

The impact of different phases of El Niño-Southern Oscillation (ENSO) on the precipitation intensity in West Africa

Team: Fukuivenator_Rumba_Presto

Team members: Daria, Emmanuel, Joana, Ludovica, Obiageri



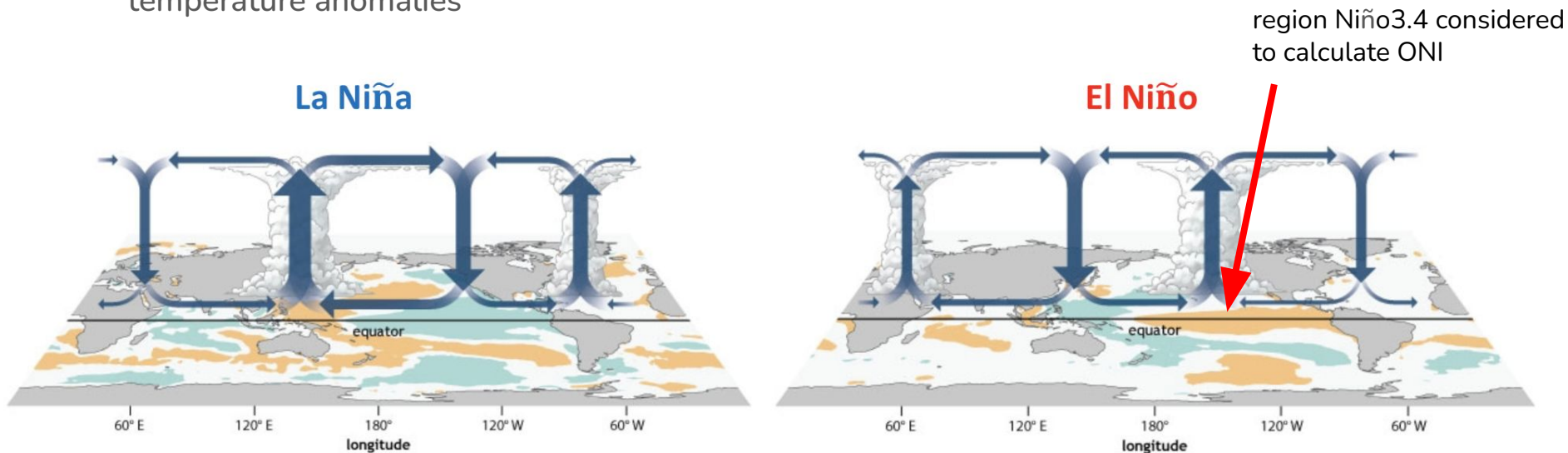
Climatematch
Academy

TAs: Marco Miani, Elégio Maúre

Let's talk about ENSO and its global impacts

[Speaker
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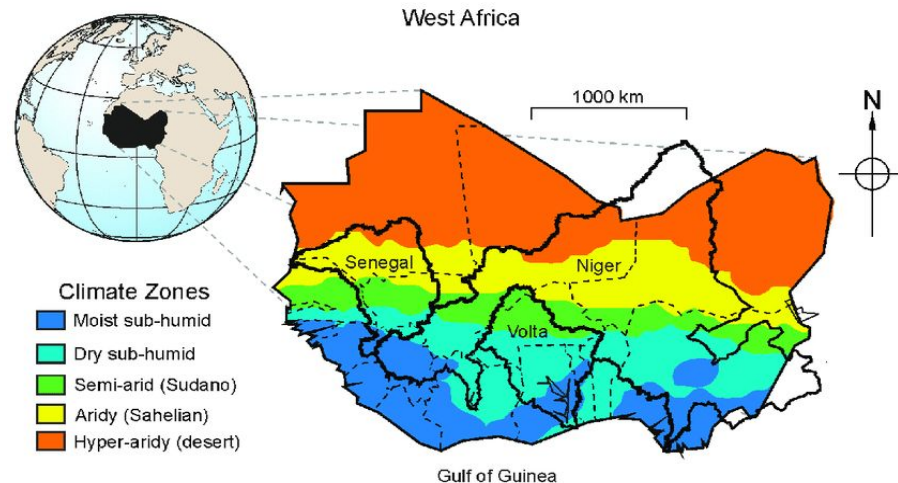
- Originates in the tropical Pacific but affects global climate patterns
- El Niño happens ~every 2-7 years, peak in Dec-Feb
- El Niño & La Niña cause flooding and drought in many parts of the world
- Oceanic Niño Index (ONI) indicates El Niño & La Niña phases by calculating sea surface temperature anomalies



West Africa at a glance and its increasing weather extremes...

[Speaker
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video]

- West African region - Lon: -15,20, Lat: 5,15
- Extensive coastline along the Atlantic Ocean
- Vulnerability to climate change
- Shifting patterns of rainfall and higher temperature —> more flooding in some areas, more drought episodes in others



HIGHLIGHTS OF EXTREME EVENT REPORTS IN SOME EL-NIÑO YEARS

[Speaker
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- **1997** - Two drought episodes over Niger and Mauritania leading to crop failure and famine
- **2016** - Five deadly flood events in Liberia, Mali, Nigeria, Niger and Côte d'Ivoire



(source : em.dat
database of natural disasters)

RESEARCH QUESTION & METHODS

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What is the relationship between the global Oceanic Niño Index (ONI) and precipitation events over West Africa?

DATA & METHODS

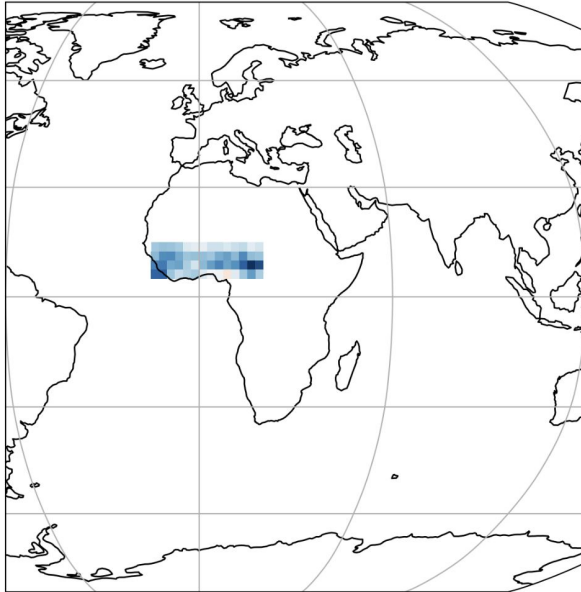
- Calculate ONI from CMIP (Coupled Model Intercomparison Project) dataset
- Correlate ONI with precipitation intensity in West Africa



PRECIPITATION PATTERNS IN WEST AFRICA

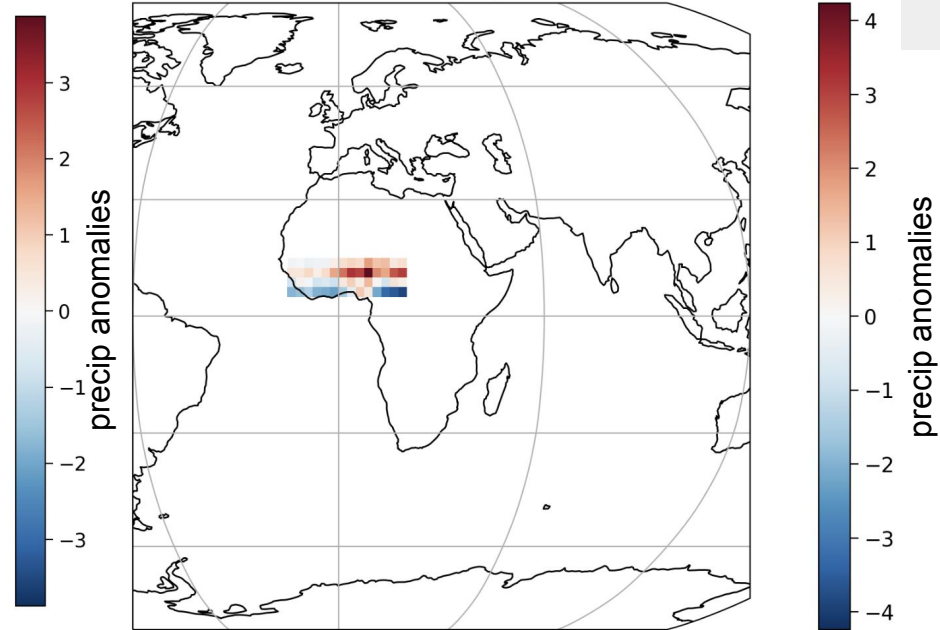
[Speaker
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time = 1997-07-01, month = 7



Drought in Niger and Mauritania

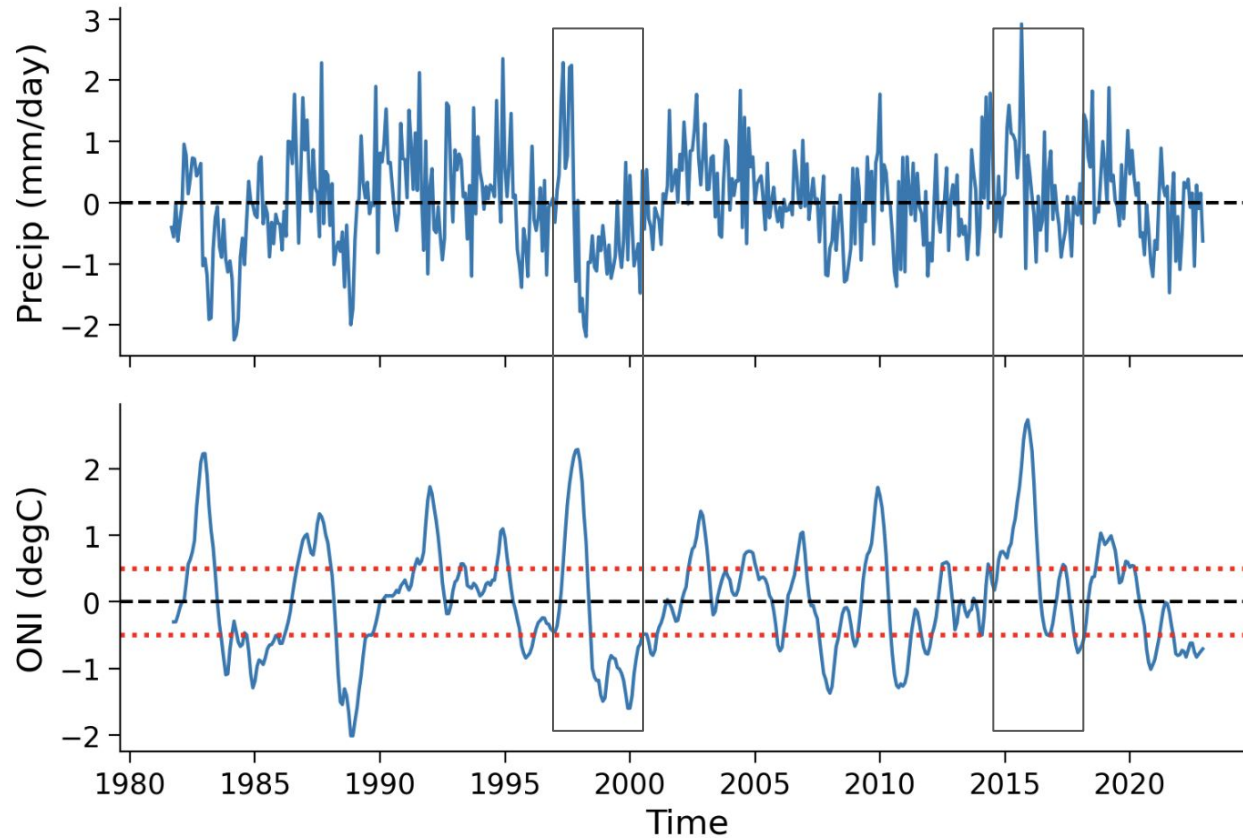
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Floods in Liberia, Mali, Nigeria, Niger and Côte d'Ivoire

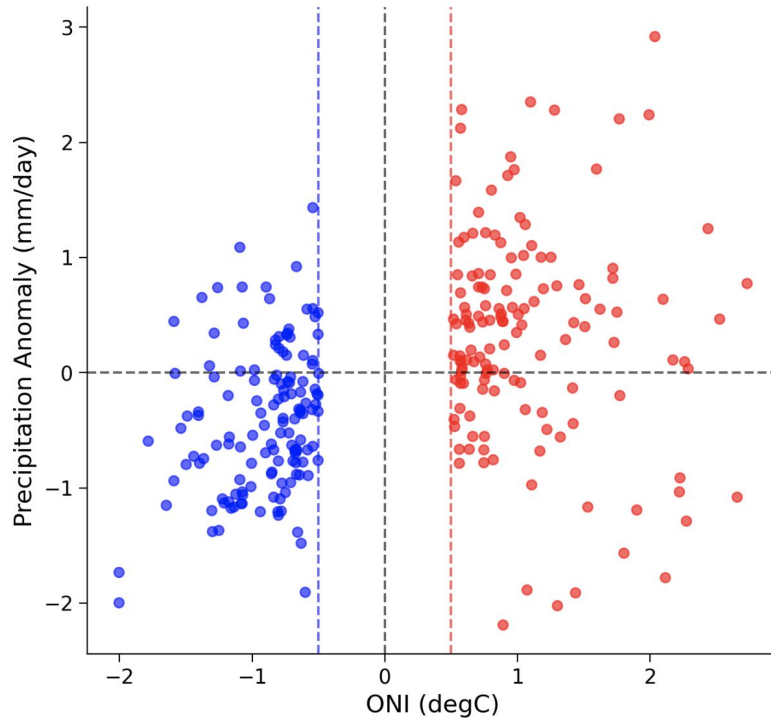
GPCP Precipitation Anomaly vs Oceanic Nino Index (ONI)

[Speaker
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video]



Precipitation Anomaly in West Africa during La Niña and El Niño phases from 1980-2022

[Speaker
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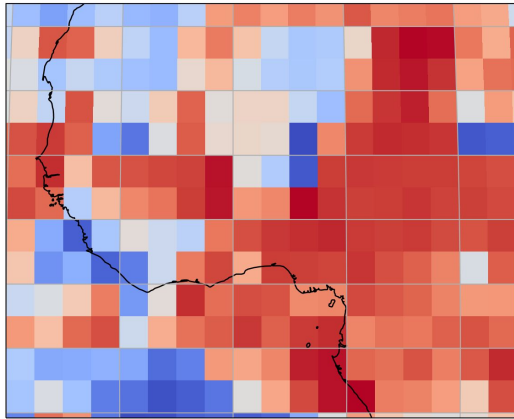


- Precipitation-El Niño correlation
 $r = -0.08$, $p = 0.3$ (n.s.)
- Precipitation-La Niña correlation
 $r = 0.26$, $p = 0.03$

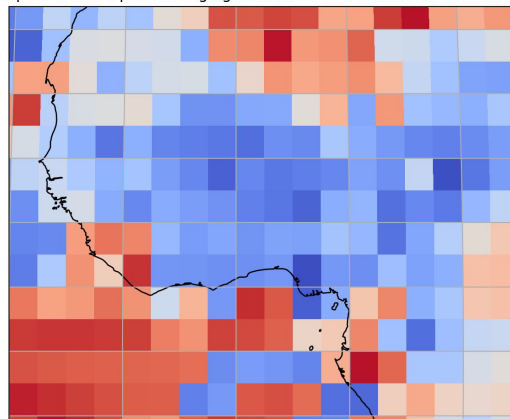
MAP OF ONI-PRECIP CORRELATIONS DURING EL NIÑO YEAR (1997)

[Speaker
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Dec 1996 - Apr 1997

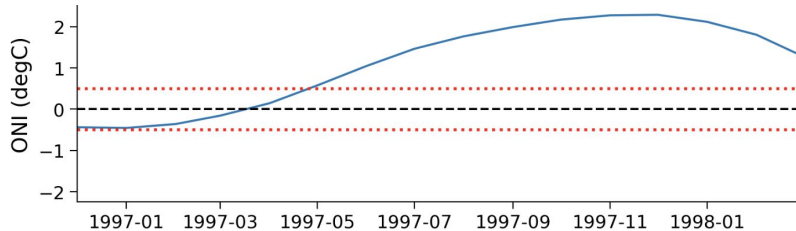
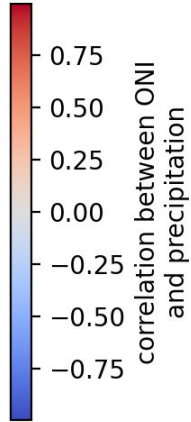
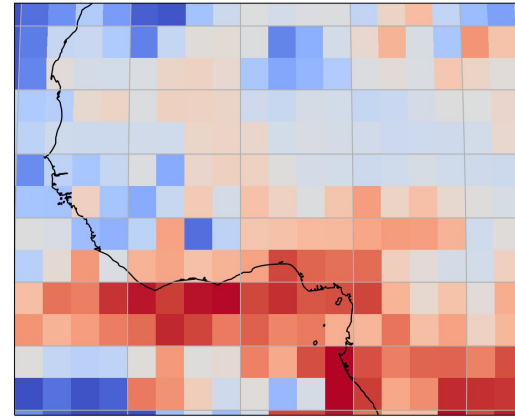


May 1997 - Sep 1997



drought period

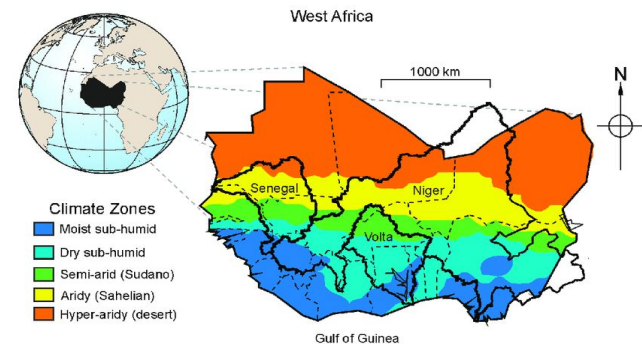
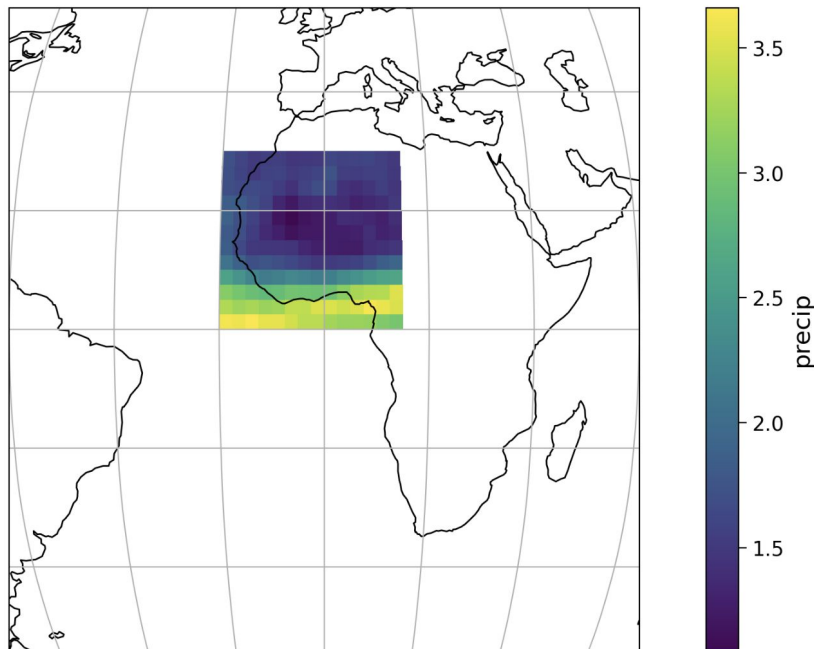
Oct 1997 - Feb 1998



Positive corr = El Niño associated with more rainfall
Negative corr = El Niño associated with more drought

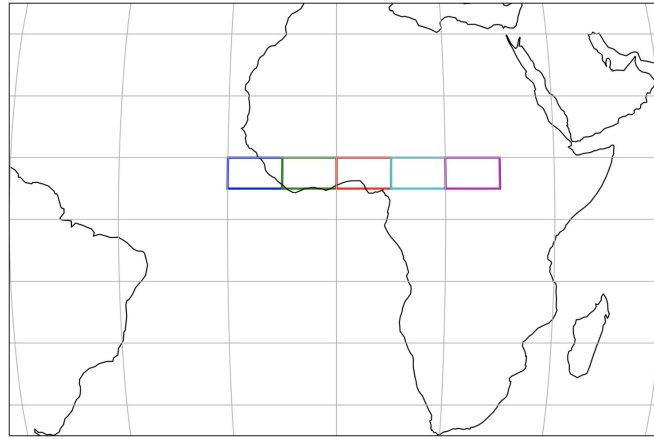
PRECIPITATION SPATIAL VARIABILITY WITHIN THE WEST AFRICA REGION FROM 1980-2022

[Speaker
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video]



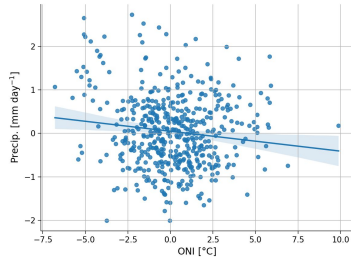
SOUTHERN (COASTAL) WEST AFRICA REGION

[Speaker
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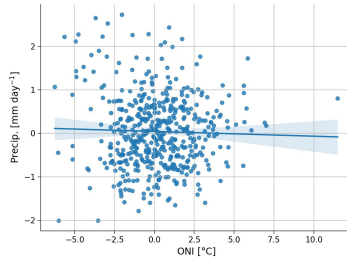


← Latitude: (5, 10)

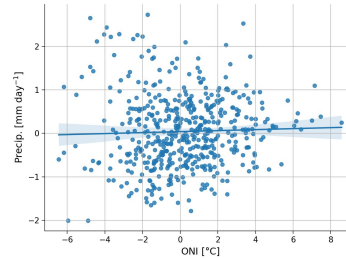
Longitude: [-20,-10]



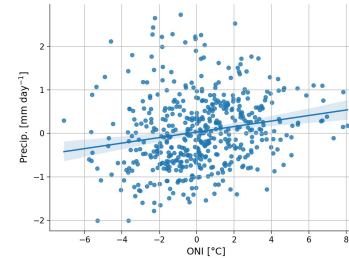
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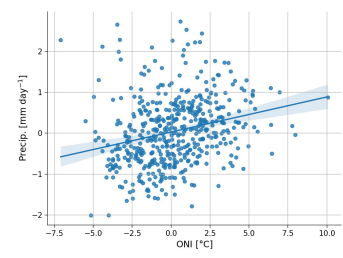
[0, 10]



[10, 20]



[20,30]



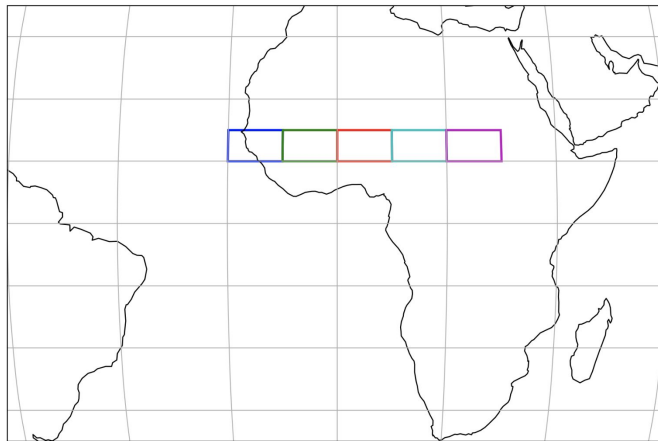
x-axis: ONI [°C]

y-axis: precip anomalies [mm day⁻¹]



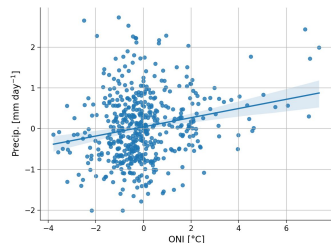
NORTHERN WEST AFRICA REGION

[Speaker
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video]

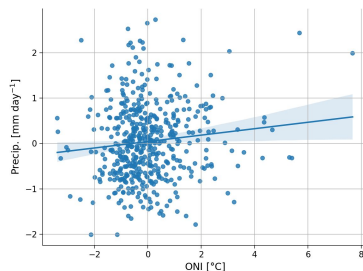


← Latitude: (10, 15)

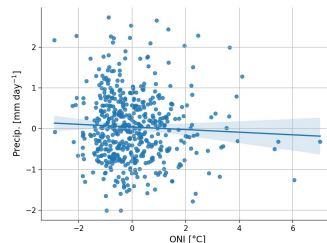
Longitude: [-20,-10]



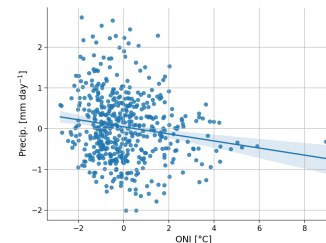
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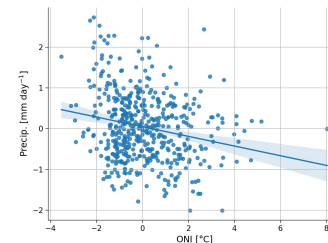
[0, 10]



[10, 20]



[20,30]



x-axis: ONI [°C]

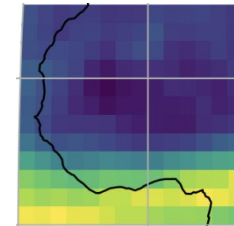
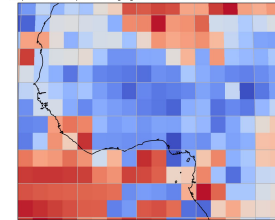
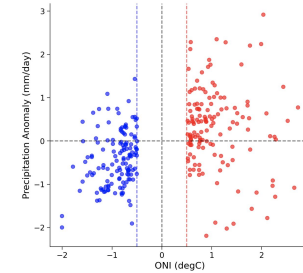
y-axis:precip anomalies [mm day⁻¹]



SUMMARY

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video]

- Precipitation in West Africa in the past 40 years positively correlates with La Niña phase of ENSO, but not El Niño
- During El Niño, spatial correlation maps provide insight into temporal dynamics of ENSO-Precipitation relationship
- The ENSO-Precipitation relationship is very different between Northern and Southern (Coastal) parts of West Africa

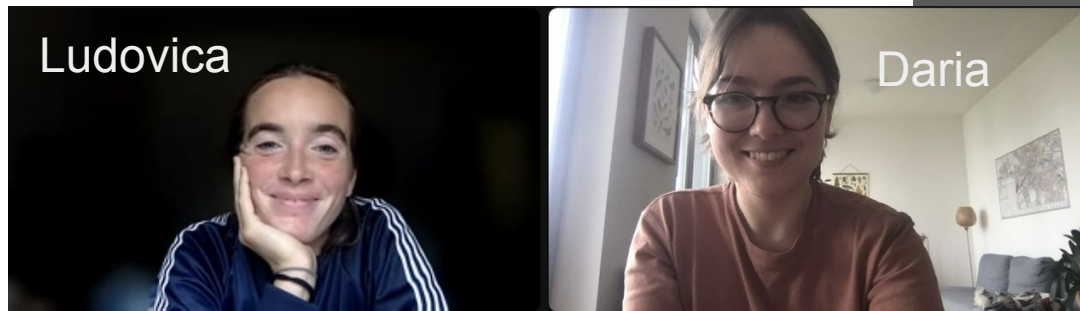


SIGNIFICANCE

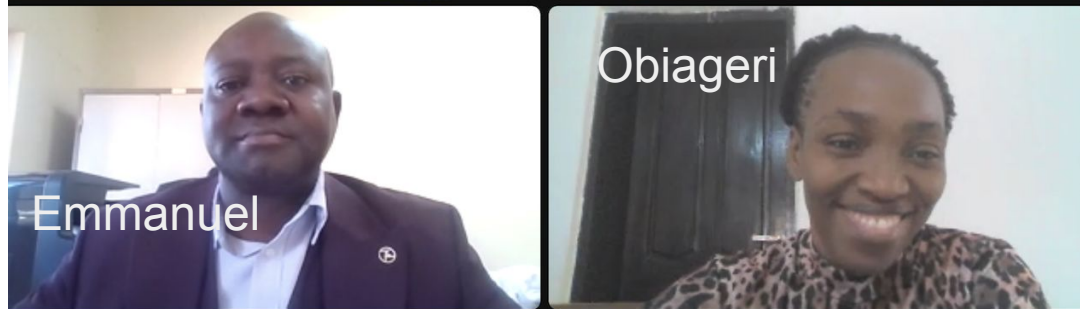
[Speaker
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video]

- Understanding the relationship between ONI and local precipitation is useful to improve forecasts and early warnings of extreme weather events
- This can help to save human lives, infrastructure, and inform decision-making





[Speaker
Zoom
video]



THANK YOU!!!

