Environmental Report

LAGOS DECEMBER 2024

RUNNING FOR CLEAN AIR

DISCLAIMER

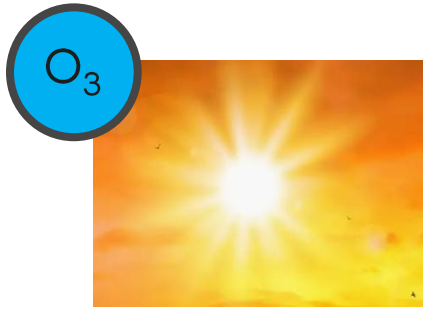
This report contains data from the Air Quality monitoring station installed at National stadium complex, Lagos, Nigeria, operating since February 8th, 2024.

The data presented in this report is collected with sensor technologies which are not regulatory-grade instrumentation following Directive 2008/50/EC. Therefore, the results presented should be considered as informative and not be used for regulatory compliance checking purposes. Any communication of the data should include this statement. After deployment, the monitors are not routinely inter-compared with reference instruments at each destination.

MAIN POLLUTANTS MEASURED

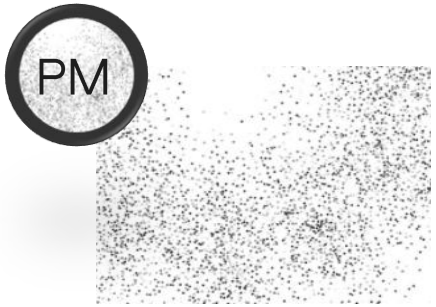
Nitrogen Dioxide

Primarily gets in the air from the burning of fuel by cars, trucks and buses, power plants



Ozone

Created by chemical reactions between (NOx) and (VOC) in the presence of sunlight



Particulate matter

Mixture of solid particles and liquid droplets found in the air. Some are emitted directly from a source, such as heating in residential, construction sites, unpaved roads, fields, smokestacks, fires or transported by the wind

TO BUILD A SIMPLIFIED AIR QUALITY INDEX (AQI)

Gaseous pollutants

NO NO_2 O_3

Particulate Matter

PM 1 PM 2.5 PM 10

EUROPEAN AQI INDEX

Help us understand data measured by the stations

EXTREMELY POOR	126-200	May cause respiratory issues in healthy people, and serious health issues in people with lung/heart disease.
VERY POOR	101-125	The pollution level has reached a critical level. Even healthy people may show symptoms for short exposures.
POOR	75-100	Effects can be immediately felt by individuals at risk. Everybody feels the effects of prolonged exposure.
MODERATE	51-75	The air has reached a high level of pollution. Higher than the maximum limit for 24 hours established by WHO.
FAIR	26-50	The air is moderately polluted. A long-term exposure constitutes a health risk.
GOOD	0-25	The air is pure, ideal for outdoor activities.

EUROPEAN AQI LEVELS

European Environment Agency

Measurements of up to five key pollutants (O3, NO2, SO2, PM10, PM2.5) determine the index level that describes the current air quality situation at the location of each Kunak device. The index corresponds to the poorest level for any of the five pollutants based on the following scheme:

Pollutant	Level index (based on pollutant concentrations in µg/m^3)					
	Good	Fair	Moderate	Poor	Very poor	Extremely poor
	(0-25)	(26-50)	(51-75)	(76-100)	(101-125)	(126-200)
$PM_{2.5}$ (24h)	0-10	10-20	20-25	25-50	50-75	75-800
PM_{10} (24h)	0-20	20-35	35-50	50-100	100-150	150-1200
NO_2	0-40	40-90	90-120	120-230	230-340	340-1000
O_3	0-50	50-100	100-130	130-240	240-380	380-800
SO_2	0-100	100-200	200-350	350-500	500-750	750-1250

https://www.kunak.es/doc/08.Manuals/html/Kunak_Cloud_UserManual_EN.html#_Toc102586013

World Health Organization

RECOMMENDED AIR QUALITY GUIDELINES LEVELS & INTERIM TARGETS

Pollutant	Averaging time	Interim target				AQG level
		1	2	3	4	
$PM_{2.5}$, µg/m³	Annual	35	25	15	10	5
	24-hour[a]	75	~~50~~	~~37.5~~	~~25~~	15
PM_{10}, µg/m³	Annual	70	50	30	20	15
	24-hour[a]	150	~~100~~	~~75~~	~~50~~	45
O_3, µg/m³	Peak season[b]	100	70	–	–	60
	8-hour[a]	160	~~120~~	–	–	100
NO_2, µg/m³	Annual	40	30	20	–	10
	24-hour[a]	120	~~50~~	–	–	25

AIR QUALITY GUIDELINES FOR NITROGEN DIOXIDE (SHORT AVERAGE TIME) REMAIN VALID

Pollutant	Averaging time	Air quality guidelines that remain valid
NO_2, µg/m³	1-hour	200

Recommended 2021 AQG levels compared to 2005 air quality guidelines

Pollutant	Averaging Time	2005 AQGs	2021 AQGs
$PM_{2.5}$, µg/m³	Annual	10	5
	24-hour[a]	25	15
PM_{10}, µg/m³	Annual	20	15
	24-hour[a]	50	45
O_3, µg/m³	Peak season[b]	-	60
	8-hour[a]	100	100
NO_2, µg/m³	Annual	40	10
	24-hour[a]	-	25
SO_2, µg/m³	24-hour[a]	20	40
CO, mg/m³	24-hour[a]	-	4

https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1&isAllowed=y

WORLD ATHLETICS

METHODOLOGY

Meteo sensors

Temperature
(WBGT) Wet bulb globe temperature
Relative Humidity

Gas sensors (ug/m3)

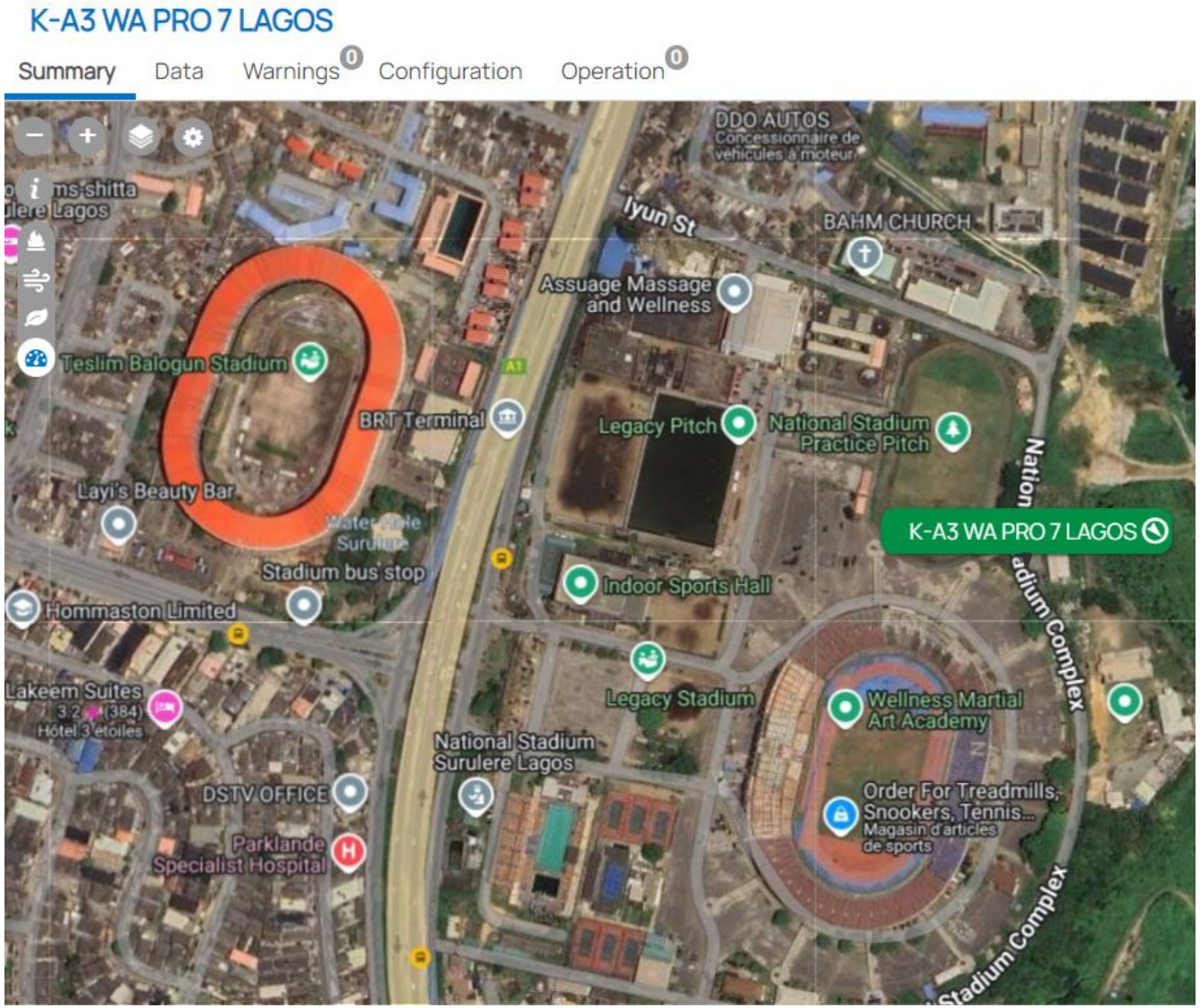
NO, NO2, O3

Particulate Matter sensor (ug/m3)

PM2.5, PM10

Positioning

GPS



WORLD ATHLETICS

AGGREGATED DATA December 1st to December 31st, 2024

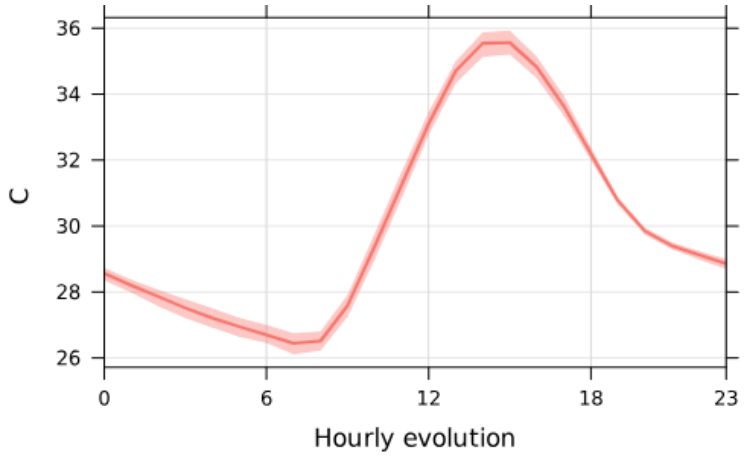
ENVIRONMENTAL DATA & AIR QUALITY INDEX

DEVICE LOCATED AT

National Stadium Surulele

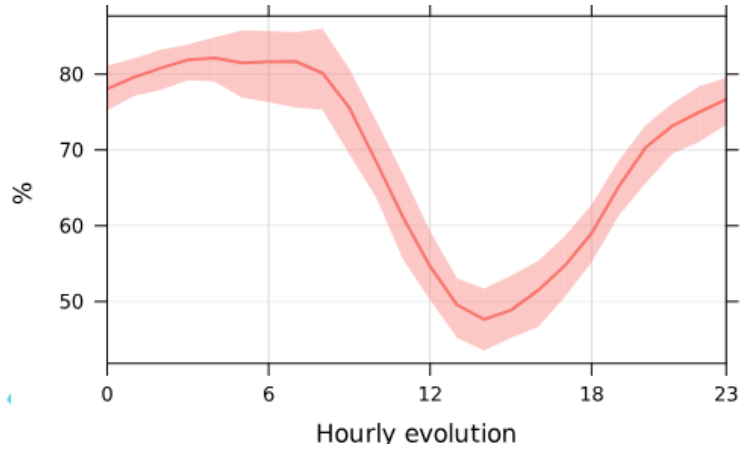
TEMPERATURE & HUMIDITY – Time variation - December 1st to 31st

Air Temperature



Aggregated data of the temperature hourly evolution indicate that the lowest temperature is measured at 07:00 and the highest between 14:00 and 15:00

Relative Humidity



Aggregated data of the humidity hourly evolution indicate that the lowest humidity is measured at 14:00 and the highest during nights and 08:00

WET BULB GLOBE TEMPERATURE - Time variation

WBGT is a measure of heat stress in direct sunlight.

It is a comprehensive measure of all the weather-related factors

(i) air temperature;

(ii) humidity;

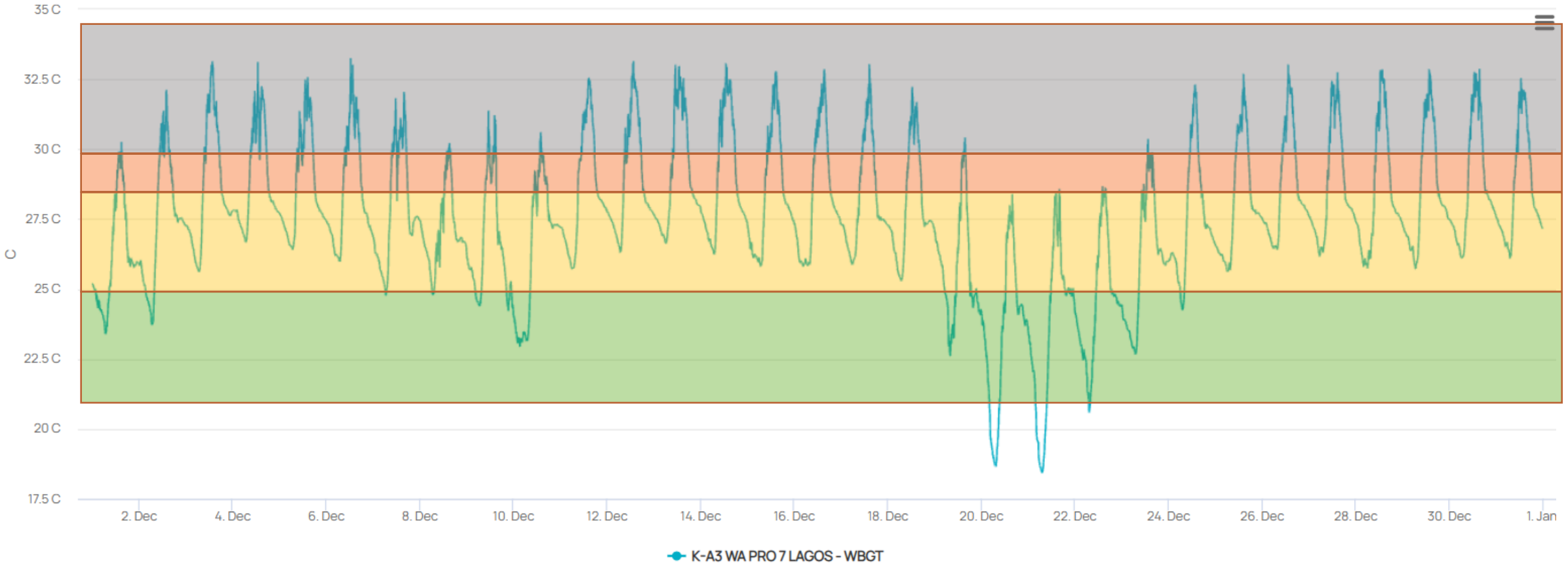
(iii) wind speed;

(iv) solar radiation

that impact the health and performance of athletes.

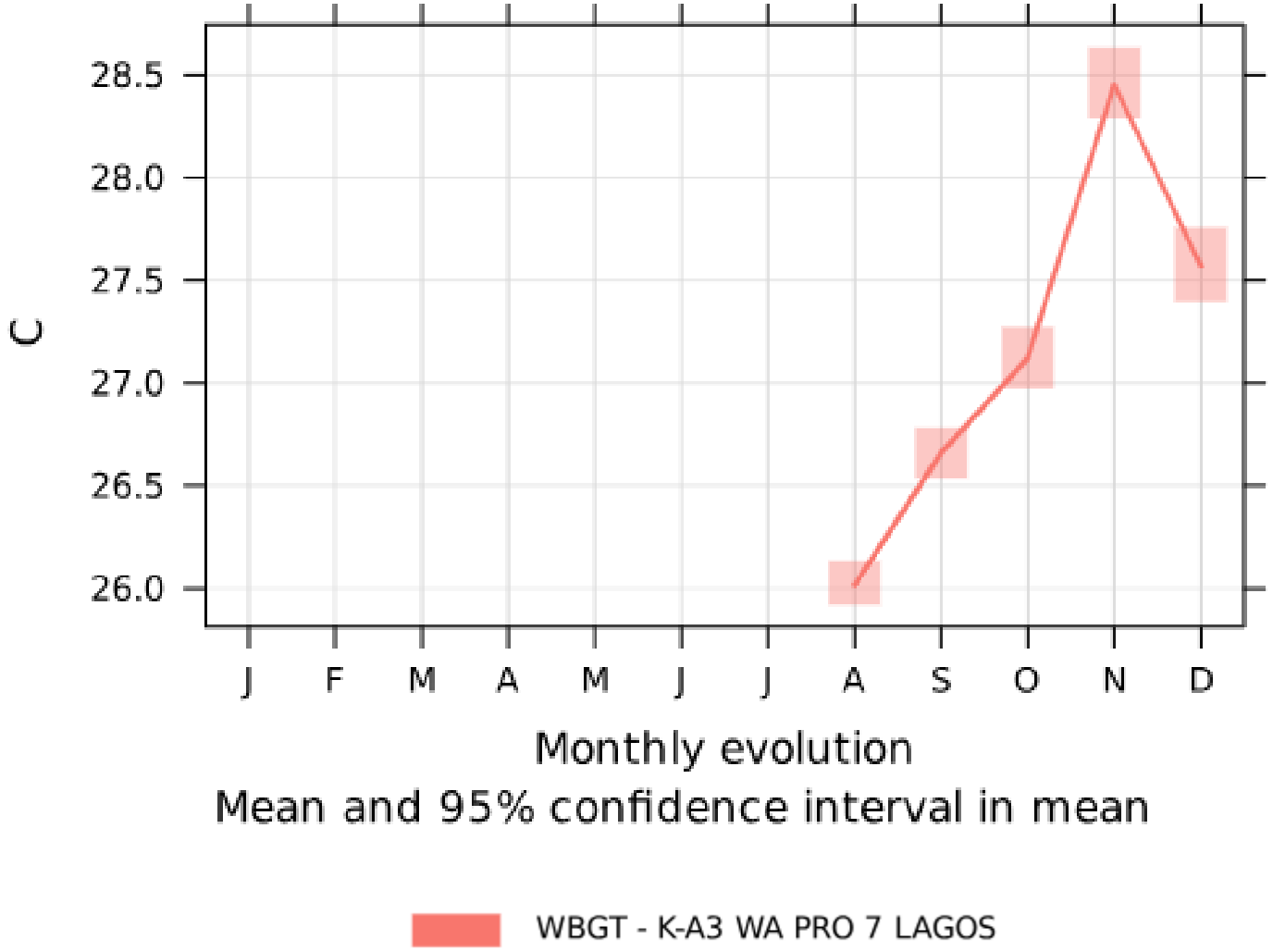
WBGT - Time variation December 1st to 31st

WBGT index during this period was very high and represent a significant level of heat stress for training athletes.

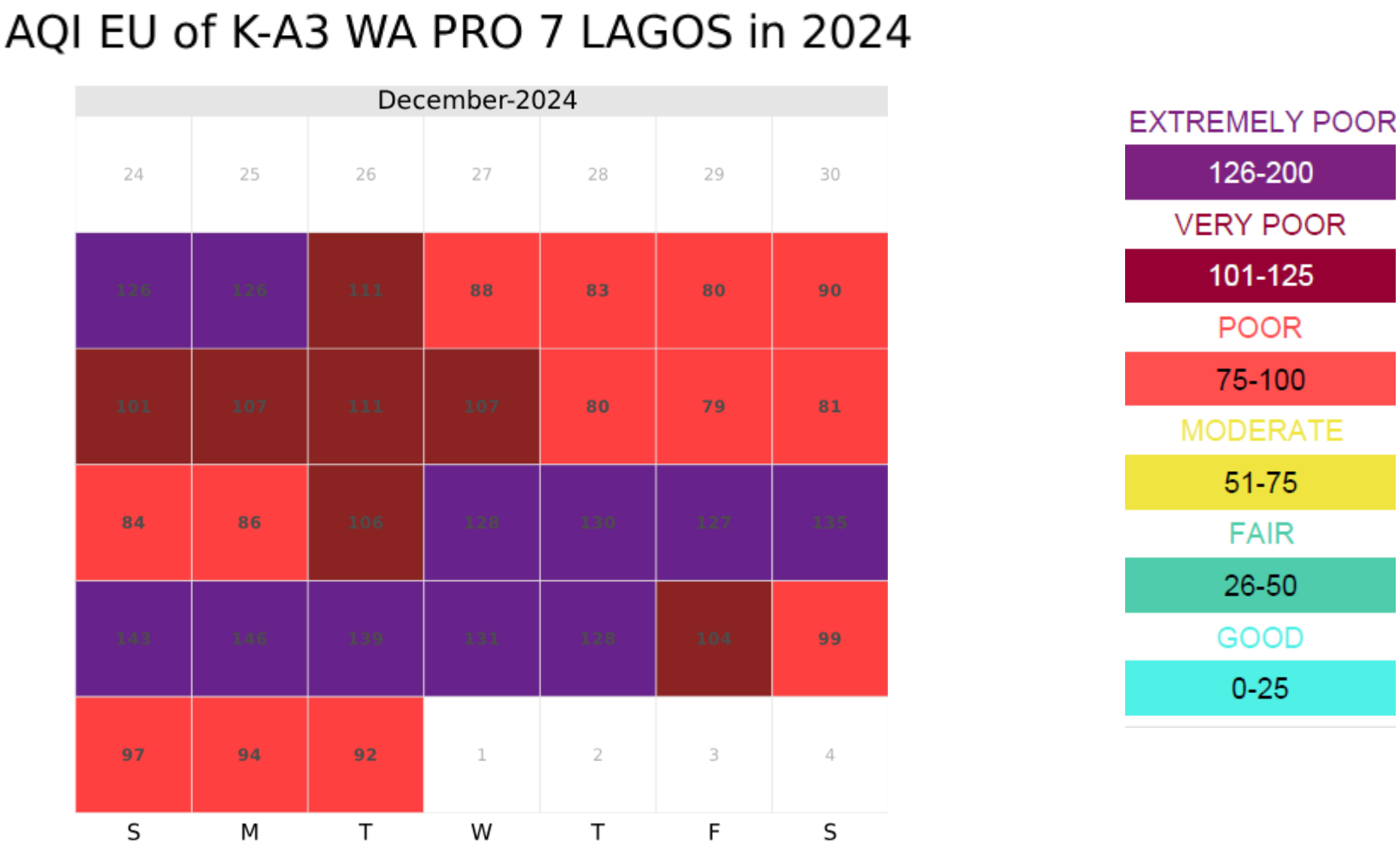


WBGT	Almost safe <21°C	Caution 21-25°C	Warning 25-28°C	Severe warning 28-30°C	Danger > 30°C

WBGT evolution from August to December

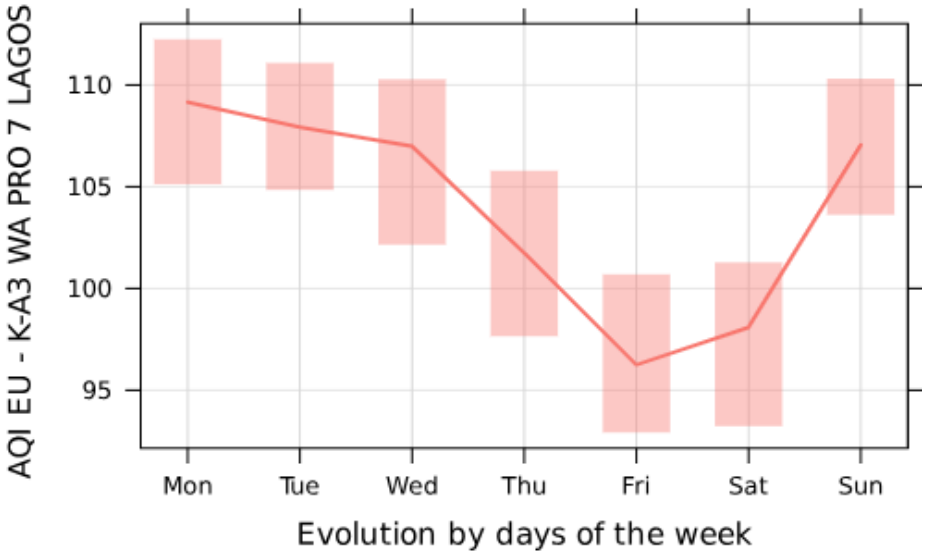


AQI EU - December 1st to 31st



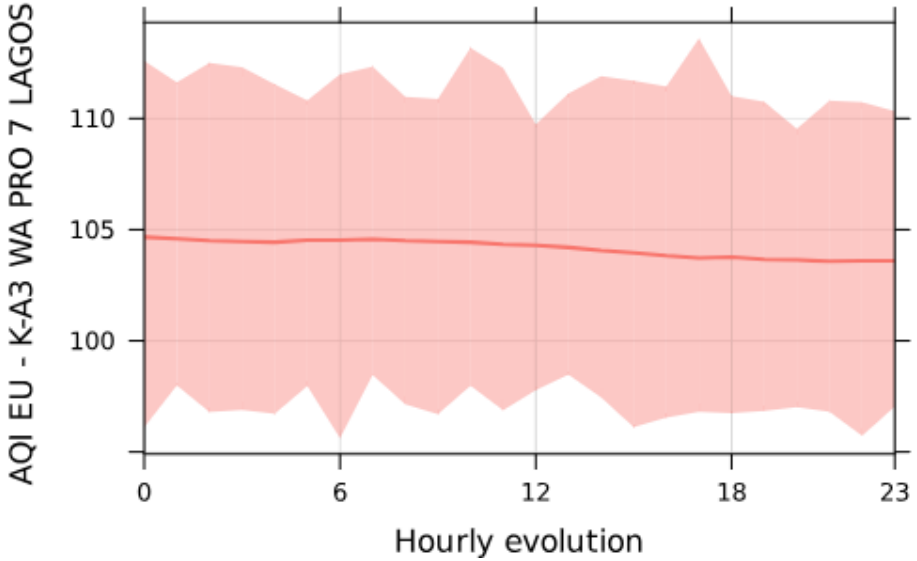
The AQI calendar plot indicates the AQI for each day during the monitoring period. Helping us to have a first glimpse of the conditions for each day. The AQI measured in December shows a poor to extremely poor air quality. The worst and best AQI values reported over the period are (80) and (144) respectively. AQI index was mostly influenced by particulates matters PM 10.

AQI - Time variation - December 1st to 31st



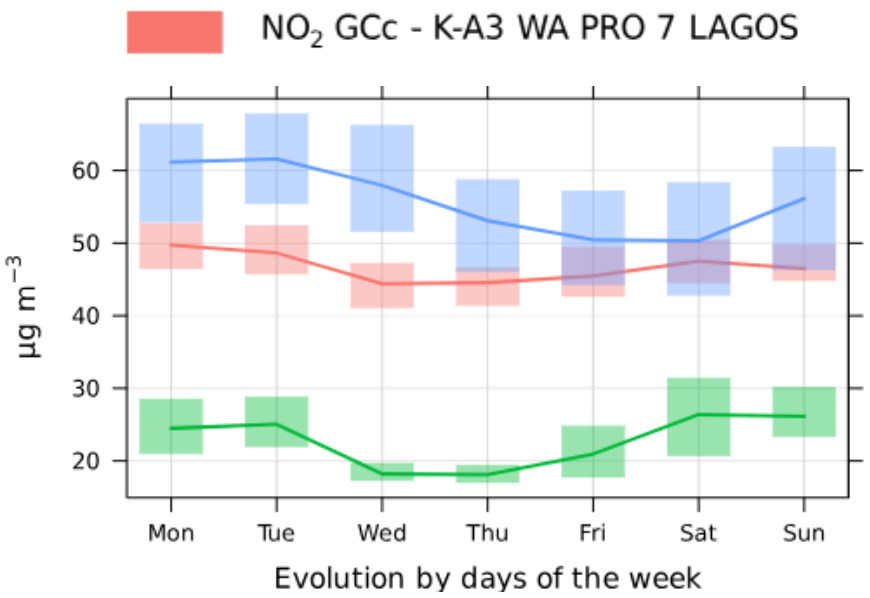
Aggregated data of the AQI evolution throughout the monitoring period helps us understand how the AQI changed based on day of the week and time of the day.

Aggregated data of the evolution by days of the week indicates the lowest AQI values were recorded on Friday this month.

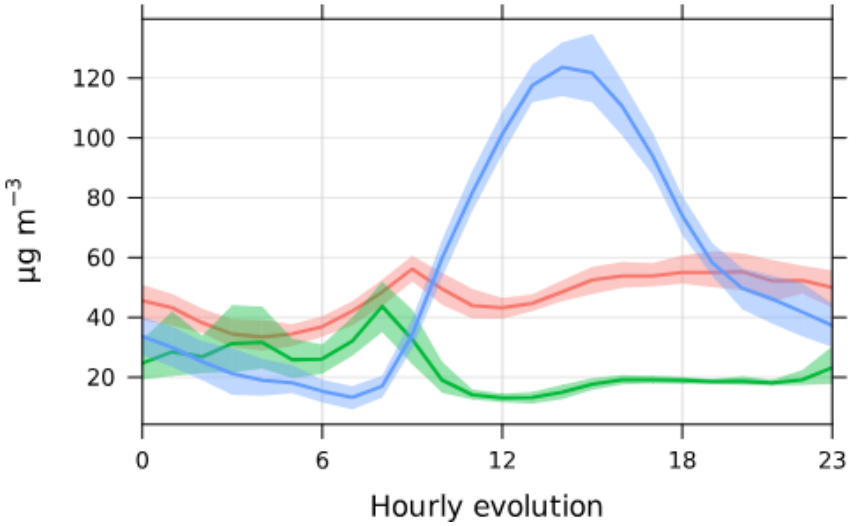


Aggregated data of the AQI hourly evolution indicates low changes throughout the day.

GASEOUS POLLUTANTS - Time variation - December 1st to 31st



Aggregated data of the gaseous pollutants evolution by days of the week indicates that absolute concentrations were moderate for **NO2, NO and O3.**

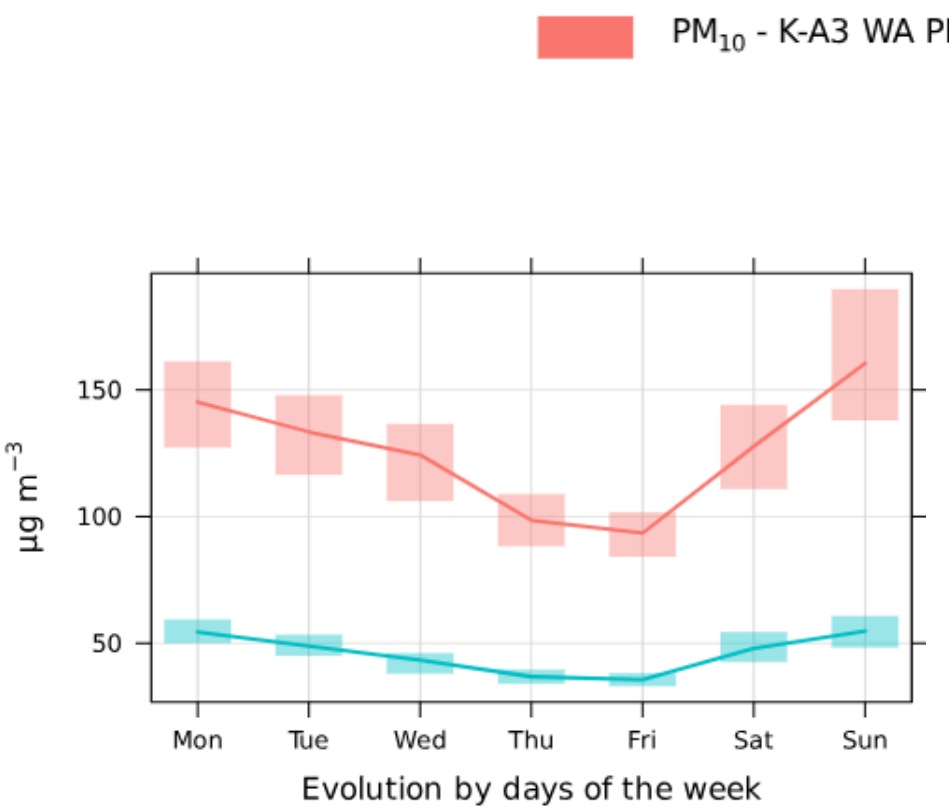


Aggregated data of the gaseous pollutants hourly evolution show typical trends for **NO2** and **NO** suggesting the influence of vehicle traffic emissions (morning and evening rush hours, 08:00 and 19:00) in this location. **O3** peaked in the early afternoon between 13:00 and 15:00. Typically, ozone levels reach their peak in early-afternoon, after exhaust fumes from morning rush hour have had time to react in sunlight.

Guideline values NO2
25 µg/m^3 (24h)
200 µg/m^3 1-hour mean

Guideline values O_3
100 µg/m^3 8-hour mean

PARTICULATE MATTERS - Time variation - December 1st to 31st



Aggregated data of the particulates pollutants evolution by days of the week indicates that absolute concentrations were higher on Sunday.

Guideline values
Coarse particulate matter (PM10): 45 µg/ m^3 24-hour mean
Fine particulate matter (PM2.5): 15 µg/ m^3 24-hour mean

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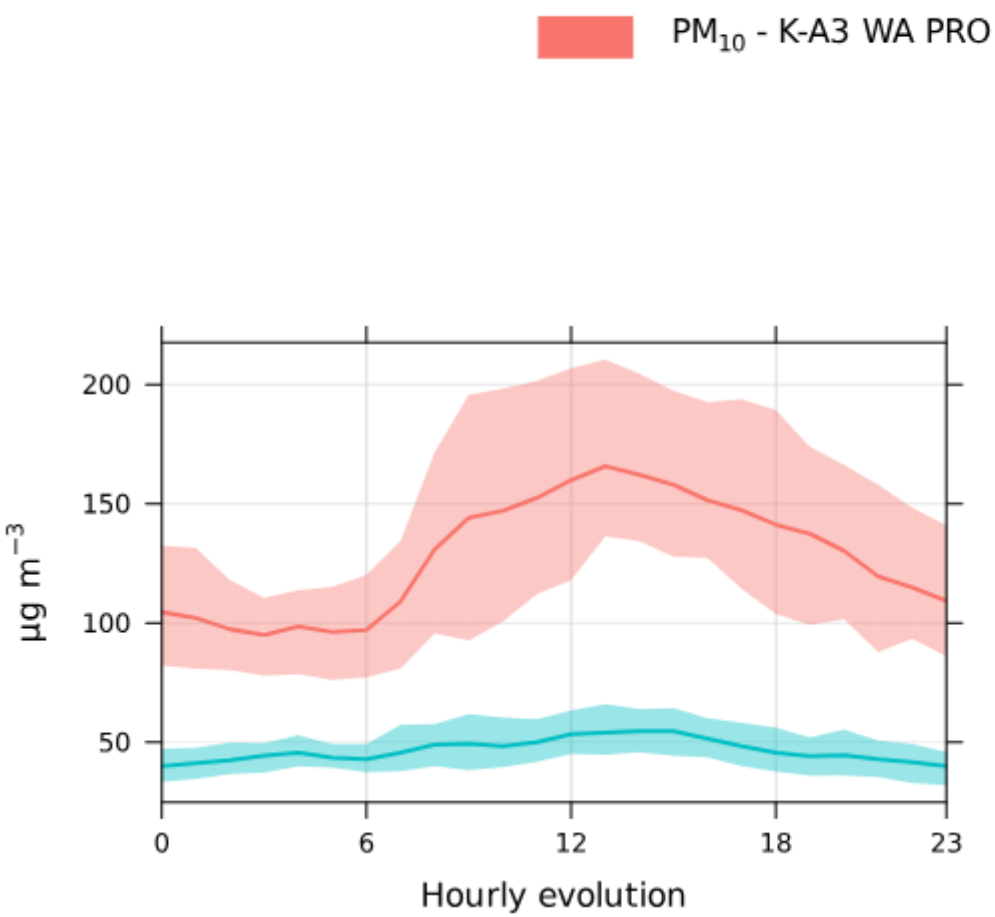
PARTICULATE MATTERS - Time variation - December 1st to 31st



These organic compounds can be emitted by both natural sources, such as trees and vegetation, as well as from man-made (anthropogenic) sources, such as industrial processes and motor vehicle exhaust.

Aggregated data of the particulates pollutants hourly evolution show a very high levels. PM10 seems to be influenced by traffic, with higher concentrations reported early afternoon.

Guideline values
Coarse particulate matter (PM10): 45 µg/ m^3 24-hour mean
Fine particulate matter (PM2.5): 15 µg/ m^3 24-hour mean

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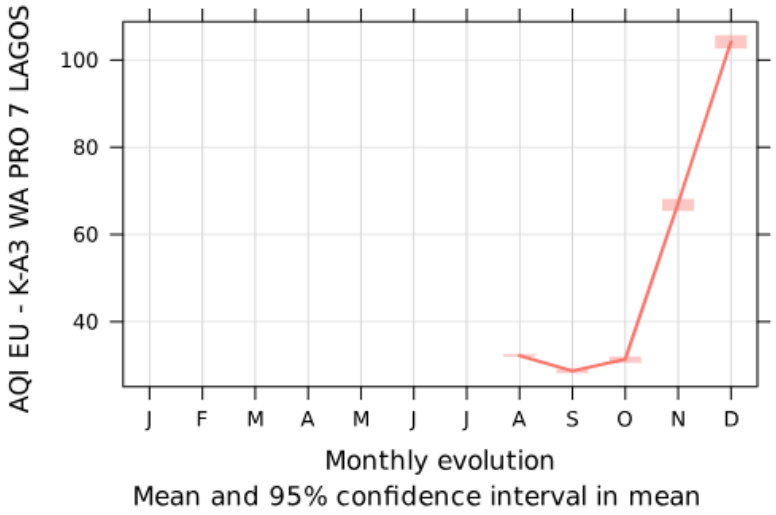
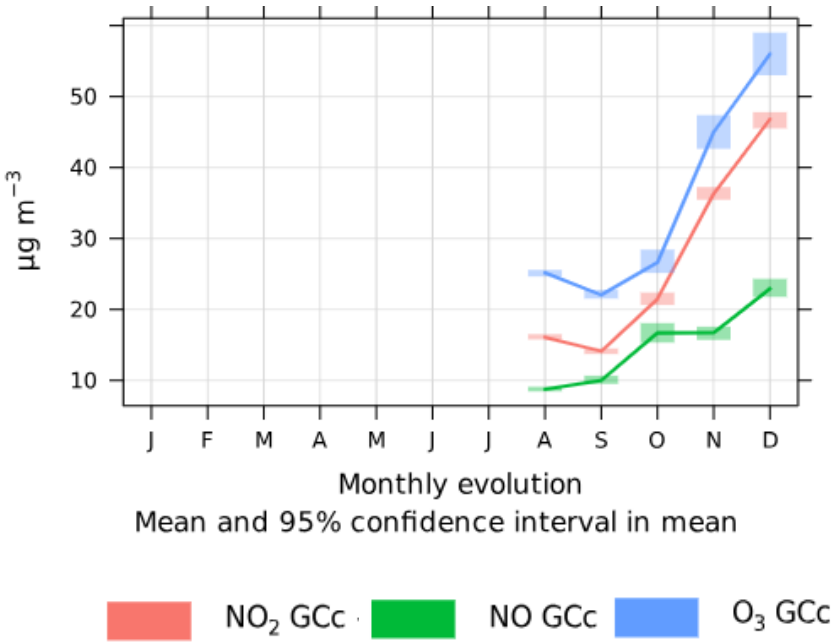
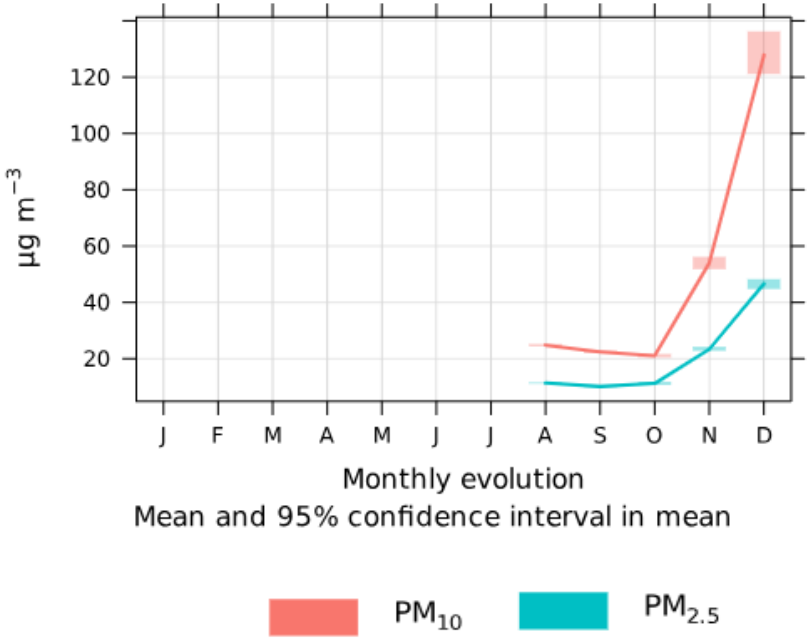
Comparison from August to December







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CONCLUSIONS

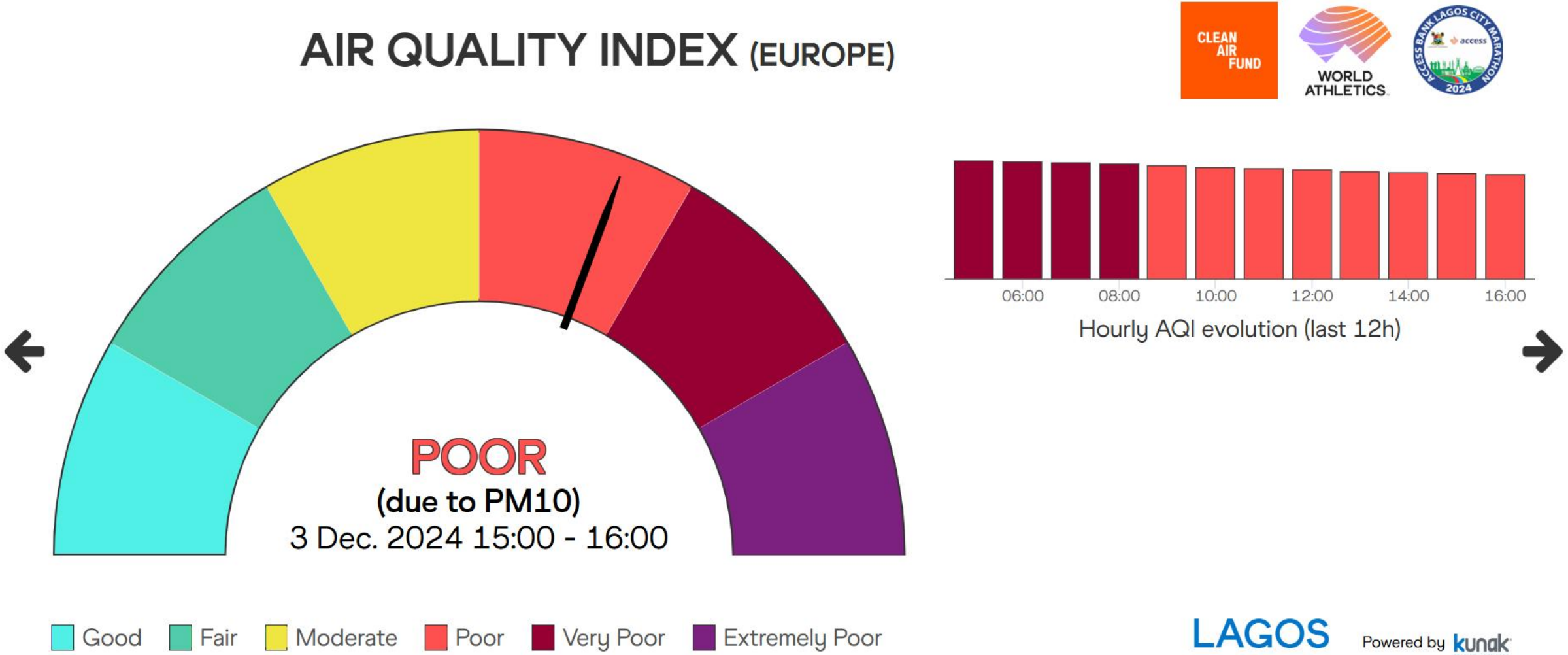
Air Quality Index values recorded during the month of December shows a poor to extremely poor levels of air pollution. AQI index was mostly influenced by particulates matters PM 10.

WBGT index during this period was very high (23 days) and represent a significant level of heat stress for training athletes.

Aggregated data of the gaseous pollutants hourly evolution show typical trends for NO2 and NO suggesting the influence of vehicle traffic emissions (morning and evening rush hours, 08:00 and 19:00) in this location. O3 peaked in the early afternoon between 13:00 and 15:00. Typically, ozone levels reach their peak in early-afternoon, after exhaust fumes from morning rush hour have had time to react in sunlight.

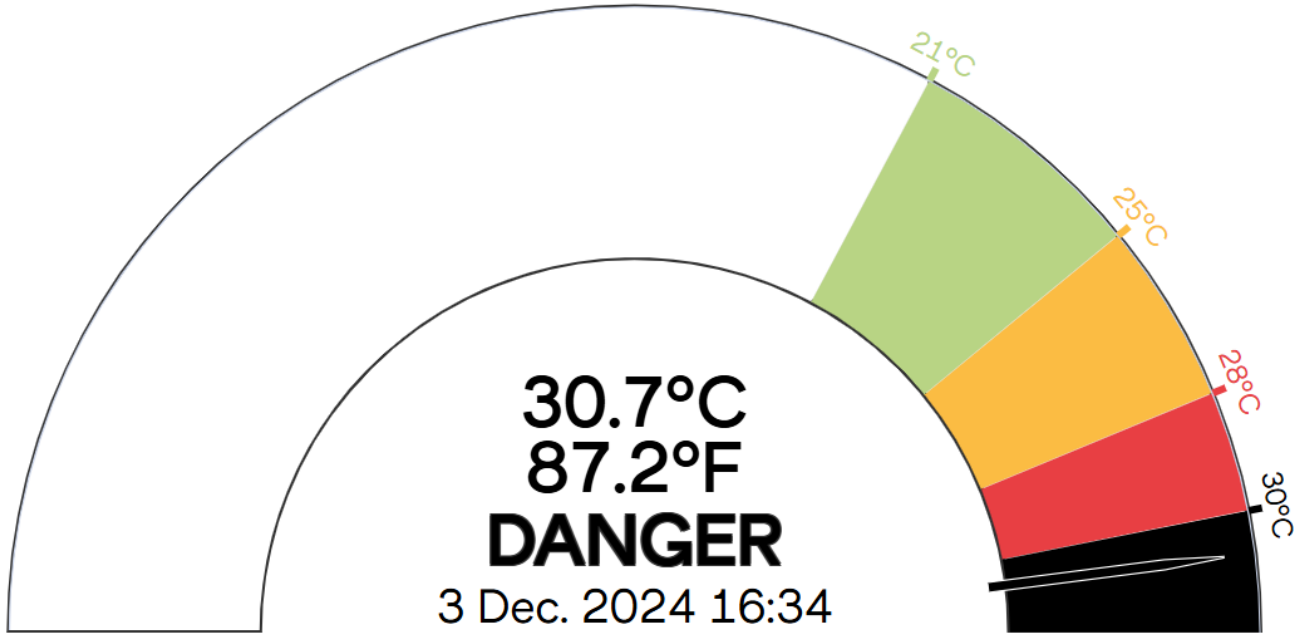
Aggregated data of the particulates pollutants hourly evolution show a very high levels during this month. PM10 peaked in the early afternoon and significantly contributes to worsening the AQI index this month in comparison to previous months. Unfortunately, the overall situation in Lagos is deteriorating significantly in terms of particulates air pollution and all the gases measured.

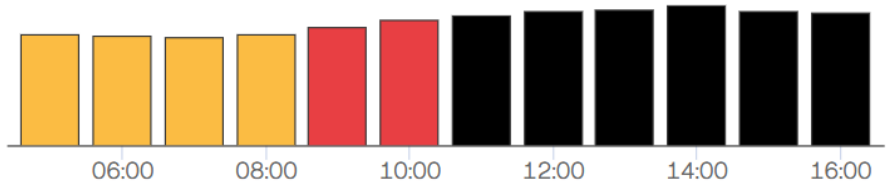
Appendix


AIR QUALITY INDEX (EUROPE)
POOR
(due to PM10)
3 Dec. 2024 15:00 - 16:00
Good
Fair
Moderate
Poor
Very Poor
Extremely Poor
06:00
08:00
10:00
12:00
14:00
16:00
Hourly AQI evolution (last 12h)

Appendix

HEAT STRESS INDEX
WET BULB GLOBE TEMPERATURE





Hourly WBGT evolution (last 12h)

Air Temperature 32.7 °C / 90.9 °F

Relative Humidity 65.8 %

Safe | Caution | Warning | Severe Warning | Danger

LAGOS Powered by kunak

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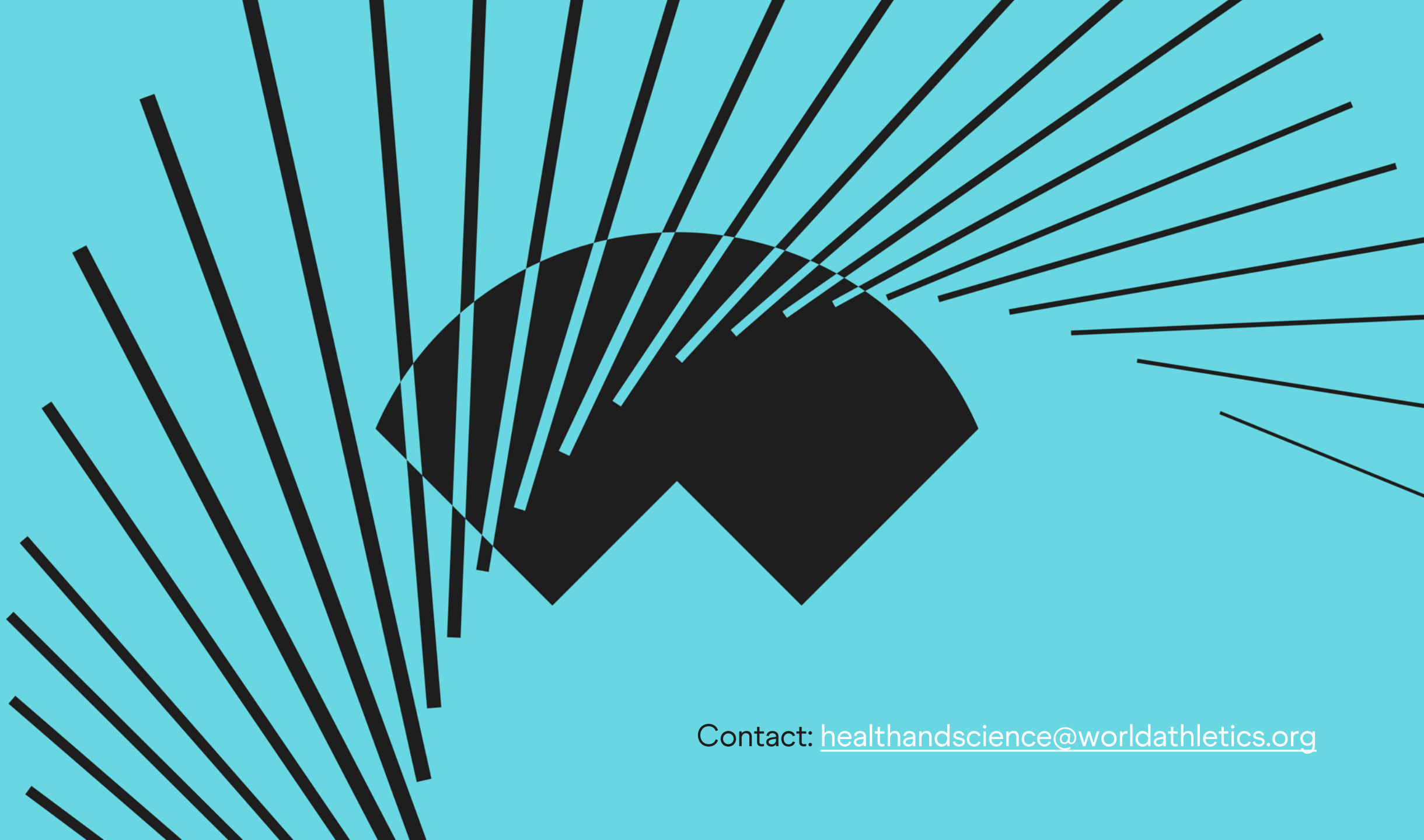

Contact: healthandscience@worldathletics.org