Air Pollution Event Report

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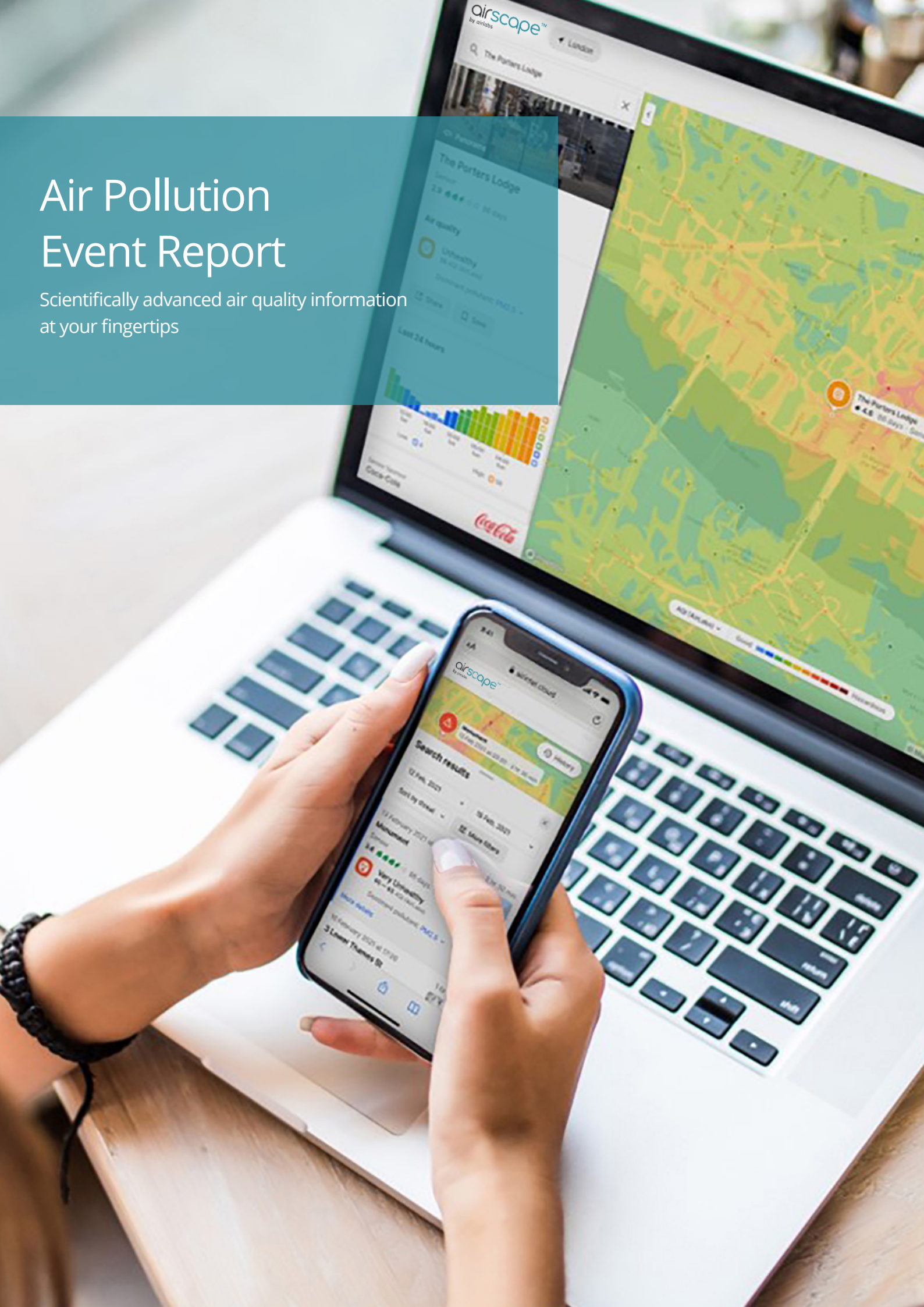

Camden, London Apr 2023

Title	Camden pollution events report (April 2023)
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Description	Report on recent pollution events in Camden, London
Authors	Szymon Kwiatkowski
Reviewers	Matthew S. Johnson
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Status	~~In review / Confirmed /~~ **Completed**

Background

This document is an analysis of pollution patterns during April 2023 over a sensor network in Camden, London. For this report a representative sample of 80 nodes (1/3 of the whole network) was analysed based on hourly average of the following pollutants: $PM_{2.5}$, O_3 and NO_2. The pollutant concentrations were also compared to previous months and the findings are presented in this report.

Analysis

For the comparison purposes the data of Camden AirNodes covers the period between February 2023 and April 2023. Nevertheless, the focus of this report is on April.

The analysis of NO_2 data, gathered from representative Camden devices, indicates marginal variation in average monthly concentrations, demonstrating a consistent daily pattern of pollutant formation (Table 1, Fig. 1). It also underscores the persistent correlation between rising NO_2 levels and declining temperatures, as well as slower wind speeds, with this trend remaining unbroken in April. The highest NO_2 concentrations appear to be intimately associated with lower temperatures. Furthermore, **the average NO_2 concentration in April significantly exceeded the World Health Organization's guidelines** for a 24-hour NO2 average (25 ug/m3), continuing a pattern observed in previous months of the current year (Fig. 2).

Table 1: Monthly averages of observed pollutants

Month/Pollutant	NO_2 in ug/m³	O_3 in ug/m³	$PM_{2.5}$ in ug/m³
February	41.3	30.5	10.3
March	40.8	37	6
April	42	40.9	8.6
3 months average	41.4 ± 0.6	36.1 ± 5.3	8.3 ± 2.2

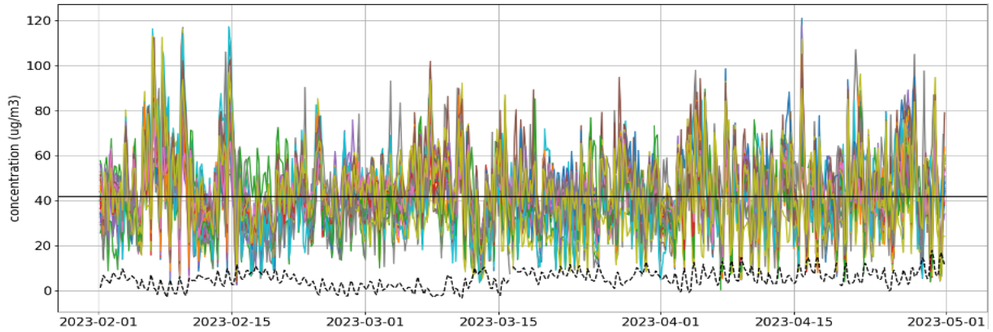

Fig. 1: NO_2 4h average in February-March period.
The black horizontal line represents an average of AirNodes for that time period. The black dashed line represents temperature observed in the AirNode.

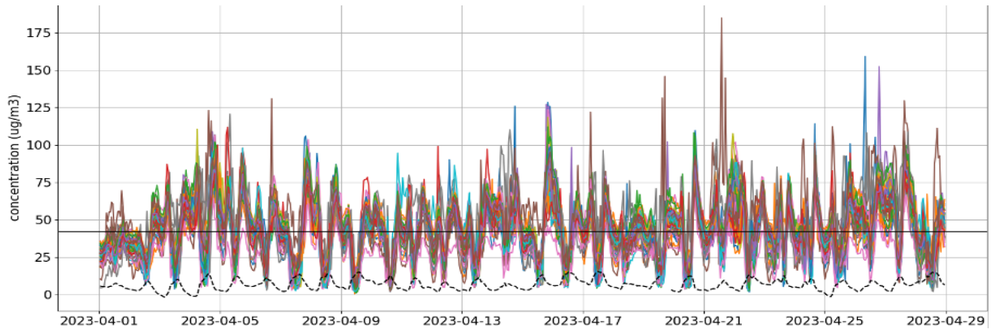

Fig. 2: NO_2 hourly average in April.
The black horizontal line represents an average of AirNodes for March. The black dashed line represents temperature observed in the AirNode.

The variability in **Ozone (O_3)** concentration demonstrated a more pronounced degree in April in comparison to NO_2. The average concentration of O_3 exhibited a rising trend over the past three months, spanning February to April (Fig. 3), a phenomenon likely attributed to extended sunshine durations. **April witnessed a distinct upsurge in O3 relative to preceding months** (Table 1), a trend that aligns well with the observed escalation in average temperature and sunlight duration.

Moreover, certain periods in April experienced a diminished O_3 concentration, which can be largely ascribed to low wind speeds and winds from the northern direction (Fig. 9). The correlation between ozone concentration and factors such as wind speed and direction remains perceptibly significant.

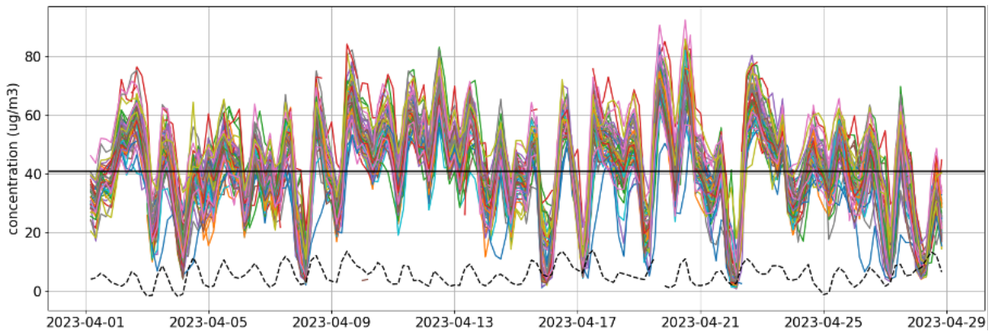

Fig. 3: O_3 4h average in Febrary - April.
The black horizontal line represents an average of AirNodes for that period.

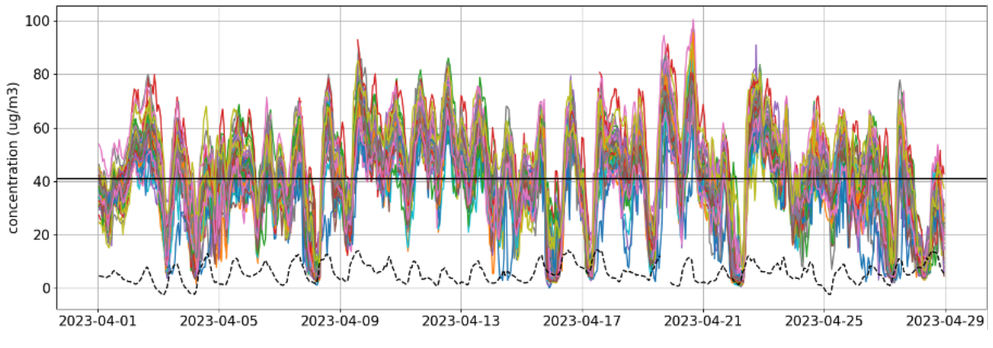

Fig. 4: O_3 hourly average in April.
The black horizontal line represents an average of AirNodes for March.

The **$PM_{2.5}$** dataset reveals a rise in concentrations, significantly exceeding the average, specifically observed over a few days at the beginning of April (8th and 9th), and again during the latter half of the month. **The $PM_{2.5}$ pollution was particularly severe on the 22nd of April** (Fig. 7), reaching concentrations akin to those registered in mid-February (Fig. 5, Fig. 6). On average, the $PM_{2.5}$ concentration in April escalated compared to March, although it remained below the average recorded during the winter months (Table 1). These spikes in $PM_{2.5}$ concentrations correlate strongly with periods of lower wind speeds (Fig. 9). Additionally, localized spikes in pollution, unaligned with the broader trends, have been observed. **Nodes situated in the southern region of Camden, specifically at Drury Lane and High Holborn, experienced more frequent incidences of elevated PM pollution.**

The **Air Quality Index (AQI)** levels for April were elevated (Fig. 8). This was anticipated due to the sequential monthly increase observed across all the pollutants under study.

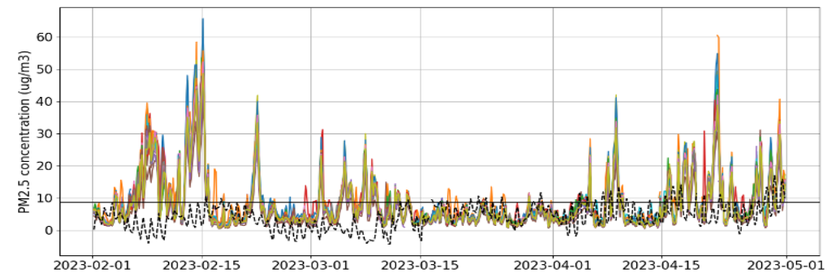

Fig. 5: $PM_{2.5}$ 4h average in February-April.
The black horizontal line represents an average of AirNodes for that time period. The black dashed line represents temperature observed in the AirNode.

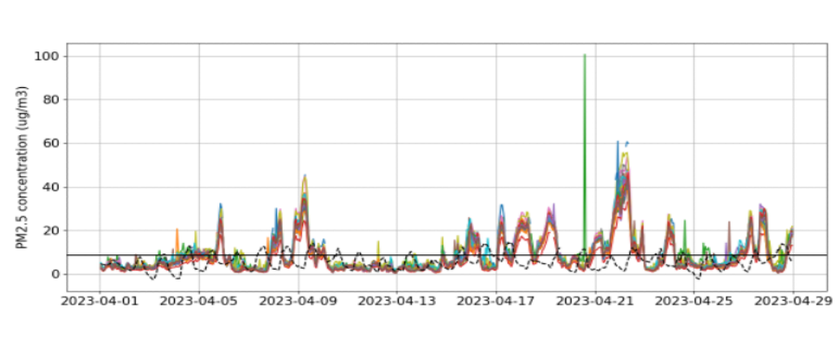

Fig. 6: $PM_{2.5}$ hourly average in April.
The black horizontal line represents an average of AirNodes for that time period. The black dashed line represents temperature observed in the AirNode.

Summary

Based on the data gathered by the Camden Network in London, the analysis of the data provides insights into patterns of pollution formation and their correlations with certain weather conditions.

NO_2 data demonstrates consistency in its formation pattern with minor monthly fluctuations. Its correlation with lower temperatures and slower wind speeds remains consistent. However, it should be noted that the concentration levels have occasionally surpassed the World Health Organization's guidelines for NO_2.

Ozone concentrations have shown a tendency to increase, likely due to longer periods of sunshine, aligning well with an increase in average temperature and sunlight duration. The influence of wind speed and direction, specifically lower speeds and northern winds, on O_3 concentration has been observable.

The $PM_{2.5}$ concentration data revealed specific peaks in April, correlating with lower wind speeds. Though there was a rise compared to March, these levels were still lower than those seen in the winter months, indicating a possible seasonal effect on $PM_{2.5}$ emissions.

Air Quality Index (AQI) levels in April were higher, reflecting the month-over-month increase observed in the monitored pollutants.

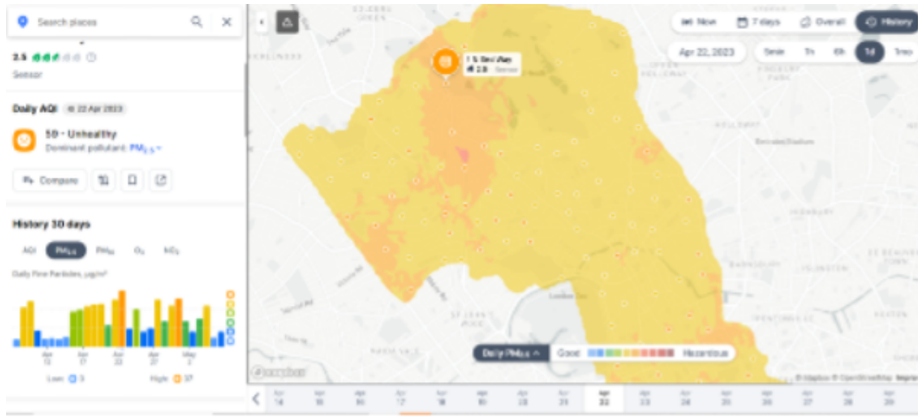

Fig. 7: $PM_{2.5}$ one of the AirNodes on 22nd April as seen on airscape.ai

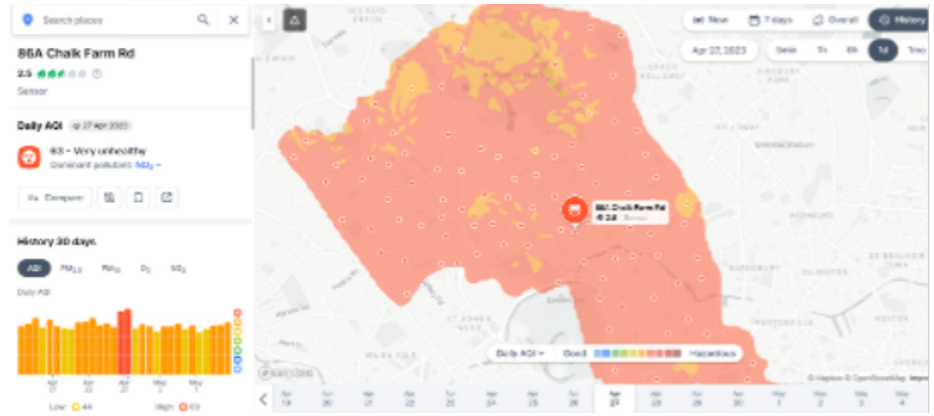

Fig. 8: AQI over Camden borough on 27th April as seen on airscape.ai

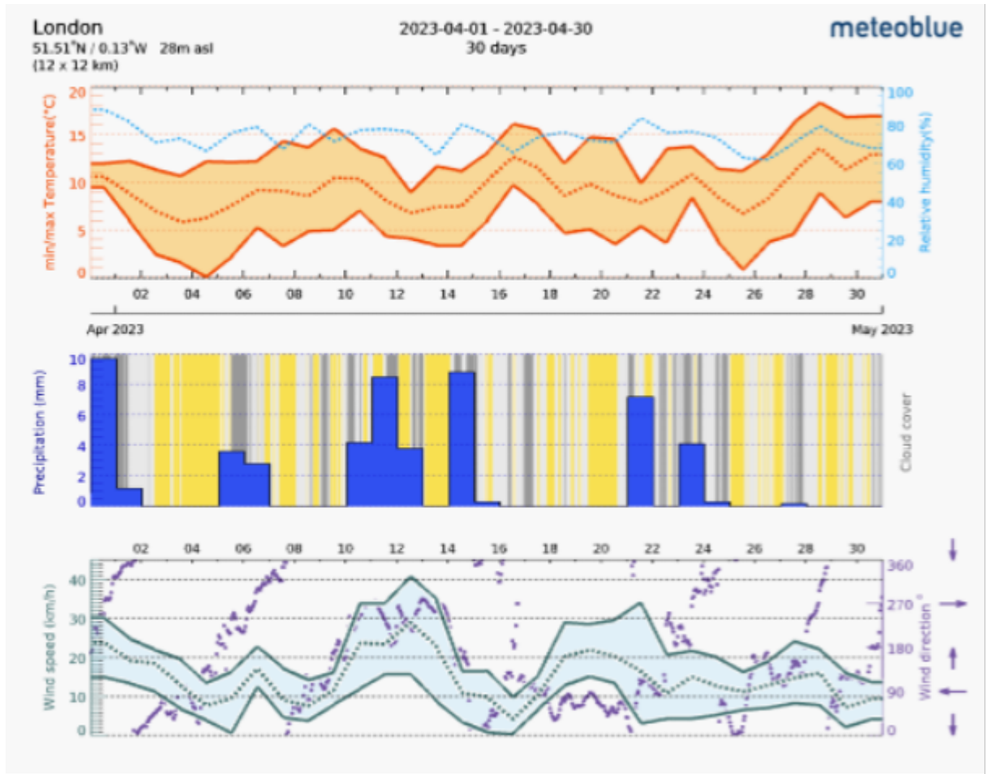

Fig. 9: Historical weather data from April 2023 (meteoblue.com)

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