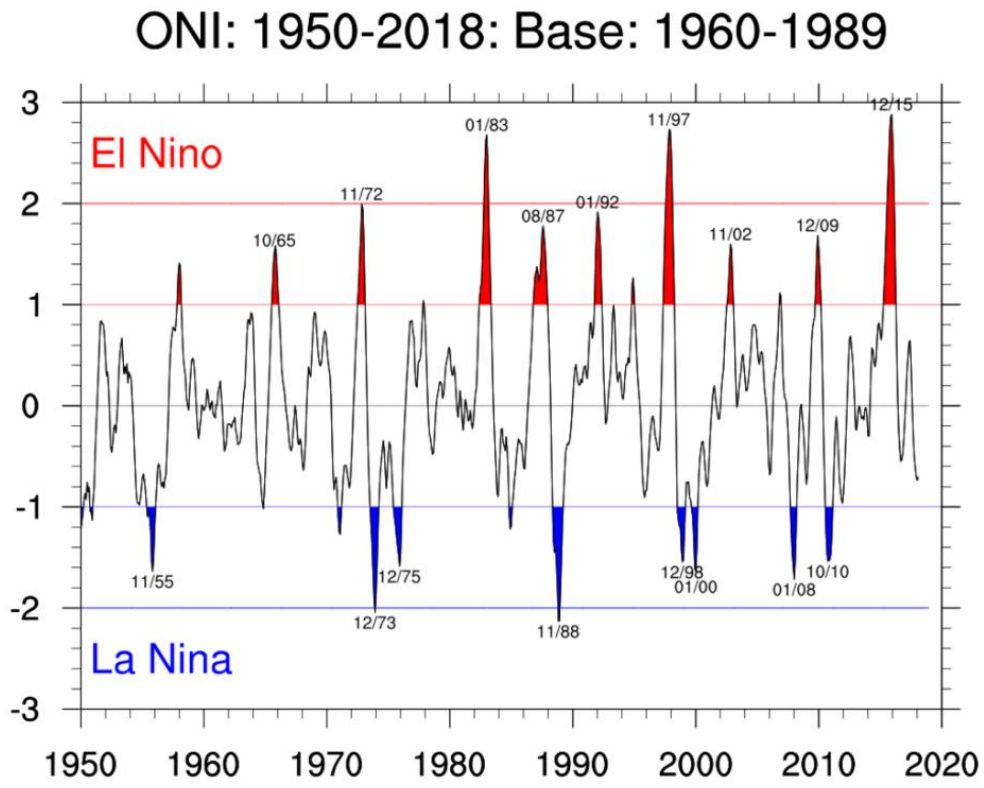
Our work:

An exploratory analysis of the data as a first approach to advance the hypothesis.

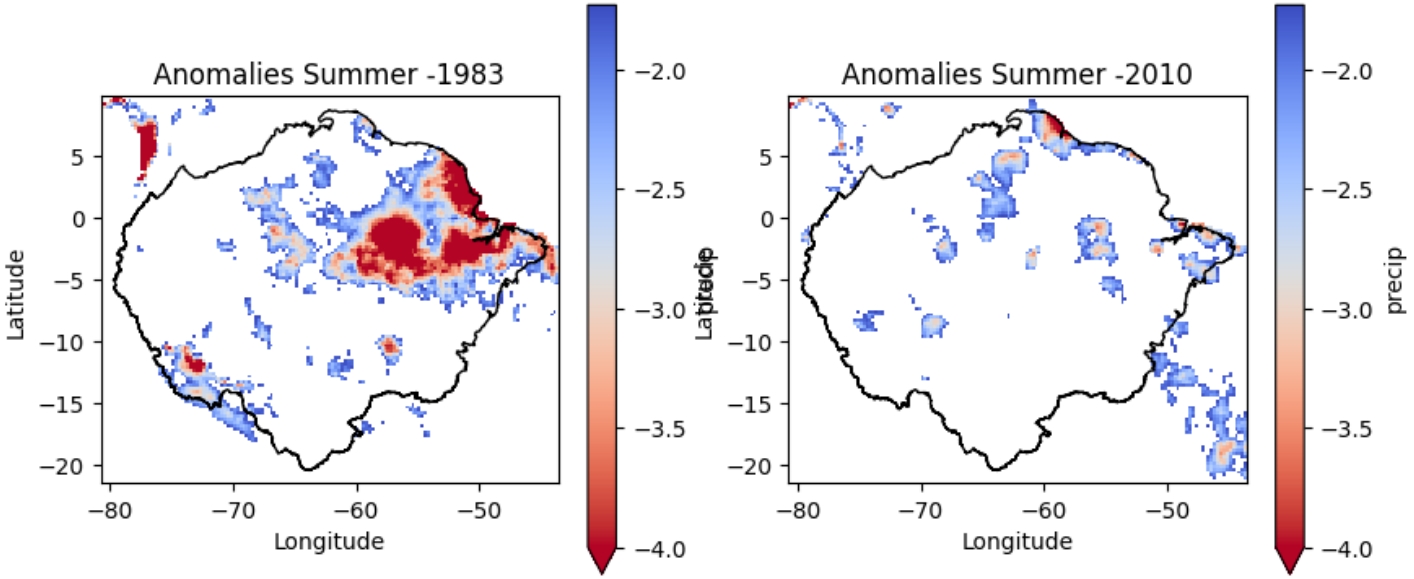
Reference:
Rickey Rogers 2005

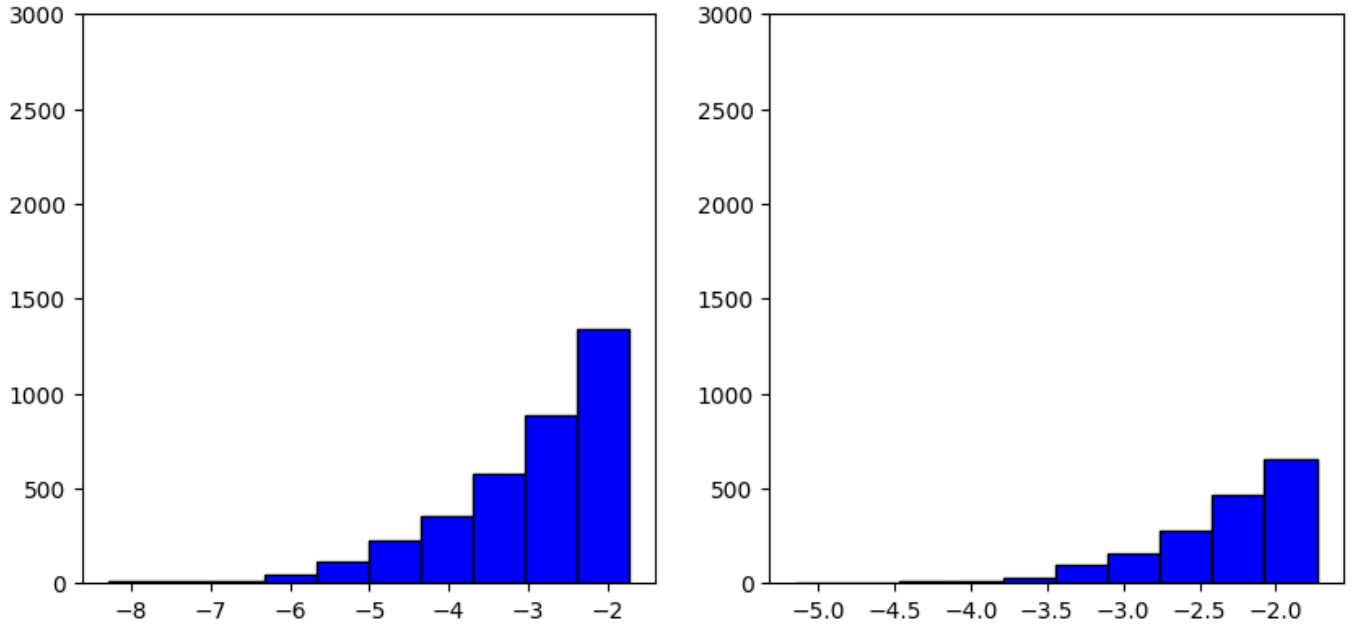
Methods:

- Which data
  1. CHIRPS Version 2.0 Global Daily 0.25°
  2. Amazon Basin shapefile
  3. ONI: 1950 - 2018; Base: 1960 - 1989 graph
- Methodology
  1. Determine the limits of the Amazon basin
  2. Cut CHIRPS database with set limits
  3. Calculate the precipitation anomaly based on the period 1981 - 2011
  4. Set the threshold for extreme events (10th percentile and 90th percentile)
  5. Events of extreme deficit or excess of precipitation were evaluated in the DJF season in El Niño years and La Niña years
  6. A masking was applied using this threshold



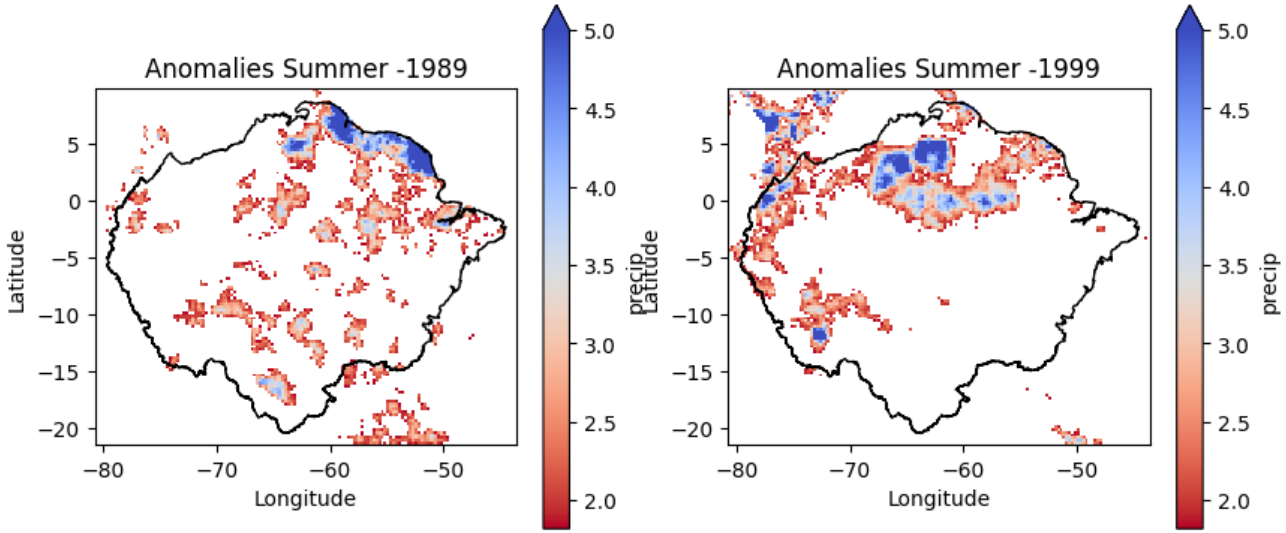
Reference: Pythia Foundations, 2023.

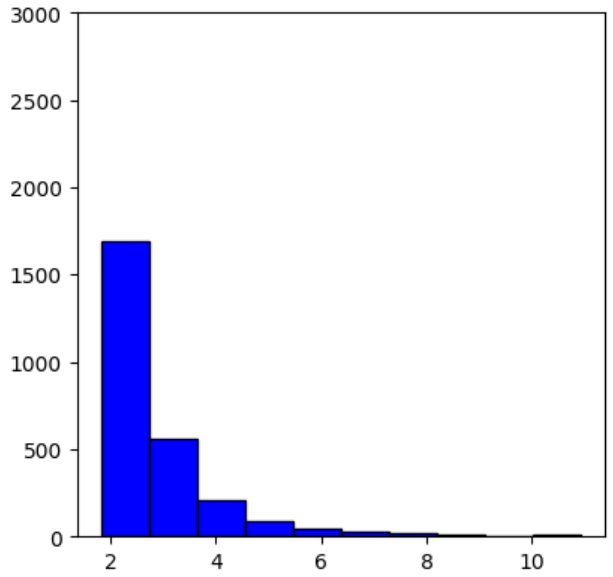


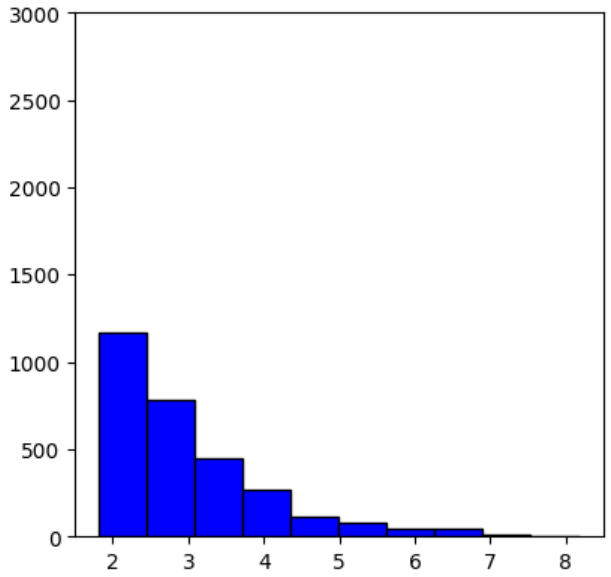


Results of El Niño years (1983 & 2010) analysis

Summer months: December, January and February







Results of La Niña years (1989 & 1999) analysis

Summer months: December, January and February

References:

- Phillips, O. L., et al. (2009). Drought sensitivity of the Amazon rainforest. Science, 323(5919), 1344-1347.
- Posada, J. M., et al. (2009). Hydrological extremes in the Amazon basin under present and future climate scenarios. Earth Interactions, 13(11), 1-31.
- Malhi, Y., et al. (2010). Climate change, deforestation, and the fate of the Amazon. Science, 319(5860), 169-172.
- Zanuncio, J. C., et al. (2010). Forest fragmentation and bird community dynamics: inference at regional scales in the Brazilian Atlantic Forest. Biota Neotropica, 10(3), 71-79.
- Nepstad, D., et al. (2004). Large-scale impoverishment of Amazonian forests by logging and fire. Nature, 398(6727), 505-508. Nepstad, D., et al. (2004). Large-scale impoverishment of Amazonian forests by logging and fire. Nature, 398(6727), 505-508.
- Coe, M. T., et al. (2013). Deforestation and climate feedbacks threaten the ecological integrity of south-southeastern Amazonia. Philosophical Transactions of the Royal Society B, 368(1619), 20120155.
- Rose, B. E. J., Kent, J., Tyle, K., Clyne, J., Banihirwe, A., Camron, D., May, R., Grover, M., Ford, R. R., Paul, K., Morley, J., Eroglu, O., Kailyn, L., & Zacharias, A. (2023). Pythia Foundations (Version v2023.05.01) https://doi.org/10.5281/zenodo.7884572