Temporal Analysis of Climate Variables in Atlanta and Niño-3.4 Region: Implications for Trends and Correlations

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Research Question 1:
What is the trend in monthly-averaged reanalysis data for 2m temperature, total precipitation for Atlanta, and sea surface temperature in the Niño-3.4 region from 1993 to 2023?

Research Question 2:
Does the correlation between 2m temperature and total precipitation in Atlanta exist across different months of the year?

Research Question 3:
Is there a significant relationship between 2m temperature and precipitation in Atlanta and sea surface temperature (SST) anomalies in the Niño-3.4 region during El Niño or La Niña events?

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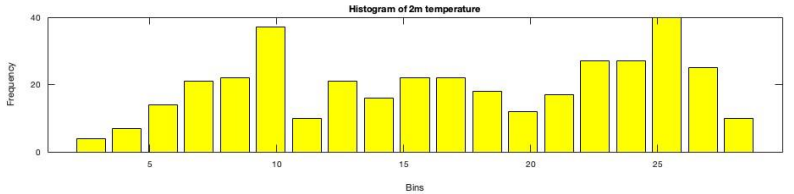
Data

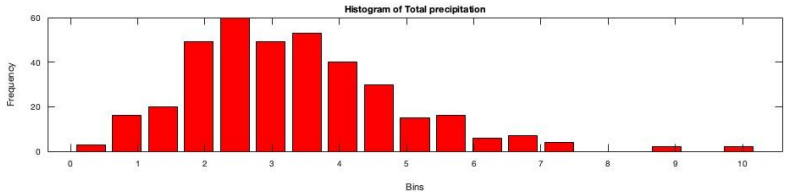
ERA5 (Reanalysis data)
It offers data starting from 1940

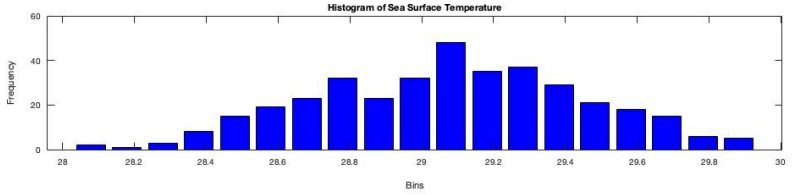
Regions: % North 33.75°, West -84.38°, South 33.74°, East -84.37° (For Atlanta) and 3.4 region

(The dataset can be accessed at the following link: https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels-monthly-means?tab=overview).

DATA DESCRIPTION	
Data type	Gridded
Projection	Regular latitude-longitude grid
Horizontal coverage	Global
Horizontal resolution	Reanalysis: 0.25° x 0.25° (atmosphere), 0.5° x 0.5° (ocean waves) Mean, spread and members: 0.5° x 0.5° (atmosphere), 1° x 1° (ocean waves)
Temporal coverage	1940 to present
Temporal resolution	Monthly







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Methods

Trend Analysis

- Trends calculated for each variable
- Slope uncertainties calculated by the bootstrap method

Correlation Analysis

- A monthly lag 0 correlation was calculated
- Correlation uncertainties calculated by the bootstrap method

Time Series Analysis

- Data was detrended
- Periodograms were plotted and analyzed
- Cross spectral analysis

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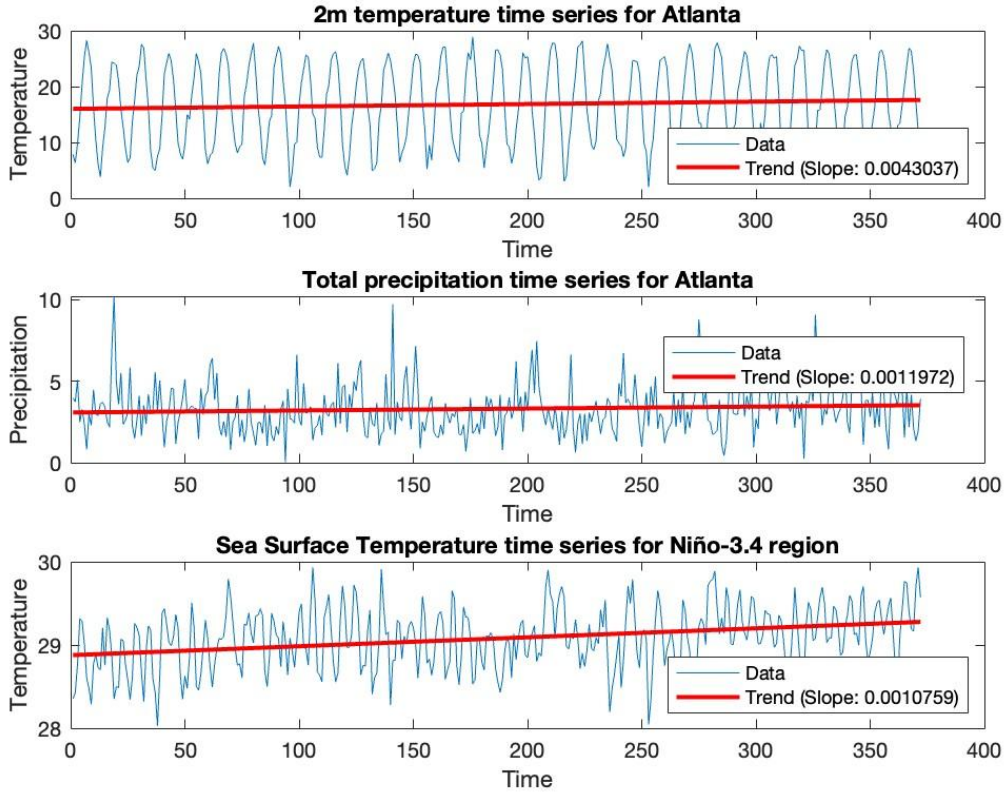
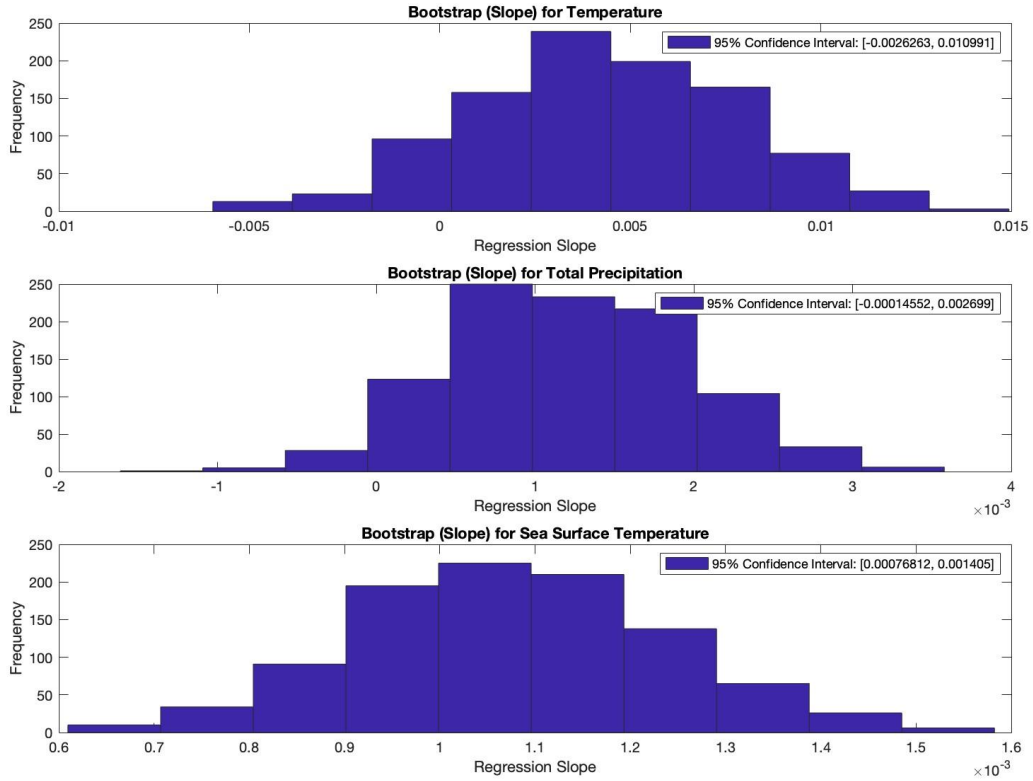
Results

- **Trend Analysis**

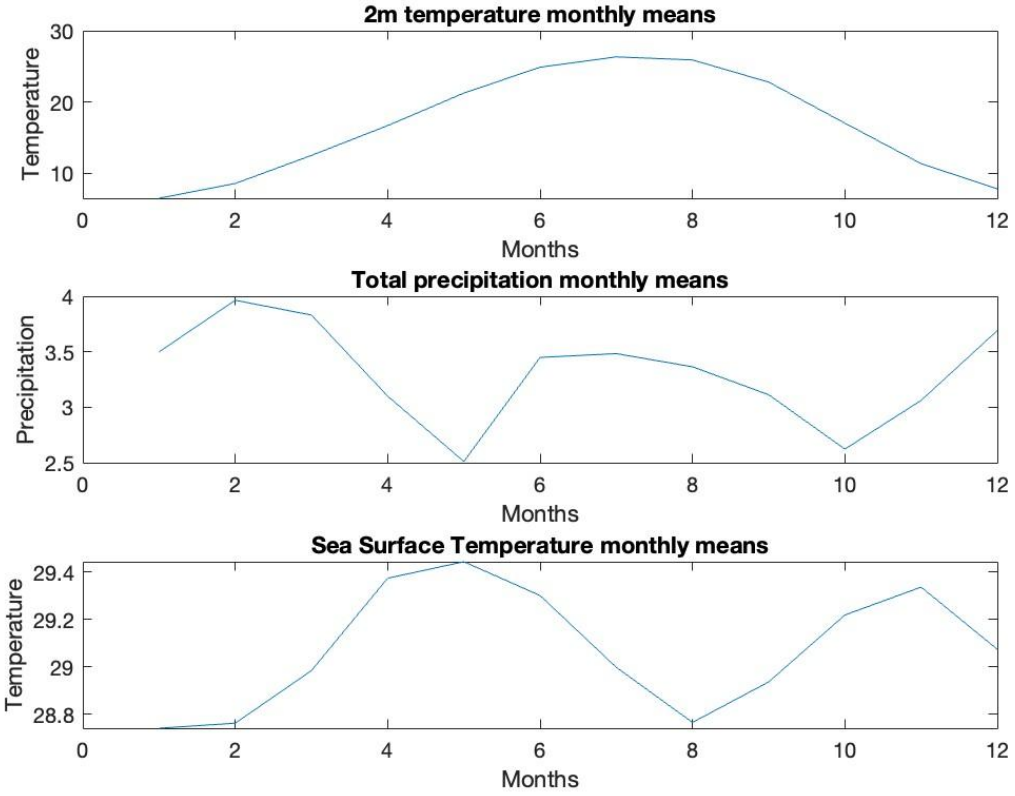


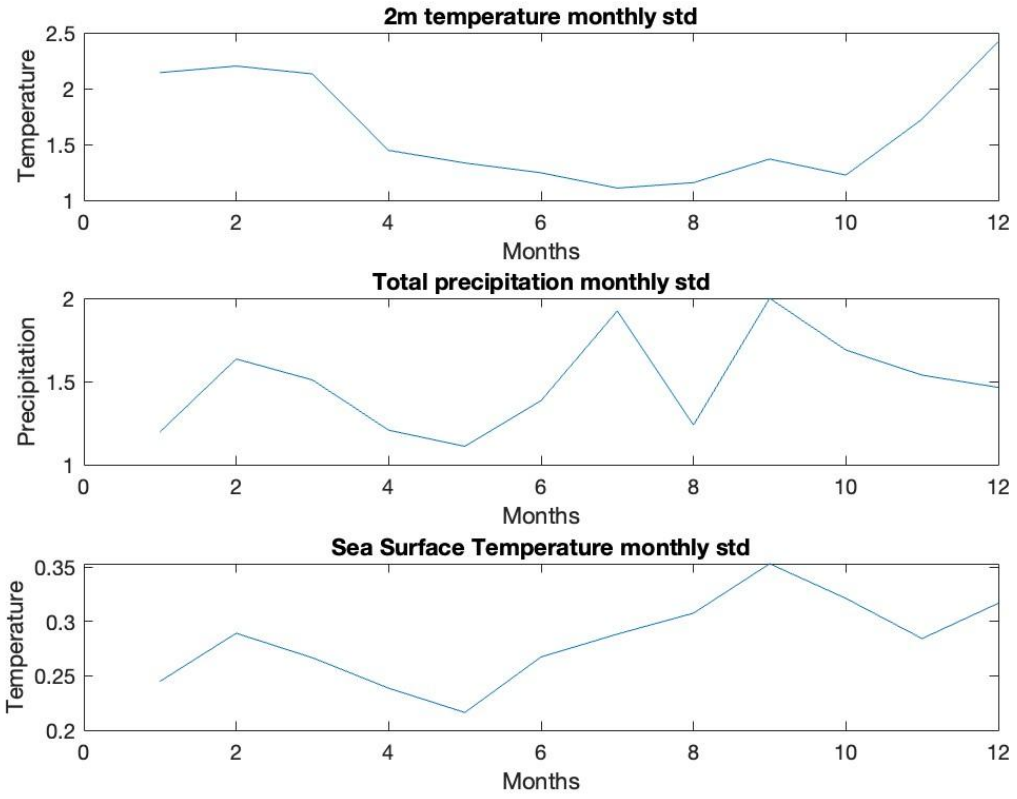
- **Bootstrap of Trends**



Results

- **Correlation Analysis**





- Monthly marginal distributions are different.
- It must be modeled with different monthly distributions.

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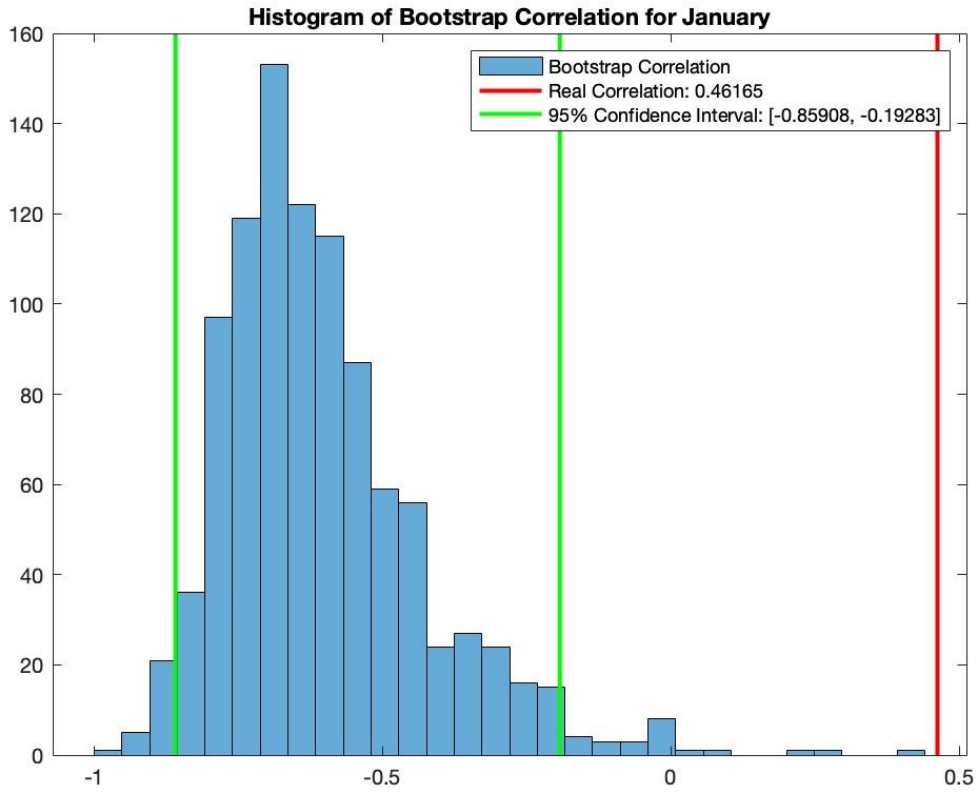
Results

- **Correlation Analysis**
- A significant correlation was found between temperature and total precipitation for January, June, July, and September.
- After conducting a bootstrapping analysis, it was observed that the correlation for January and July falls outside the confidence interval. However, for June and September bootstraps, the correlation was still reliable.



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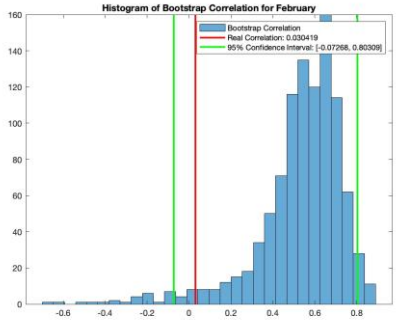
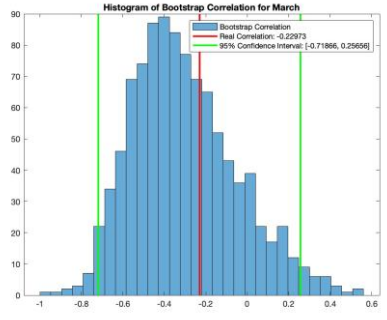
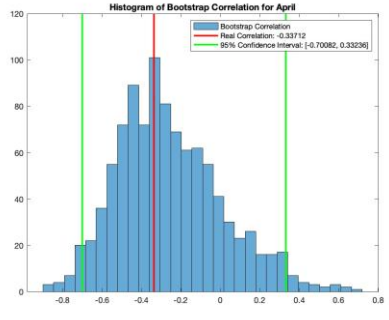
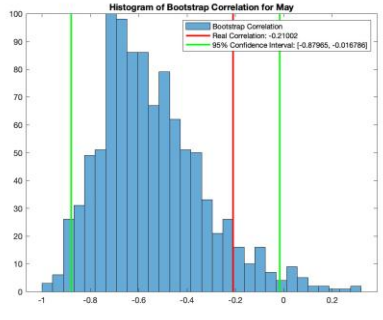
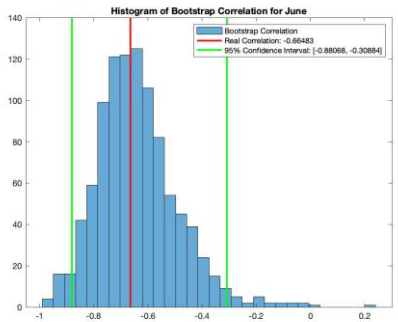
Results

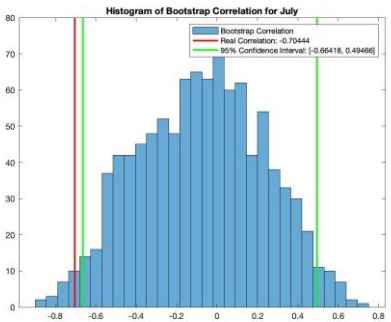


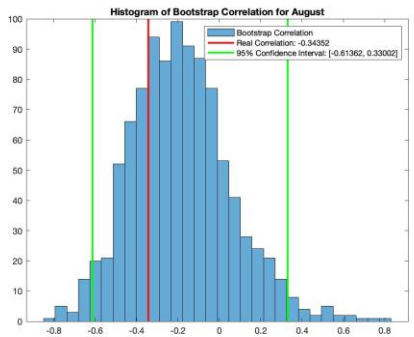


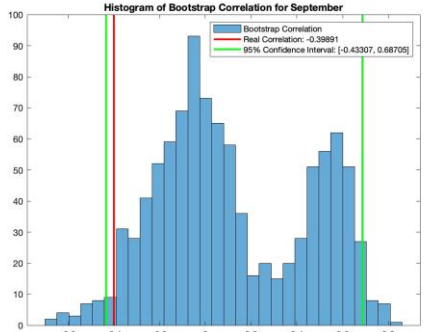


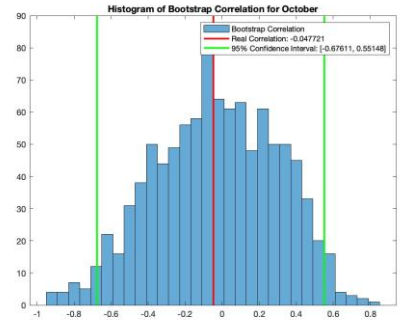


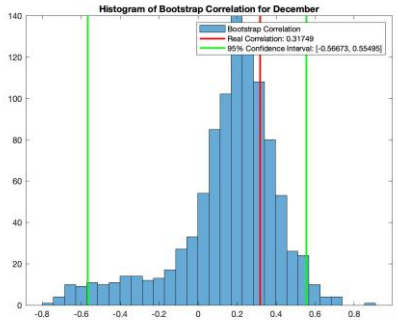












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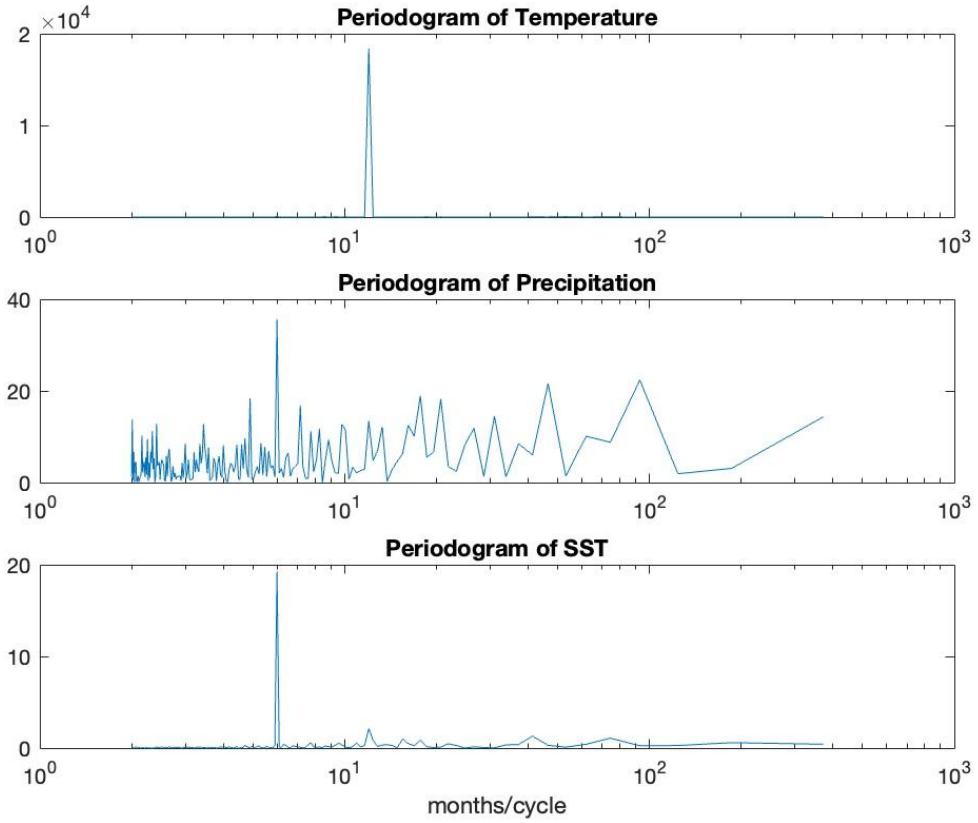
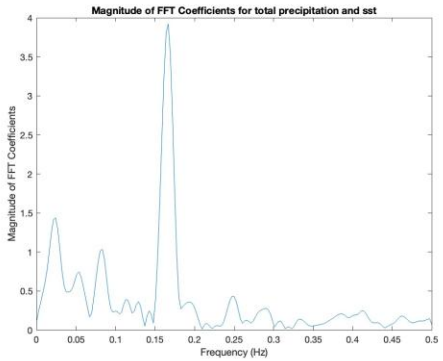
Time Series Analysis

- Periodograms

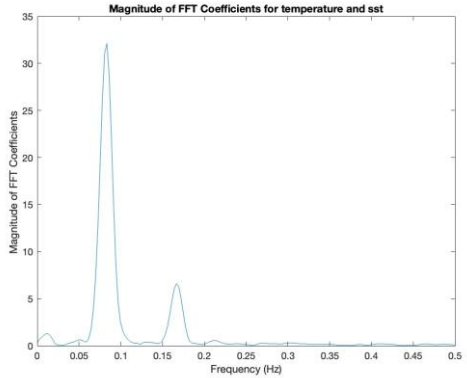


Time Series Analysis

- Cross spectral analysis for total precipitation and sea surface temperature



- Cross spectral analysis for temperature and sea surface temperature



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THANK YOU!

QUESTIONS?

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