[Speaker Zoom video]

Impact of El Niño events on rainfall, temperature, and vegetation in Indonesia

Protoceratops_Jitterbug_Vivace

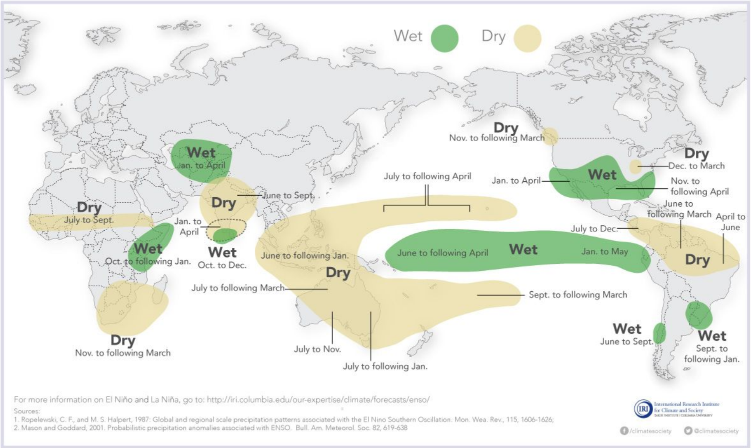
Climatematch Academy

Indonesia and El Niño

[Speaker Zoom video]

El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. Although they vary somewhat from one El Niño to the next, the strongest shifts remain fairly consistent in the regions and seasons shown on the map below.



FMT

Indonesia sees rising wildfire risk amid dry weather conditions

The number of 'hotspots' has doubled to 12,701 from 6,082 just a week earlier.

The high cost of an El Niño in 2023

BBC

El Niño starting in 2023 could cost the global economy as much as $3.4tn over the following five years. In the past, tropical countries such as Indonesia, suffered a 10% drop in GDP.

Govt warns of dengue rise from hotter weather as El Niño returns

The Jakarta Post

Still bold, fiercely independent

In 2022, the Health Ministry reported 143,000 dengue fever cases, with 1,236 deaths, concentrated in West Java, Central Java, Bali, and East Java. As of May 2023, 35,694 cases and 270 deaths were reported nationwide. The imminent El Niño could exacerbate the situation, increasing mosquito bites and dengue transmission risk due to rising temperatures above 30 degrees Celsius.

Hypothesis

[Speaker Zoom video]

Based on historical records, El Niño events, as measured by the ONI index, will be associated with the following in Indonesia, compared to other times:

- ➔ Reduced rainfall
- ➔ Elevated temperatures
- ➔ Lower NDVI values

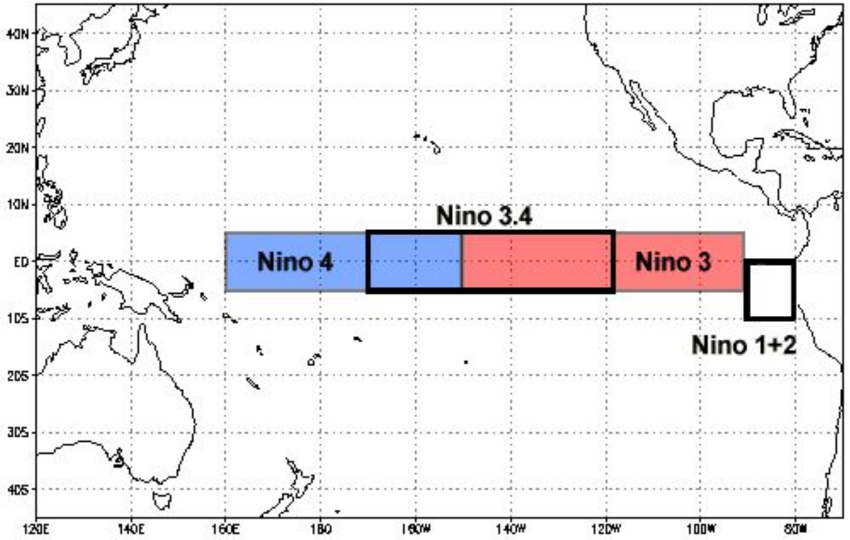
Datasets & Methods

[Speaker Zoom video]

- Sea Surface Temperature Anomaly
- (OISST SST, NOAA)
- Air Temperature anomaly (GISS)
- Precipitation (GPCP)
- NDVI Index (MODIS-MOD13C2)

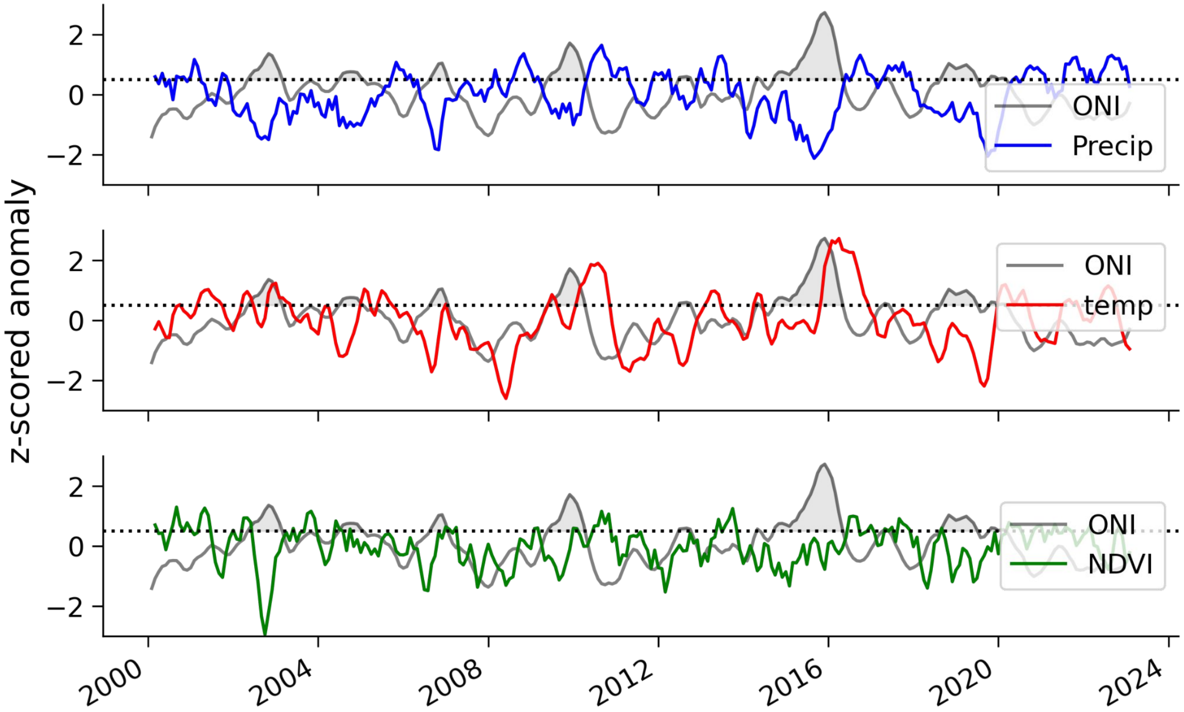
Time range: 2000-2023
Seasons: Dec-Feb & June-Aug

- Anomaly calculation
- ENSO phases comparison
- Compositing data (rainfall, temp, NDVI)



Time series analysis for Precipitation, Temperature and NDVI anomalies

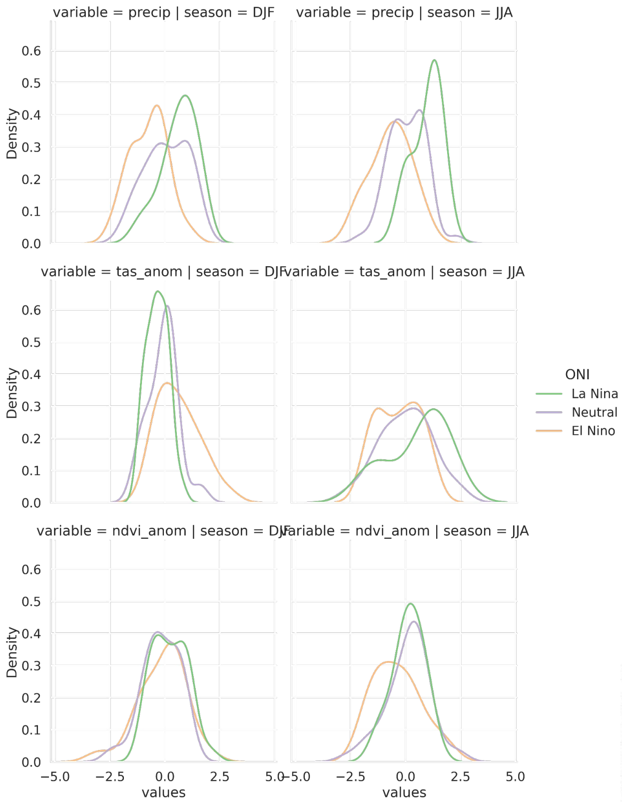
[Speaker Zoom video]

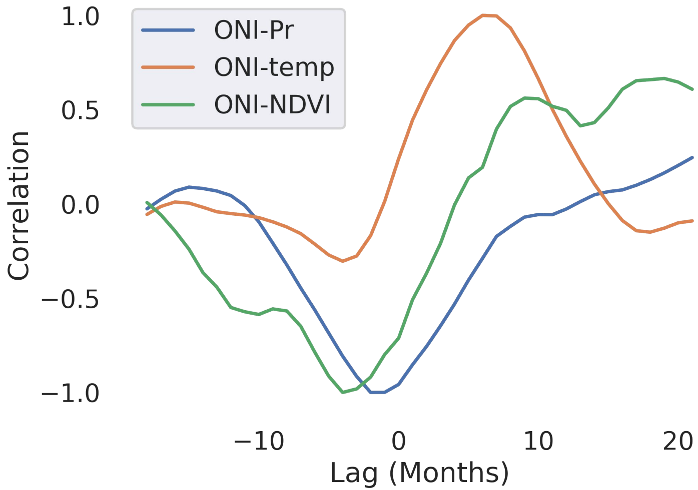


- Periods with positive values of ONI (>0.5) shows **decrease in precipitation**.
- **Air temperature anomaly increases** after ONI >0.5.
- **NDVI showed a mixed response** to ONI (>0.5), with greening decreasing more significantly at first ONI (>0.5) event compared to other events.

Comparison between ENSO phases

[Speaker Zoom video]






```
Kruskal-Wallis Analysis of Variance
precip,        season=DJF     stat=21.491    p_val=0.000
tas_anom,      season=DJF     stat=14.003    p_val=0.001
ndvi_anom,     season=DJF     stat=2.815     p_val=0.245
precip,        season=JJA     stat=15.293    p_val=0.000
tas_anom,      season=JJA     stat=3.256     p_val=0.196
ndvi_anom,     season=JJA     stat=3.850     p_val=0.146
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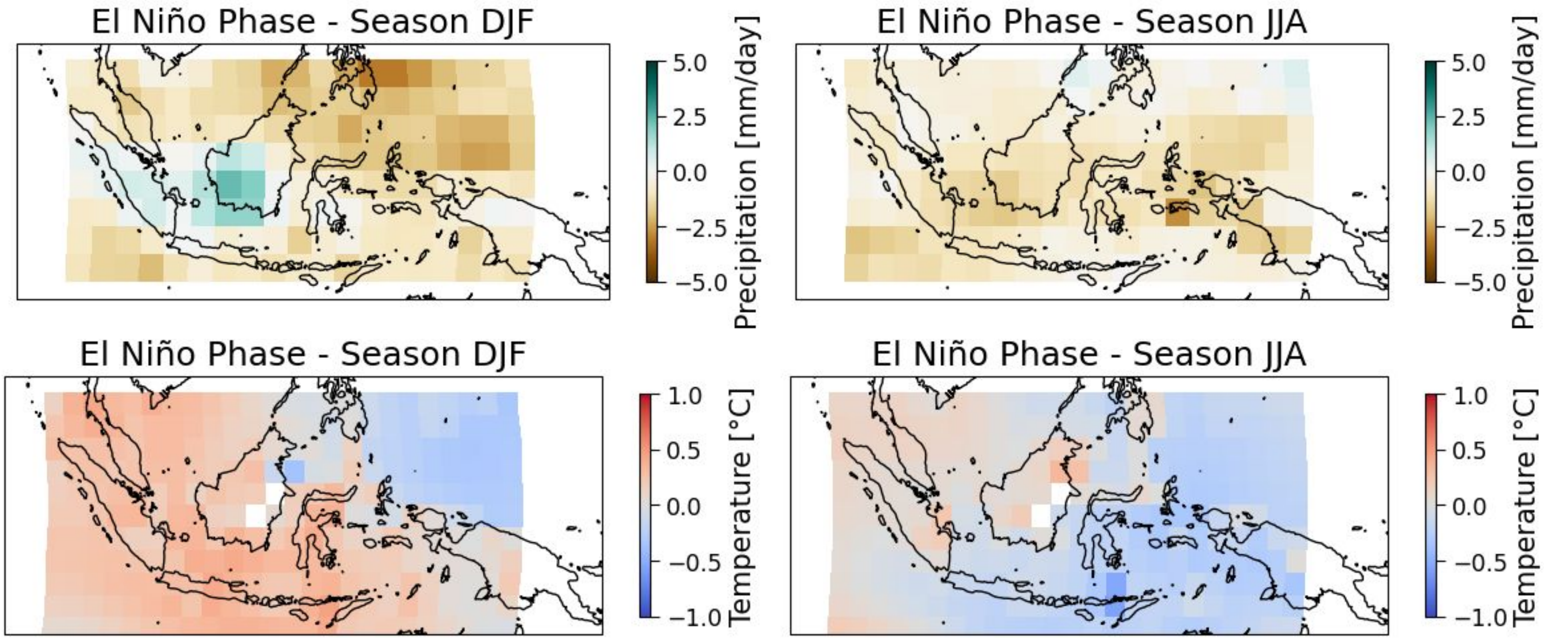
Composite Analysis - Precipitation and Temperature Anomalies

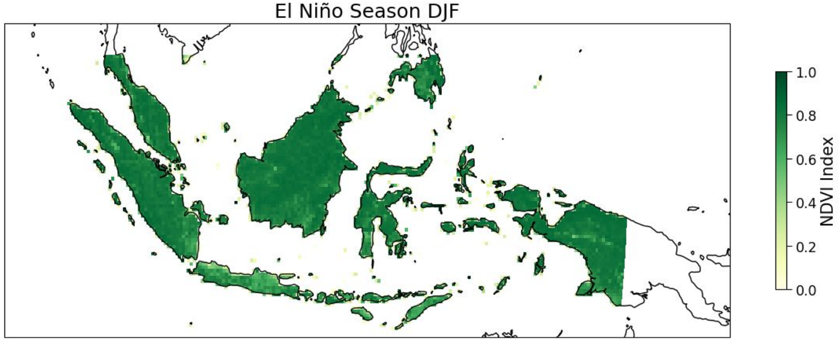
[Speaker Zoom video]

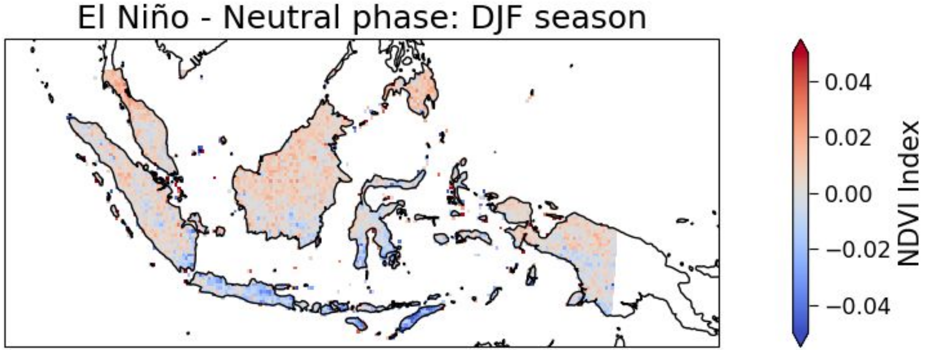
El Niño also causes disruptions to the rainy season in Indonesia by changing the Inter-Tropical Convergence Zone (ITCZ).

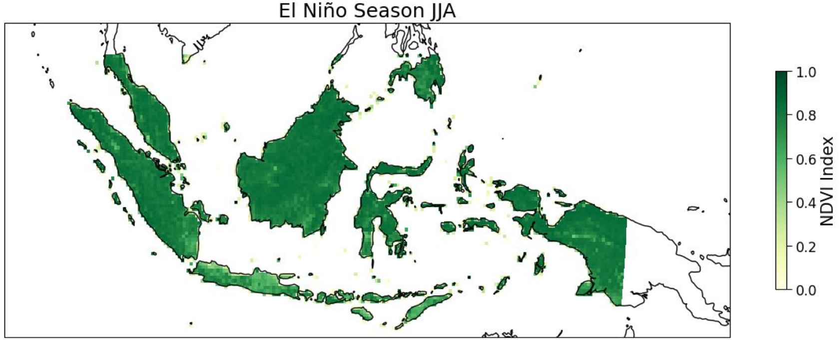


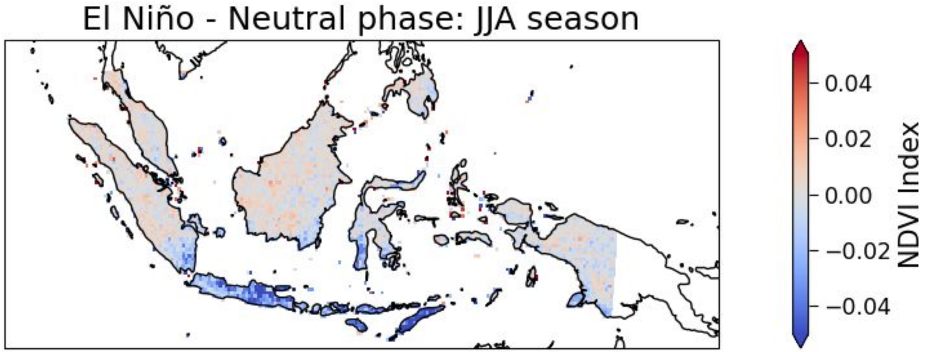
Composite Analysis - NDVI

[Speaker Zoom video]









Conclusions

[Speaker Zoom video]

We find that El Niño events are associated with:

- ❏ *Reduced* rainfall
- ❏ *Elevated* temperatures
- ❏ *Mixed conclusion* on NDVI values

Effect of El Niño on Indonesia

[Speaker Zoom video]

Due to the effects of El Niño, Indonesia has suffered from various damages, not just in terms of the environment but also in terms of human activities.

1. Ecosystem Impacted
2. Health Issues
3. Economic Issues

Questions?

[Speaker Zoom video]

[Speaker Zoom video]

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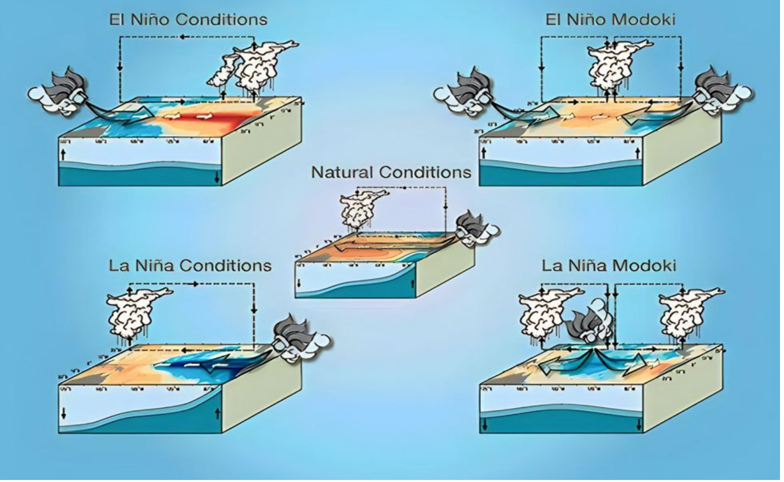

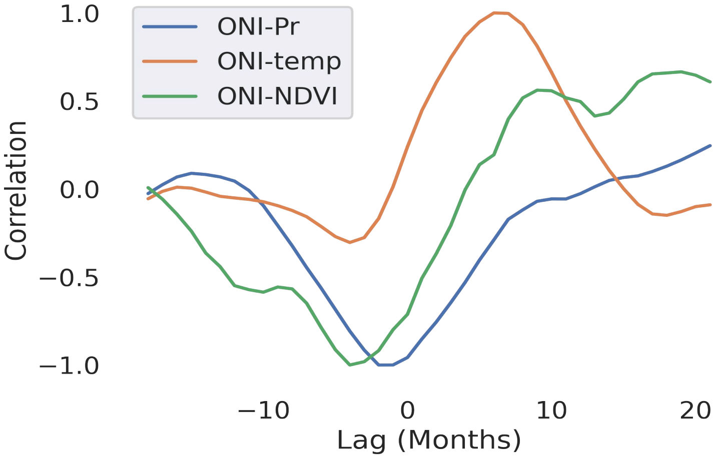

[Speaker Zoom video]

ENSO Modoki events, which are distinct from conventional El Niño events, have been found to significantly impact temperature and precipitation patterns in Indonesia (Ashok et al., 2007)

The Pacific-East Asian teleconnection, which is a large-scale atmospheric circulation pattern, plays a role in transmitting the impacts of El Niño Modoki to Indonesia. The impacts of El Niño Modoki on precipitation and temperature can be observed with a time lag. causing wet or dry events conditions (Wang et al., 2000).

El Niño 3.4 region and its impact on weather conditions in Indonesia can vary, but it generally ranges from a few weeks to a few months. The early signals of El Niño's influence on Indonesia's weather, such as shifts in rainfall patterns or higher temperatures, may start to be observed a few weeks after the initial warming. However, significant and widespread impacts on Indonesia's weather and climate, such as droughts or heavy rainfall, may take several months to fully develop (Delage et al., 2020)

[Speaker Zoom video]

Mean of each variable aligned to ONI crossing 0.5 from below (ONI-triggered average)