

Global
hackathon-Hamburg node

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Motivation

- ✓ Derive surface wind climatology using kilometer-scale climate model simulations over global and regional domains.
- ✓ Quantify global dust uplift potential based on surface wind characteristics.
- ✓ Investigate the diurnal cycle of winds in key source regions.
- ✓ Evaluate model performance through comparisons with observational data, reanalysis products, and CMIP simulations.

ERA 5 global and regional wind speed distribution patterns (1994-2024)

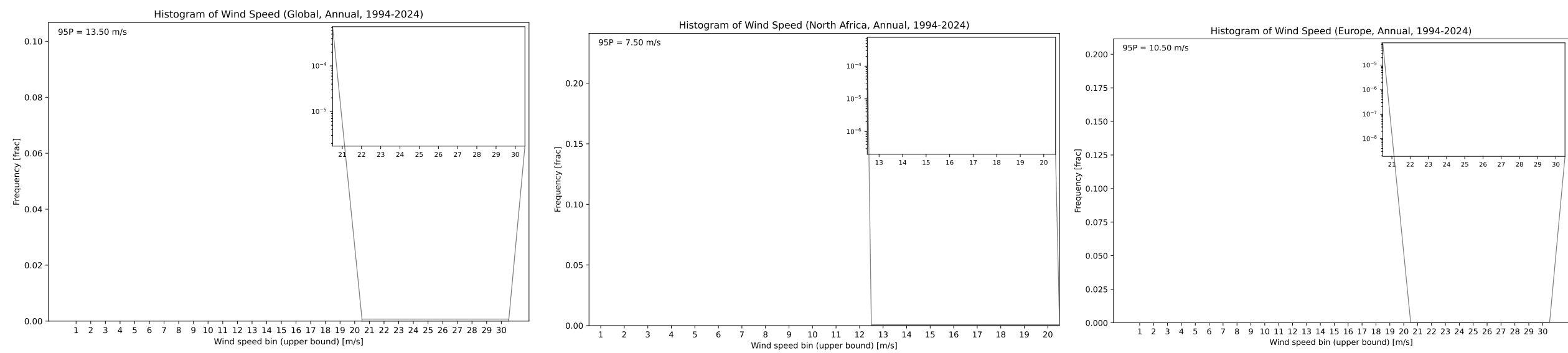


Figure1 : shows the annual distribution of 10-meter hourly wind speed based on ERA5 reanalysis data from 1994 to 2024. The analysis covers a spatial domain that includes global, Europe and North Africa. The histogram presents the relative frequency of wind speed occurrences, where wind speeds have been grouped into bins defined by their upper bounds. The distributions exhibit a strong peak at moderate wind speeds and a rapid decrease in frequency at higher wind speeds. The inset plot highlights the tail of the distribution using a logarithmic scale to better visualize the low-frequency occurrences of high wind speeds. The 95th percentile of the original distribution is indicated in the main plot, providing a threshold for extreme wind events.

Dust uplift potential over North Africa (1994-2024)

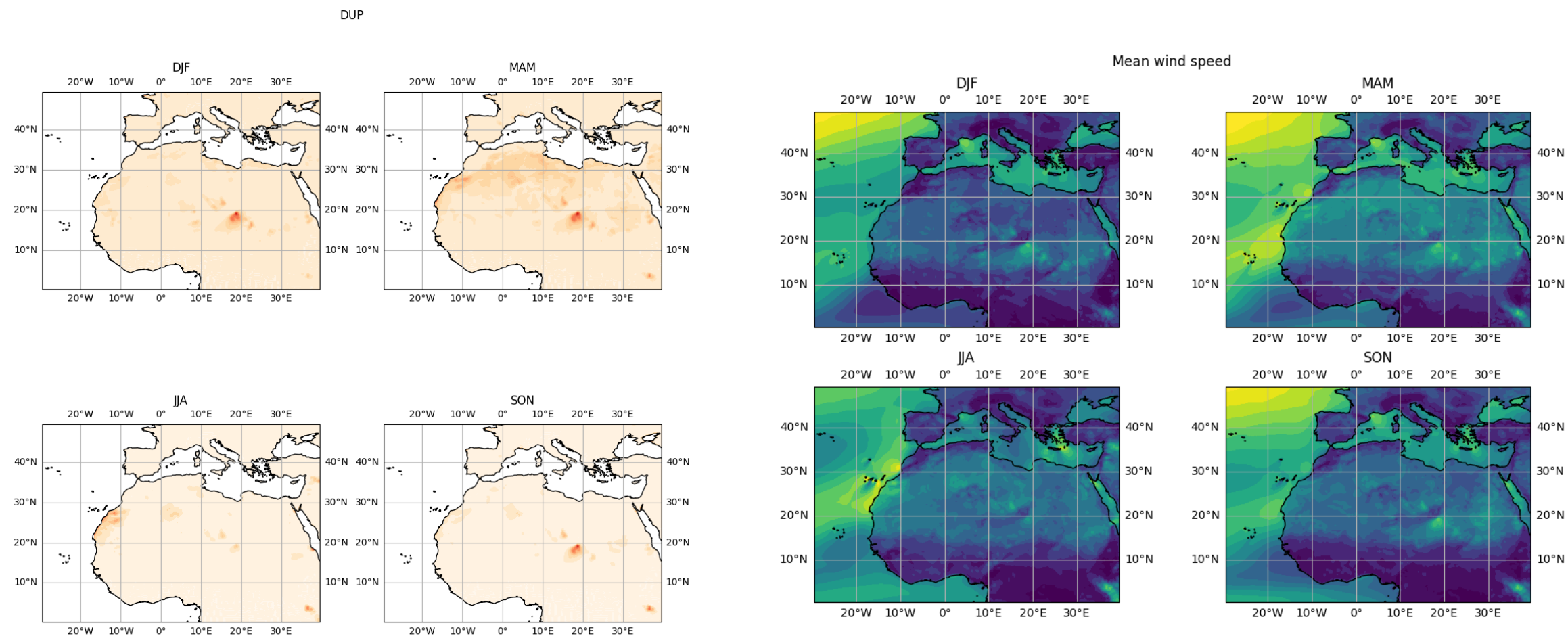


Figure 2: Heat map illustration of mean dust uplift potential (left) and mean surface wind speed (right) over North Africa from 1994-2024

Dust uplift potential over North Africa (1994-2024)

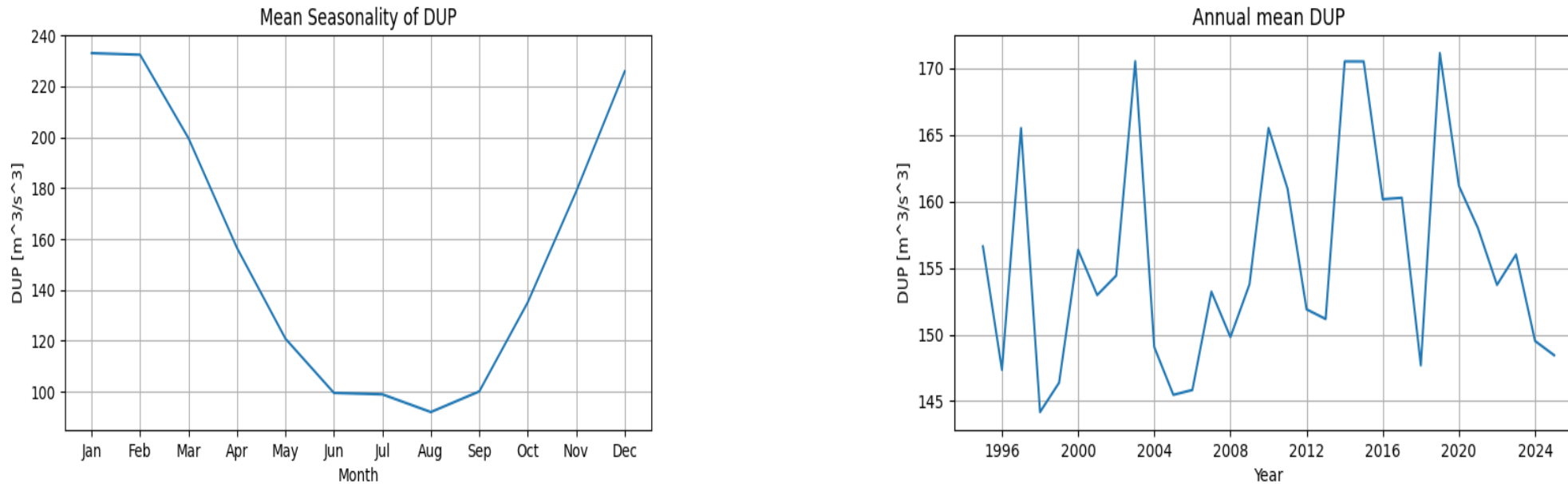


Figure 3: shows the mean seasonal and annual Dust Uplift potential over North Africa between 1994 and 2024

Dust uplift potential over North Africa (1994 -2024)

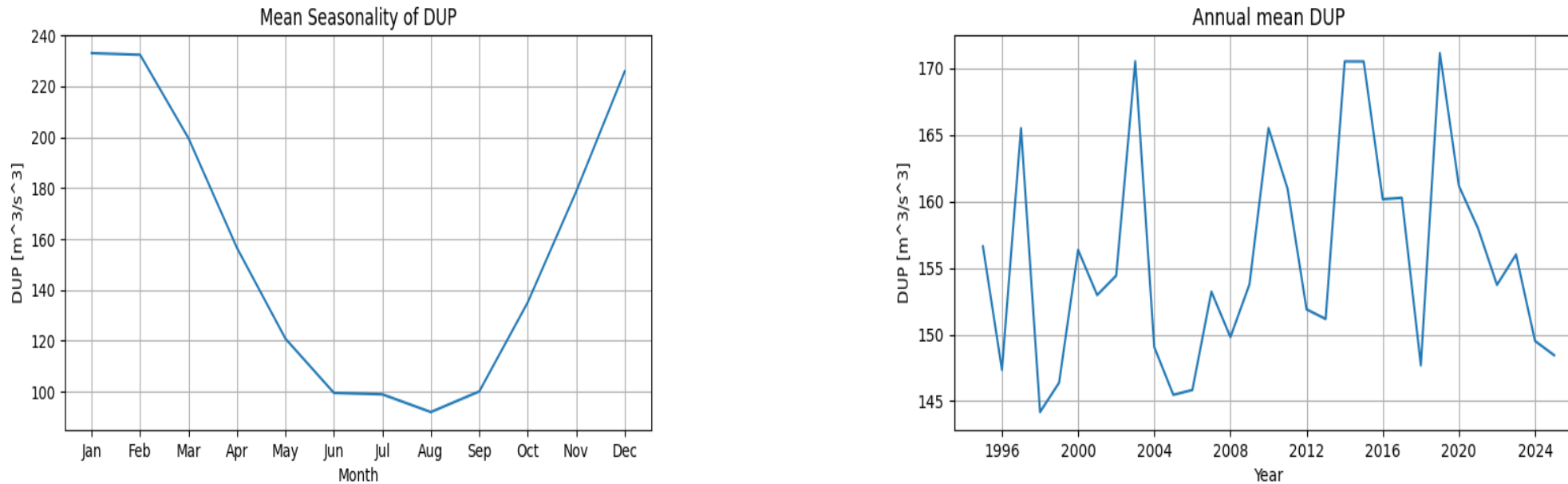
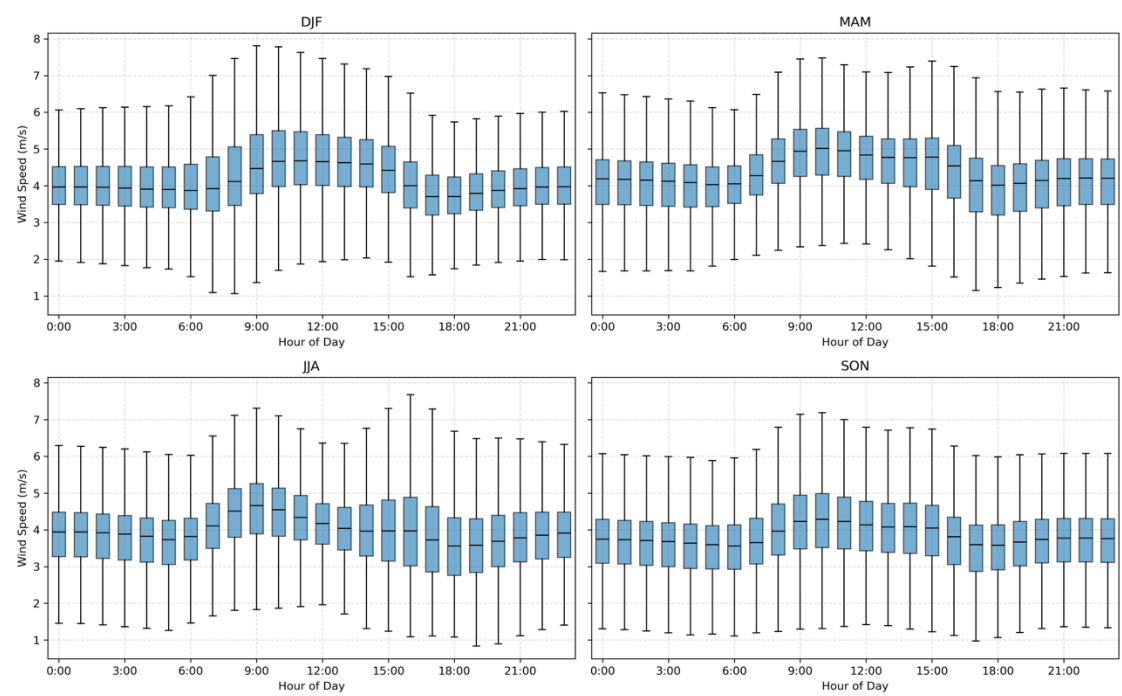


Figure 3: shows the mean seasonal and annual Dust Uplift potential over North Africa between 1994 and 2024

Diurnal wind speed distribution over North Africa (1994-2024)

30 years Mean Hourly Wind Speed Distribution by Season (North Africa, 1994-2023)



North Africa: Hourly Mean Wind Speed by Season (1994-2023)

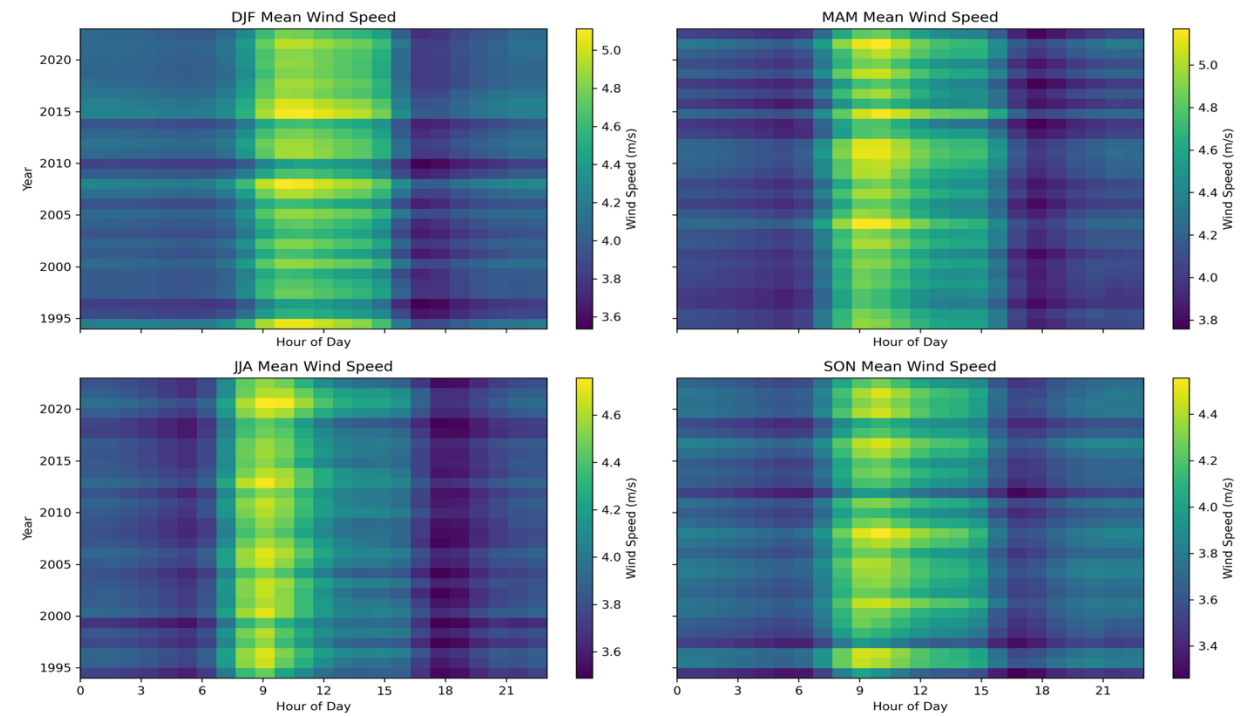
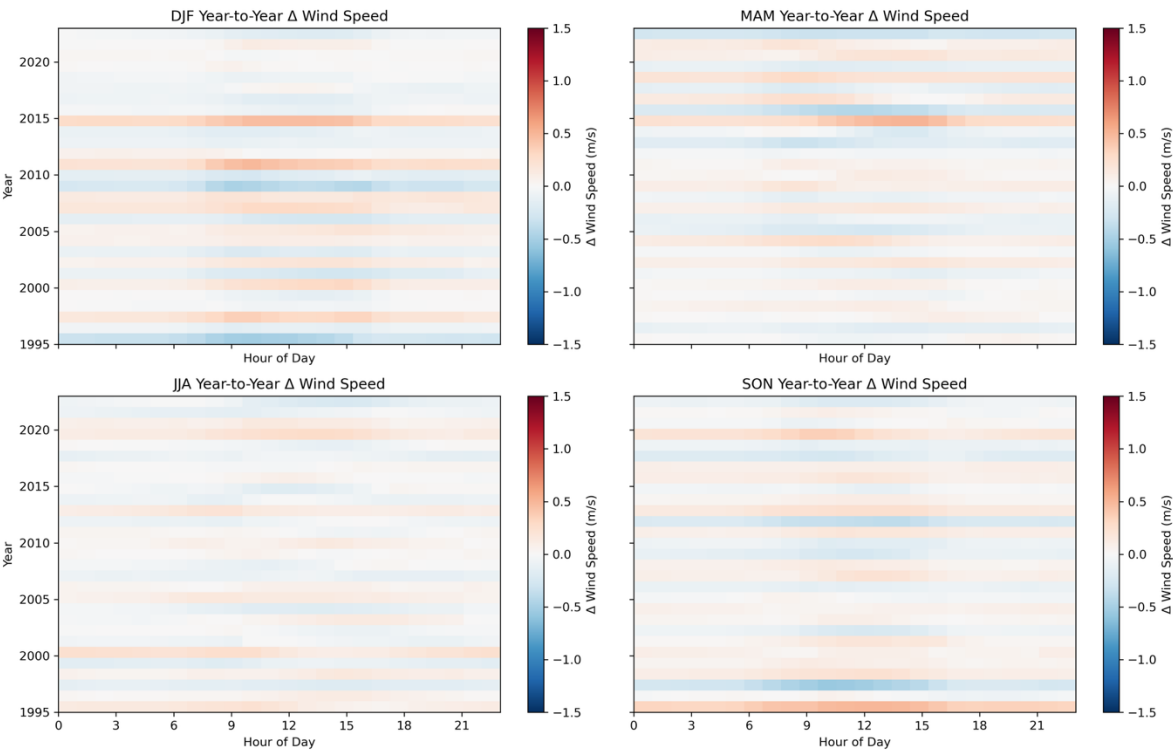


Figure 4: shows the 30 years averaged statistical hourly wind speed (left) and yearly mean wind speed distribution for different seasons over Northern Africa from 1994-2024.

Diurnal wind speed distribution over North Africa (1994-2024)

North Africa: Hourly Year-to-Year Change in Wind Speed (1994-2023)



North Africa: Hourly Wind Speed Anomaly vs. Climatology (1994-2023)

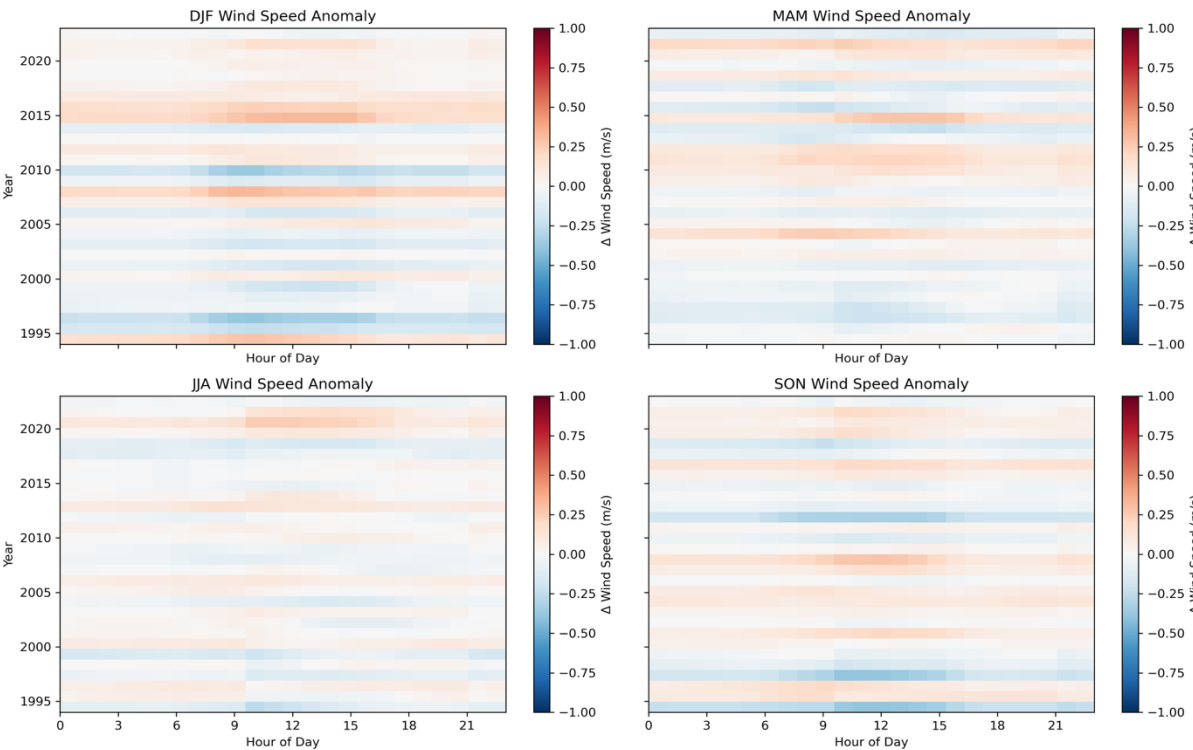


Figure 5: shows the year to year (left) and year to 30 years averaged (right) difference in wind speed for different seasons over North Africa from 1994-2024.