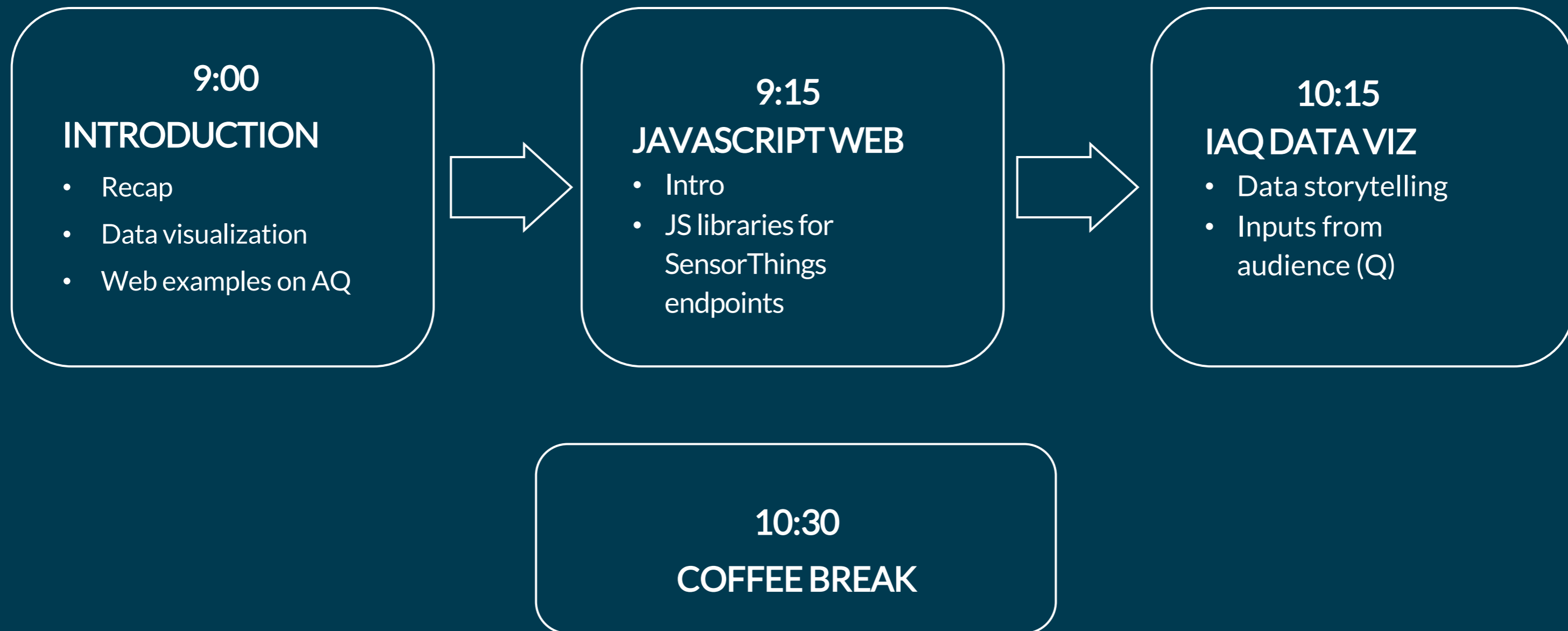


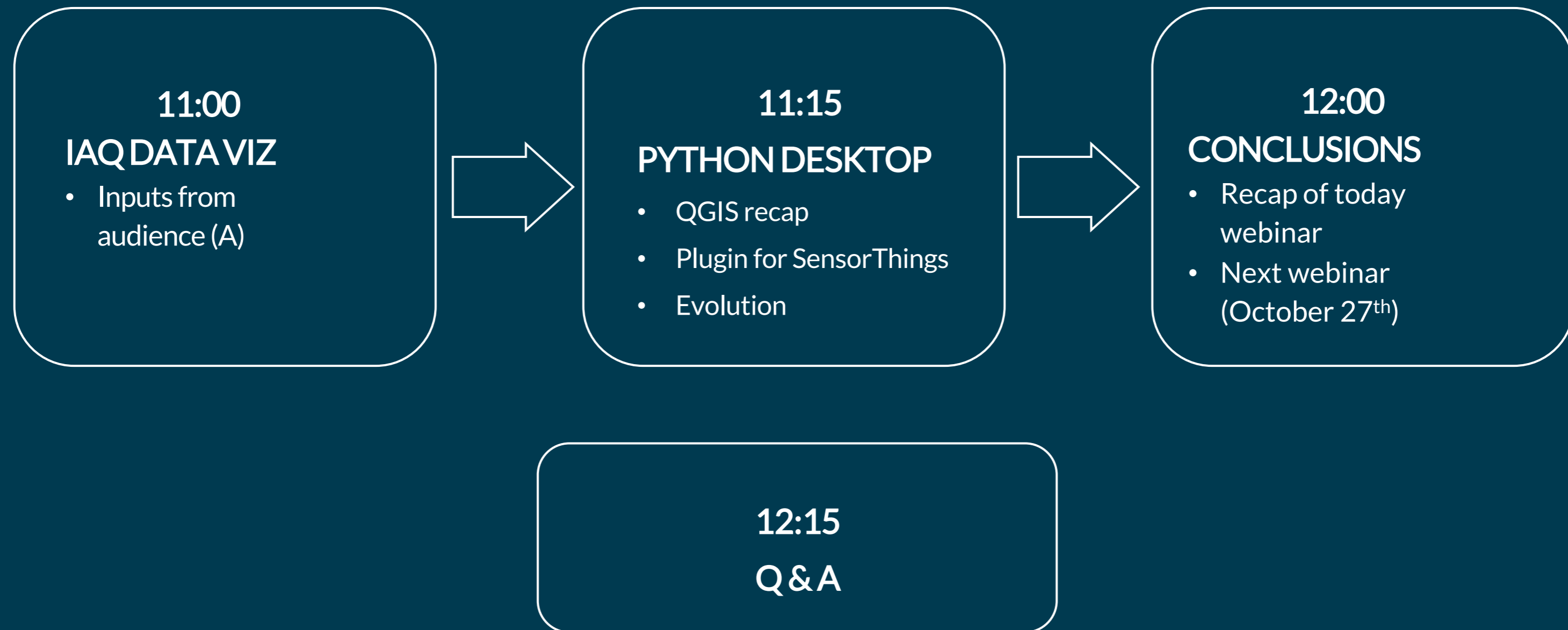
EDIAQI

Evidence  
Driven Indoor  
Air Quality  
Improvement

# Third session (September 29<sup>th</sup>) – part 1



# Third session (September 29<sup>th</sup>) – part 2



# Third session (September 29<sup>th</sup>)



Piergiorgio  
Cipriano

---

Deda Next



Luca  
Giovannini

---

Deda Next



Marcello  
Verona

---

The Lisbon  
Council



Beatrice  
Olivari

---

Deda Next

# 01 – Introduction

Piergiorgio Cipriano



This project has received funding from the European Union's HE research and innovation programme under the grant agreement No. 101057497

# First session (June 21<sup>st</sup>)

## INTRODUCTION

- Presentations
- OGC Intro
- Data interoperability

## SENSORTHINGS API

- Intro
- Data Model
- API

## STA REQUESTS

- Locations, Things
- Datastream, Multidatastream
- Observations

## FROST

- Characteristics
- Deploy options
- PostgreSQL and plugin

## STA+

- STA limitations
- STA+ additional properties
- Applications for EDIAQI

## INSPIRE

- Directive
- Regulations
- Technical Guidelines

# Second session (July 21<sup>st</sup>)

## WHY FROST?

- Reasons
- Evolution
- Live demos

Dr. Hylke van der Schaaf  
(Fraunhofer Institute)

## ROUND TABLE

- Questions and comments to Dr. van der Schaaf

## DEPLOY ON TOMCAT

- Example Ferrara
  - PostgreSQL
  - PostGIS
  - TimeScaleDb

## DEPLOY DOCKER

- Brief how-to

## DATA INGESTION

- Examples in Ferrara
  - weather
  - traffic
  - air quality (out)

## SEMANTICS 4 EDIAQI

- Parameters and UoM
- Frequency
- Location / Spatial

# Training sessions



## Training Session on data interoperability: FROST open source server solution for interoperable dynamic data

On Friday 21st of July 2023, the second training session on data interoperability for sensors was held by the Deda Next team, titled "SensorThings API standard and FROST open source server solution for interoperable dynamic data".

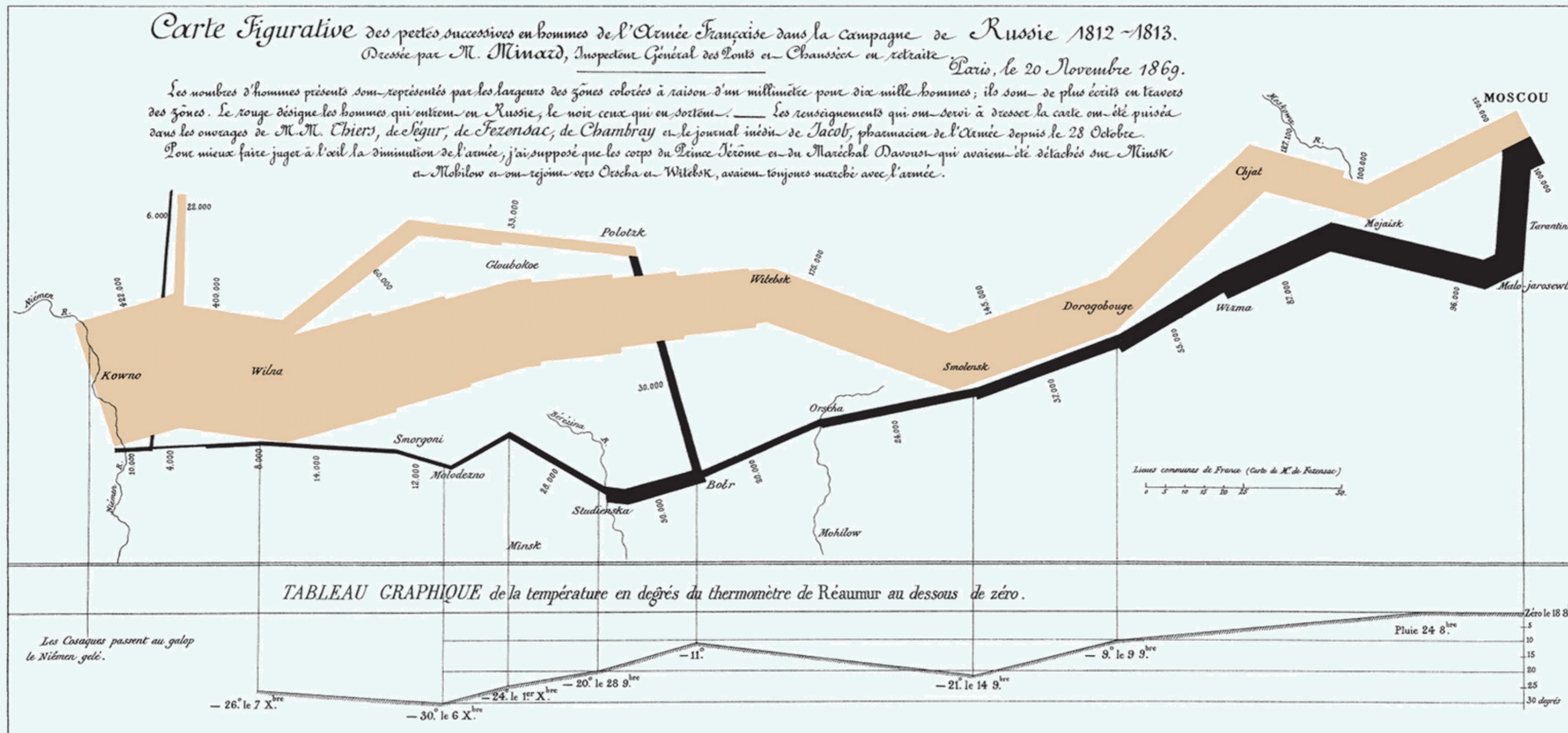


## Training Session on data interoperability: SensorThings API standard and FROST open source server solution

On Wednesday 21st of June 2023, the first training session on data interoperability for sensors was held by the Deda Next team, titled "SensorThings API standard and FROST open source server solution".



# Data Viz



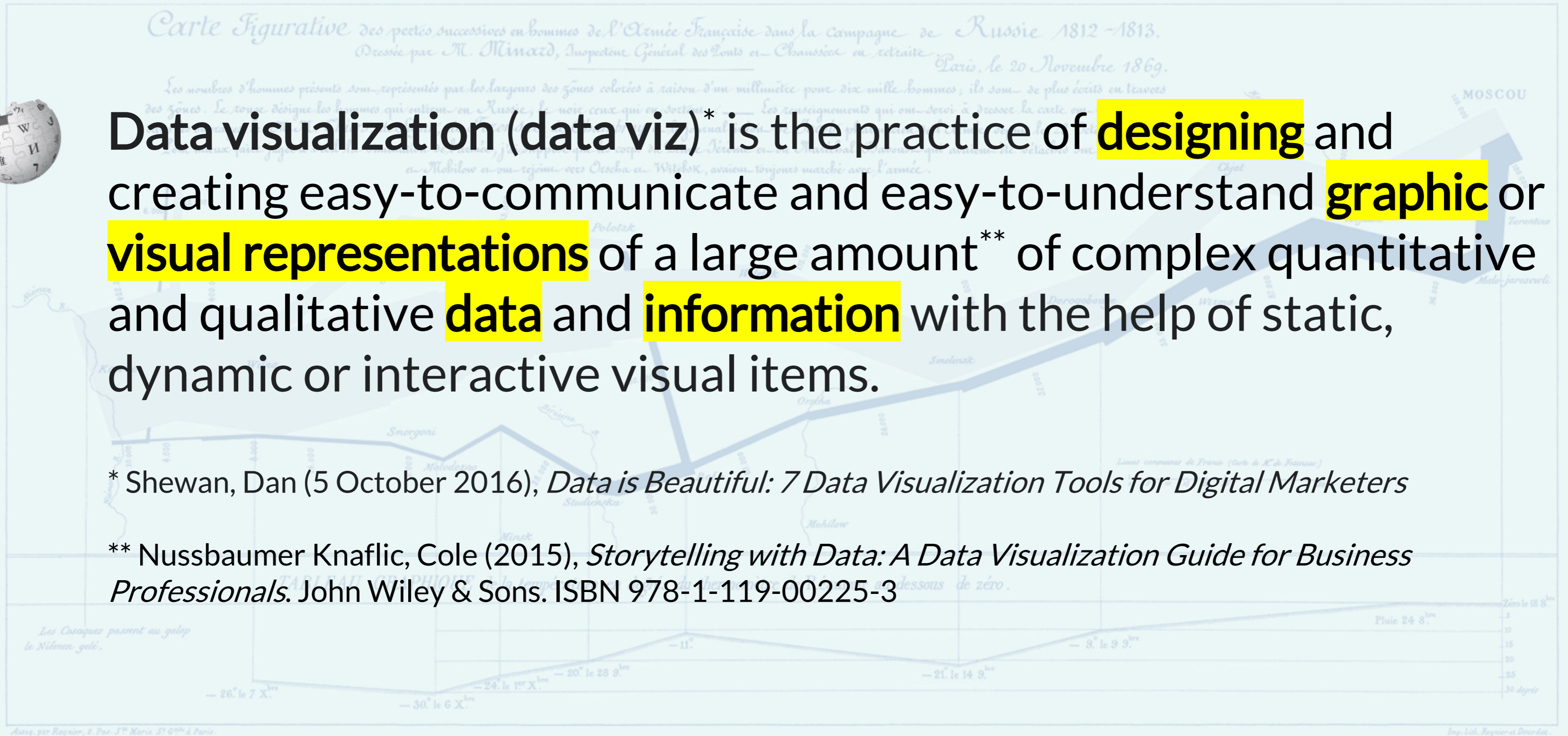
# Data viz



Data visualization (data viz)\* is the practice of **designing** and creating easy-to-communicate and easy-to-understand **graphic** or **visual representations** of a large amount\*\* of complex quantitative and qualitative **data** and **information** with the help of static, dynamic or interactive visual items.

\* Shewan, Dan (5 October 2016), *Data is Beautiful: 7 Data Visualization Tools for Digital Marketers*

\*\* Nussbaumer Knaflic, Cole (2015), *Storytelling with Data: A Data Visualization Guide for Business Professionals*. John Wiley & Sons. ISBN 978-1-119-00225-3

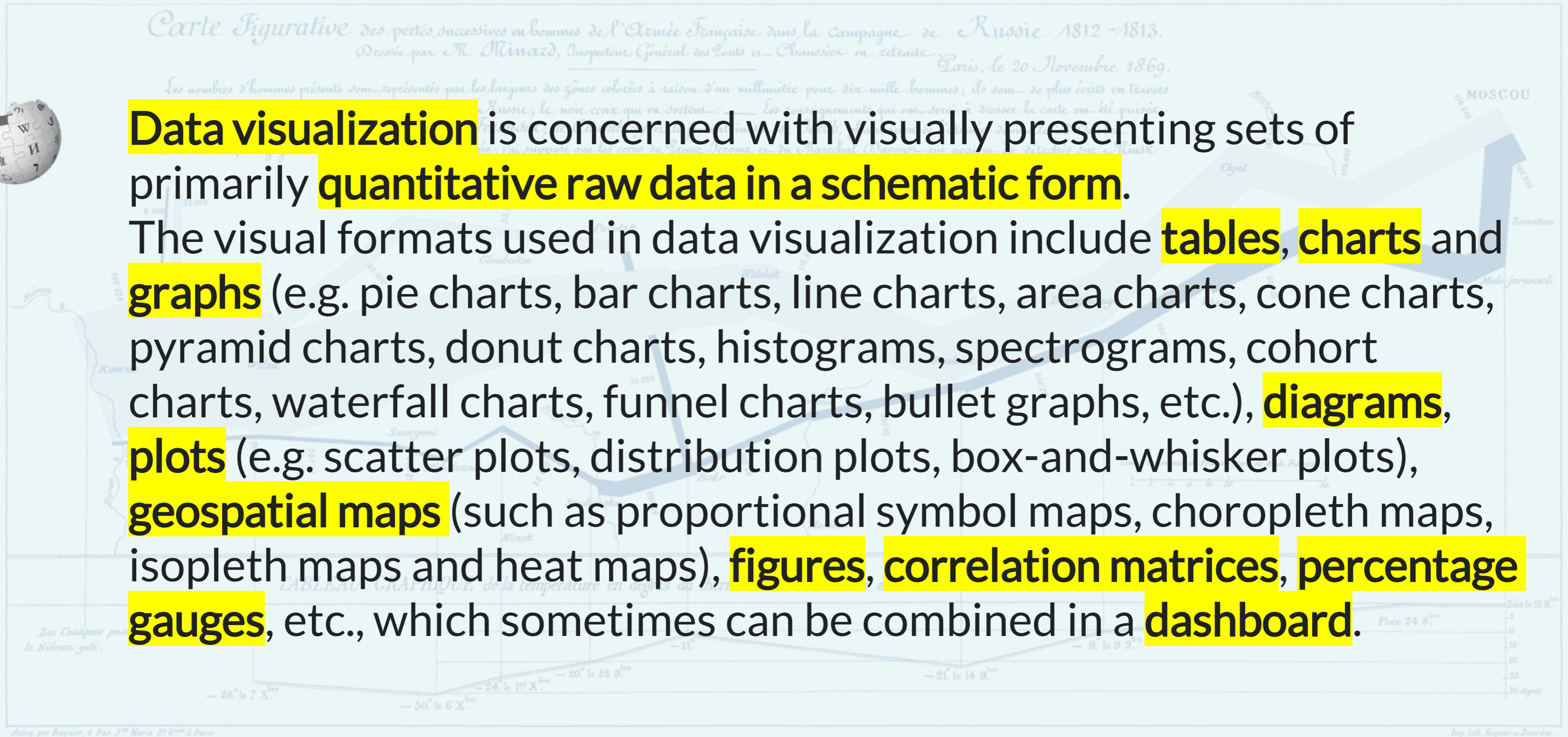


# Data viz



**Data visualization** is concerned with visually presenting sets of primarily **quantitative raw data in a schematic form**.

The visual formats used in data visualization include **tables, charts** and **graphs** (e.g. pie charts, bar charts, line charts, area charts, cone charts, pyramid charts, donut charts, histograms, spectrograms, cohort charts, waterfall charts, funnel charts, bullet graphs, etc.), **diagrams**, **plots** (e.g. scatter plots, distribution plots, box-and-whisker plots), **geospatial maps** (such as proportional symbol maps, choropleth maps, isopleth maps and heat maps), **figures, correlation matrices, percentage gauges**, etc., which sometimes can be combined in a **dashboard**.



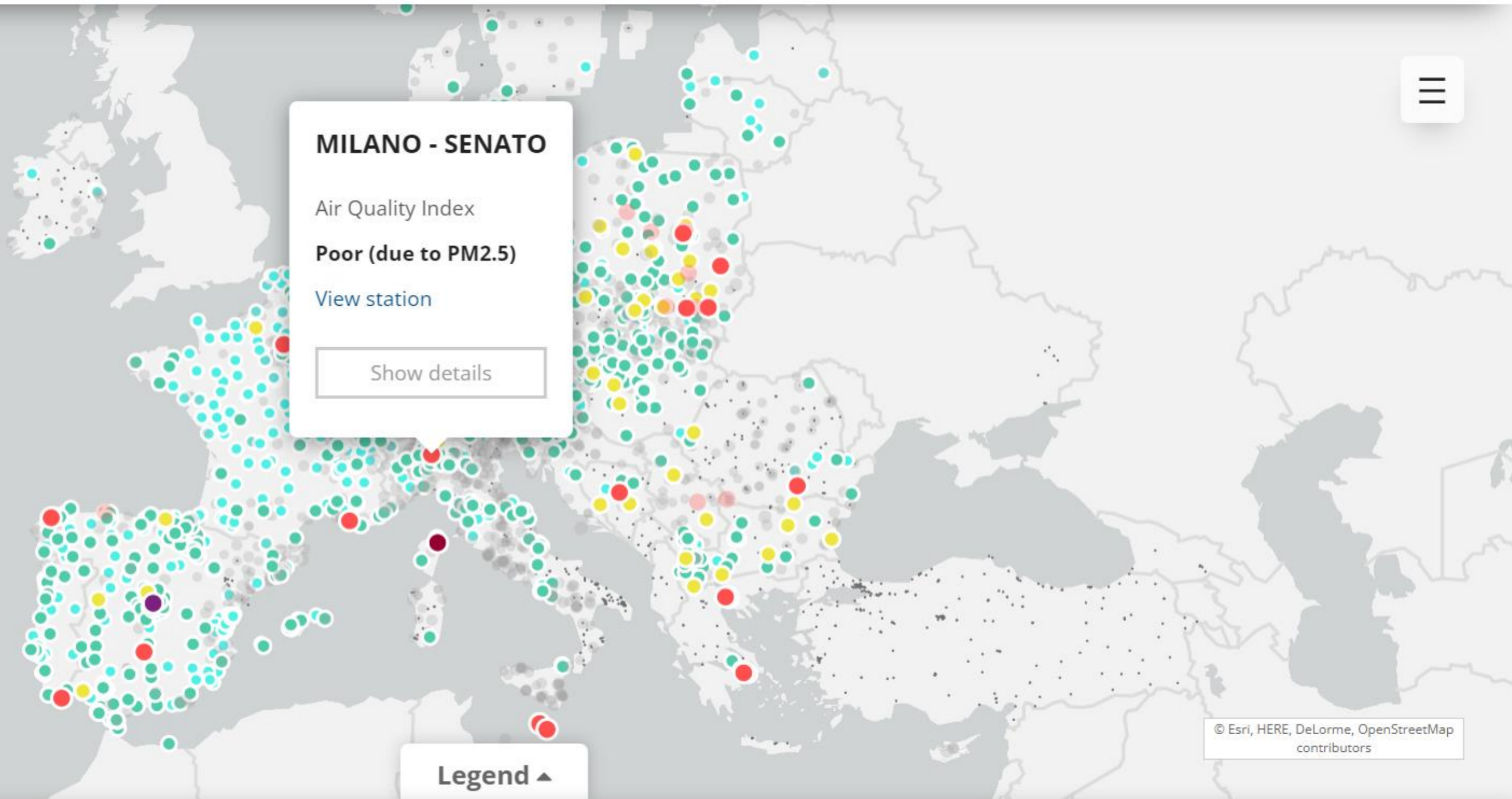
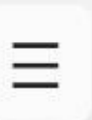
# AIR QUALITY INDEX (EEA)

<https://airindex.eea.europa.eu/Map/AQI/Viewer/>



## European Air Quality Index

2023-09-27 07:00 UTC+2



# MILANO - SENATO (IT1016A)

**Air Quality Index** Poor (due to PM2.5)  
**Date** 2023-09-27 08:00 UTC+2  
**Country** Italy  
**Location** VIA SENATO ANG MARINA - Milano (MI)  
**Classification** Traffic  
**Area** Urban

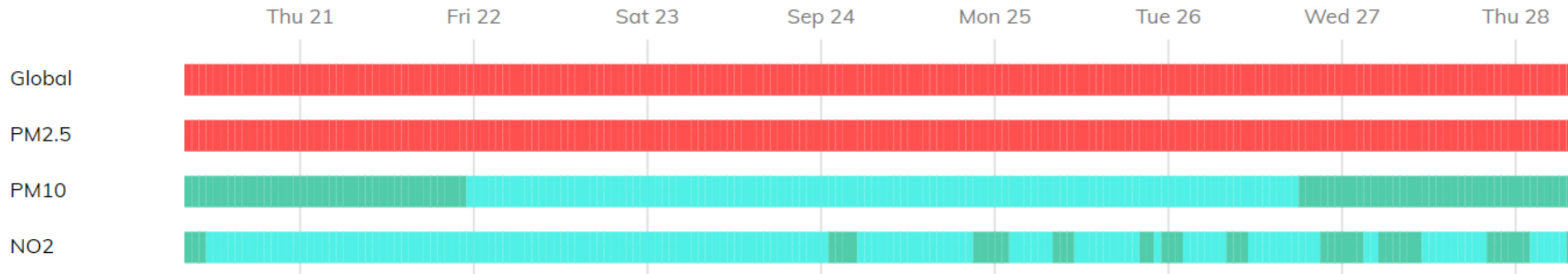
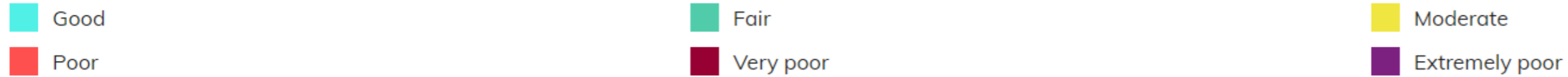
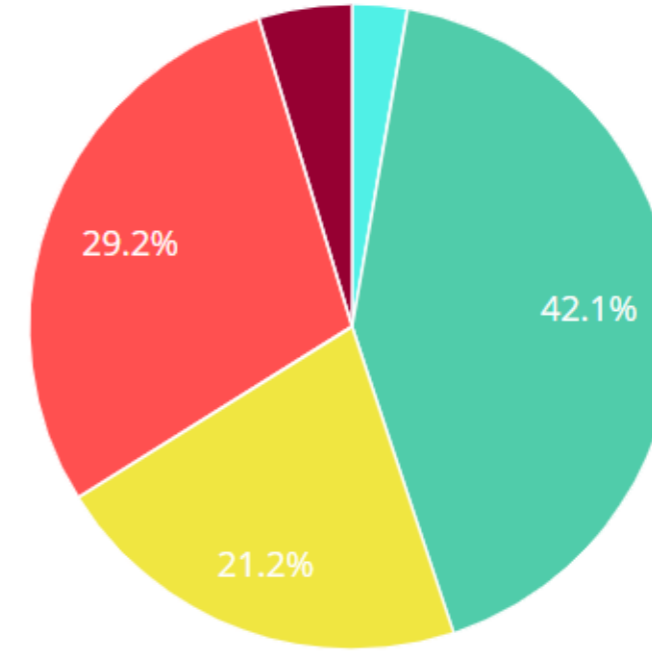
## General population

Consider reducing intense activities outdoors, if you experience symptoms such as sore eyes, a cough or sore throat.

## Sensitive population

Consider reducing physical activities, particularly outdoors, if you experience symptoms.

## Accumulated past 365 days



# Legend explained



Circles and dots on the map represent the locations of air quality monitoring stations. The colour corresponds to the air quality index at the given hour at that station. Note that it does not reflect the annual average measured at the air quality situation which may differ significantly (see Info).

Measurements of up to five key pollutants supported by modelled data determine the index level that describes the current air quality situation at each monitoring station. The index corresponds to the poorest level for any of five pollutants according to the following scheme.

Pollutant	Index level (based on pollutant concentrations in µg/m3)					
	Good	Fair	Moderate	Poor	Very poor	Extremely poor
Particles less than 2.5 µm (PM <sub>2.5</sub> )	0-10	10-20	20-25	25-50	50-75	75-800
Particles less than 10 µm (PM <sub>10</sub> )	0-20	20-40	40-50	50-100	100-150	150-1200
Nitrogen						

# Daily Air Quality Tracker (EPA, US)

<https://www.epa.gov/outdoor-air-quality-data/air-data-daily-air-quality-tracker>



## Air Data - Daily Air Quality Tracker

Compare daily AQI values for any year with the 20-year high and low (2000-2019) and the five-year average (2015-2019). You can also generate a [one-page PDF report for 2020](#).

More information: The most recent AQI values are based on available ozone and PM<sub>2.5</sub> data from AirNow (see "Use of AirNow Data" info box). The 20-year high/low backdrop is based on AQS data from 2000-2019. It shows the range of the highest and lowest daily max AQI values on each date. The 5-year average is based on AQS data from 2015-2019. It shows the average of daily max AQI values on each date.

**Tip:** Hover over lines to display data points. Download the data using the link below the charts.

1. Pollutant
  2. Year
  3. Geographic Area
- or --
- 

### Use of AirNow Data

This plot provides ozone and PM<sub>2.5</sub> data from [AirNow](#) for recent days that are not available from AQS. AQS data, as it becomes available, replaces any AirNow data. The AirNow data are not fully verified and validated through the quality assurance procedures monitoring organizations use to officially submit and certify data on the EPA AQS (Air Quality System) and, therefore, cannot be used to formulate or support regulation, guidance or any other Agency decision or position.

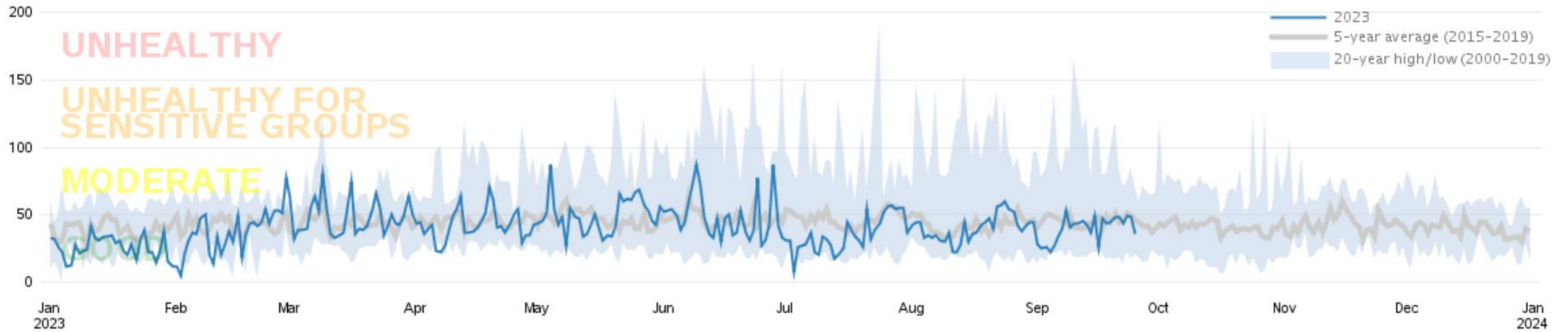
# Daily Air Quality Tracker (EPA, US)

<https://www.epa.gov/outdoor-air-quality-data/air-data-daily-air-quality-tracker>



## Combined Ozone and PM2.5 Daily AQI Values

Tuscaloosa County, AL



Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: September 27, 2023



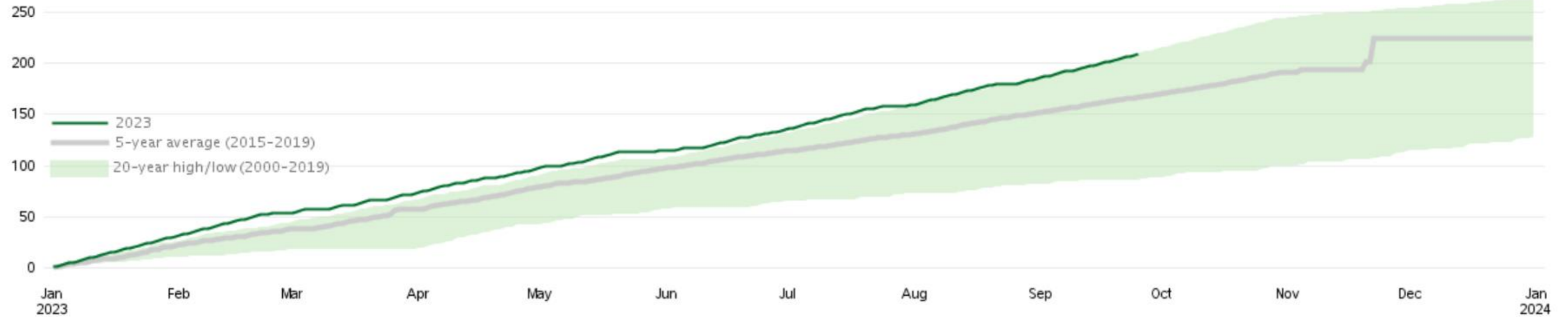
# Daily Air Quality Tracker (EPA, US)

<https://www.epa.gov/outdoor-air-quality-data/air-data-daily-air-quality-tracker>



## Cumulative Number of Good AQI Days (AQI<50)

Tuscaloosa County, AL



Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: September 27, 2023

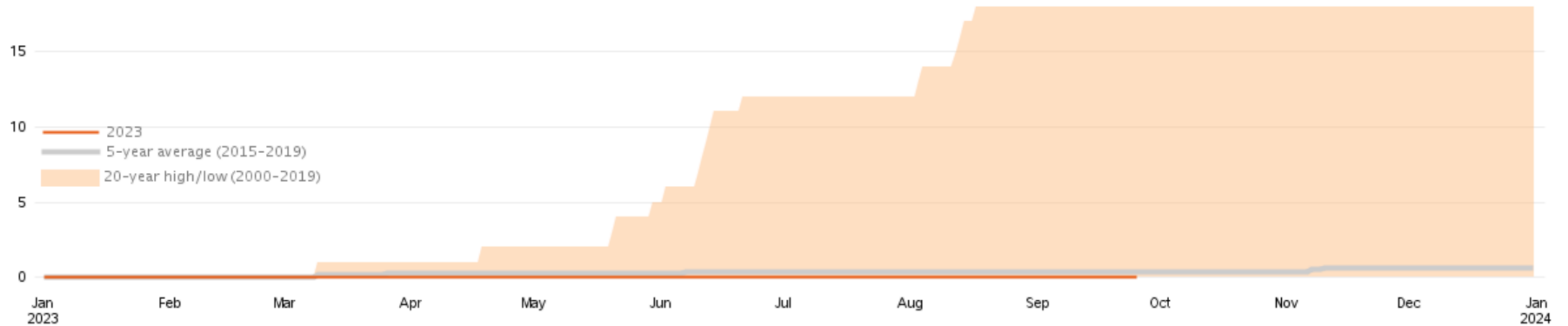
# Daily Air Quality Tracker (EPA, US)

<https://www.epa.gov/outdoor-air-quality-data/air-data-daily-air-quality-tracker>



## Cumulative Number of AQI Days >100

Tuscaloosa County, AL



Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: September 27, 2023

The following data links are active for the next 10 minutes, after which you must resubmit your query.

[Download AQI data from first chart](#)

[Download AQI day counts from second and third charts](#)




# AIR QUALITY DASHBOARD (Bristol, UK)

<https://opendata.bristol.gov.uk/apps/air-quality-dashboard/explore>




## Air Quality Dashboard


Membro privato   
Bristol City Council

Visualizzare i dettagli completi


## Dettagli

 Applicazione  
Web Experience

 20 giugno 2023  
Data aggiornamento

 25 aprile 2023  
Data di pubblicazione

 Pubblico  
Chiunque può vedere questo contenuto

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Richiedere autorizzazione all'utilizzo



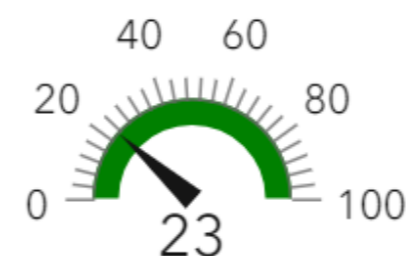
## Air Quality

Current air quality at continuous analysers according to the [National Air Quality Index](#)

### NO<sub>2</sub>



Parson Street School  
Air Quality Index (pollution) is Low



Wells Road  
Air Quality Index (pollution) is Low



Bristol St.Paul's  
Air Quality Index (pollution) is Low

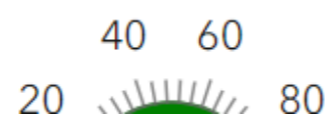


Brislington Depo  
Air Quality Index (pollution) is Low

Bristol Temple Way  
Air Quality Index (pollution) is Low

Colston Avenue  
Air Quality Index (pollution) is Low

Marlborough Stree  
Air Quality Index (pollution) is Low



EDIAQI - scaletta webinar venerdì 29/9 | Microsoft Teams Classic



# AIR QUALITY DASHBOARD (Bristol, UK)

<https://opendata.bristol.gov.uk/apps/air-quality-dashboard/explore>




## Air Quality Dashboard

 **Membro privato** ⓘ  
Bristol City Council


Visualizzare i dettagli completi

### Dettagli

 **Applicazione**  
Web Experience

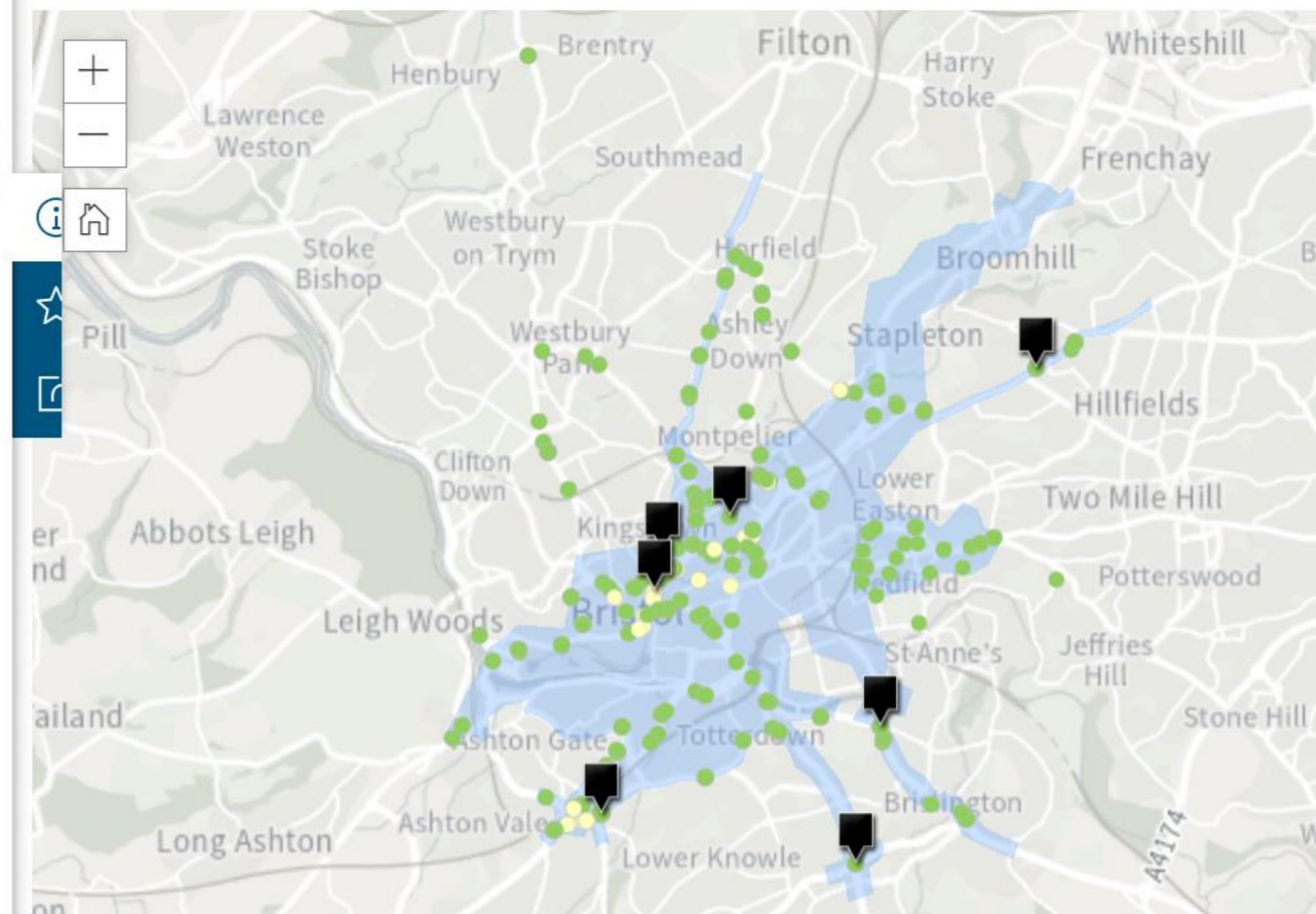
 **20 giugno 2023**  
Data aggiornamento

 **25 aprile 2023**  
Data di pubblicazione

 **Pubblico**  
Chiunque può vedere questo contenuto

 **Nessuna licenza fornita**  
Richiedere autorizzazione all'utilizzo

## Air Quality Monitoring Sites



Real-time air quality monitors

NO2 diffusion tubes

Annual mean NO2 concentration  $\mu\text{g}/\text{m}^3$  in 2022

- > 60 - 80
- > 40 - 60
- 0 - 40

Air Quality Management Area

# AIR QUALITY DASHBOARD (Bristol, UK)

<https://opendata.bristol.gov.uk/apps/air-quality-dashboard/explore>



## Air Quality Dashboard

 **Membro privato** ⓘ  
Bristol City Council

[Visualizzare i dettagli completi](#)


### Dettagli

 **Applicazione**  
Web Experience

 **20 giugno 2023**  
Data aggiornamento

 **25 aprile 2023**  
Data di pubblicazione

 **Pubblico**  
Chiunque può vedere questo contenuto

 **Nessuna licenza fornita**  
Richiedere autorizzazione all'utilizzo

### Annual Mean NO2 Concentrations

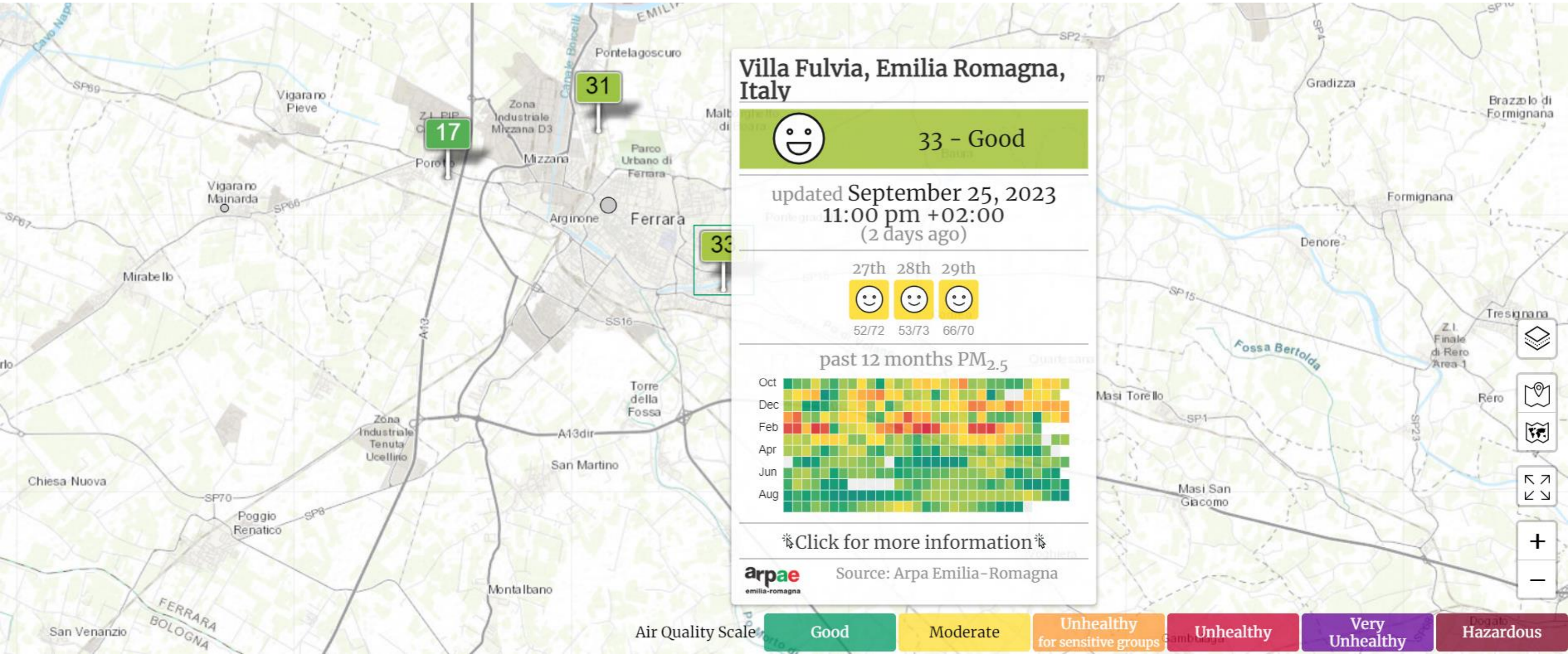
SitelD	Location	Year_	Concentration_...
2	Colston Avenue	2022	40,2897529056838
4	Three Lamps	2022	38,4014069892562
11	Whitefriars	2022	35,2616694678052
14	Red Lion Knowle	2022	30,3314965204197
125	York Road	2022	33,6049669151944
295	Lamppost 16 Ashley Road...	2022	41,047731600907
371	Lamb Street façade	2022	29,0050002168853
487	Junction 3 Millpond Street	2022	36,8101780759791

### Statistics

Sites exceeding 40 µg/m-3 NO2 (legal limit)

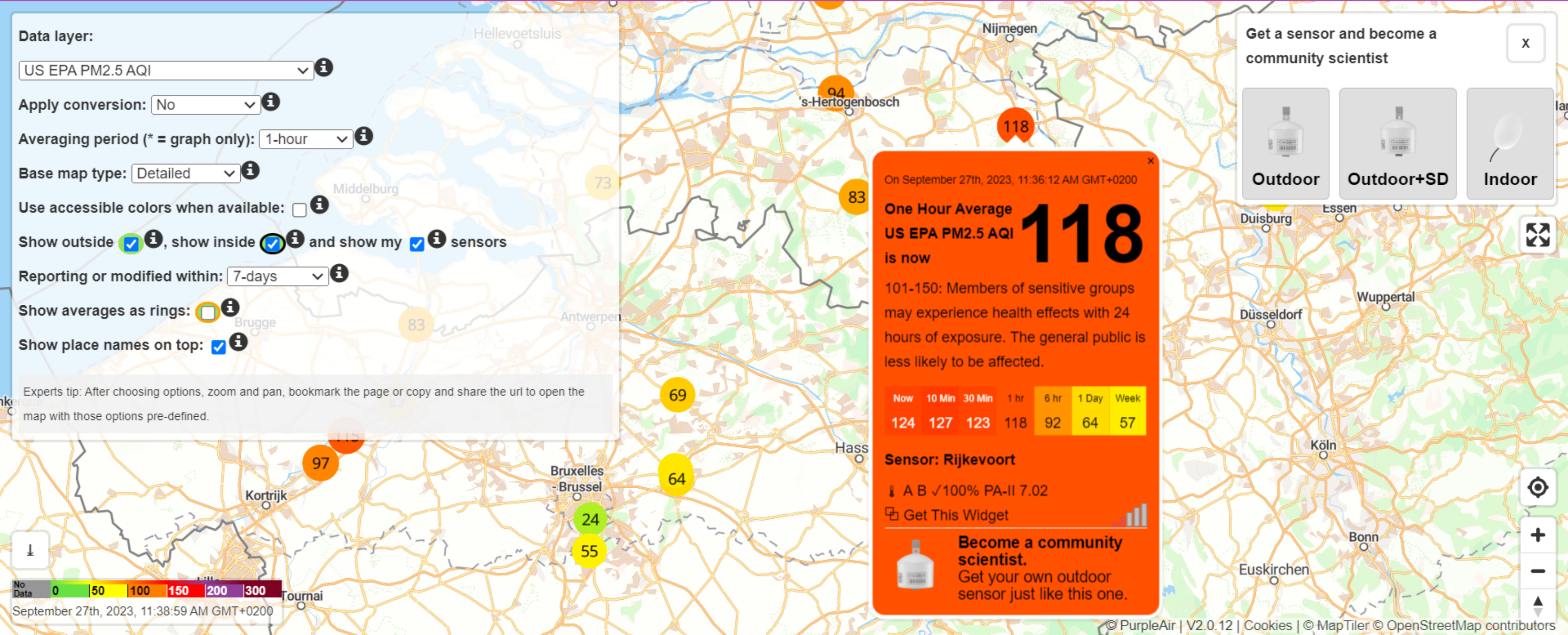
# World's Air Pollution

<https://waqi.info/>



# PURPLE AIR (citizen science)

<https://map.purpleair.com/>



# Sensor Up (Calgary, CA)

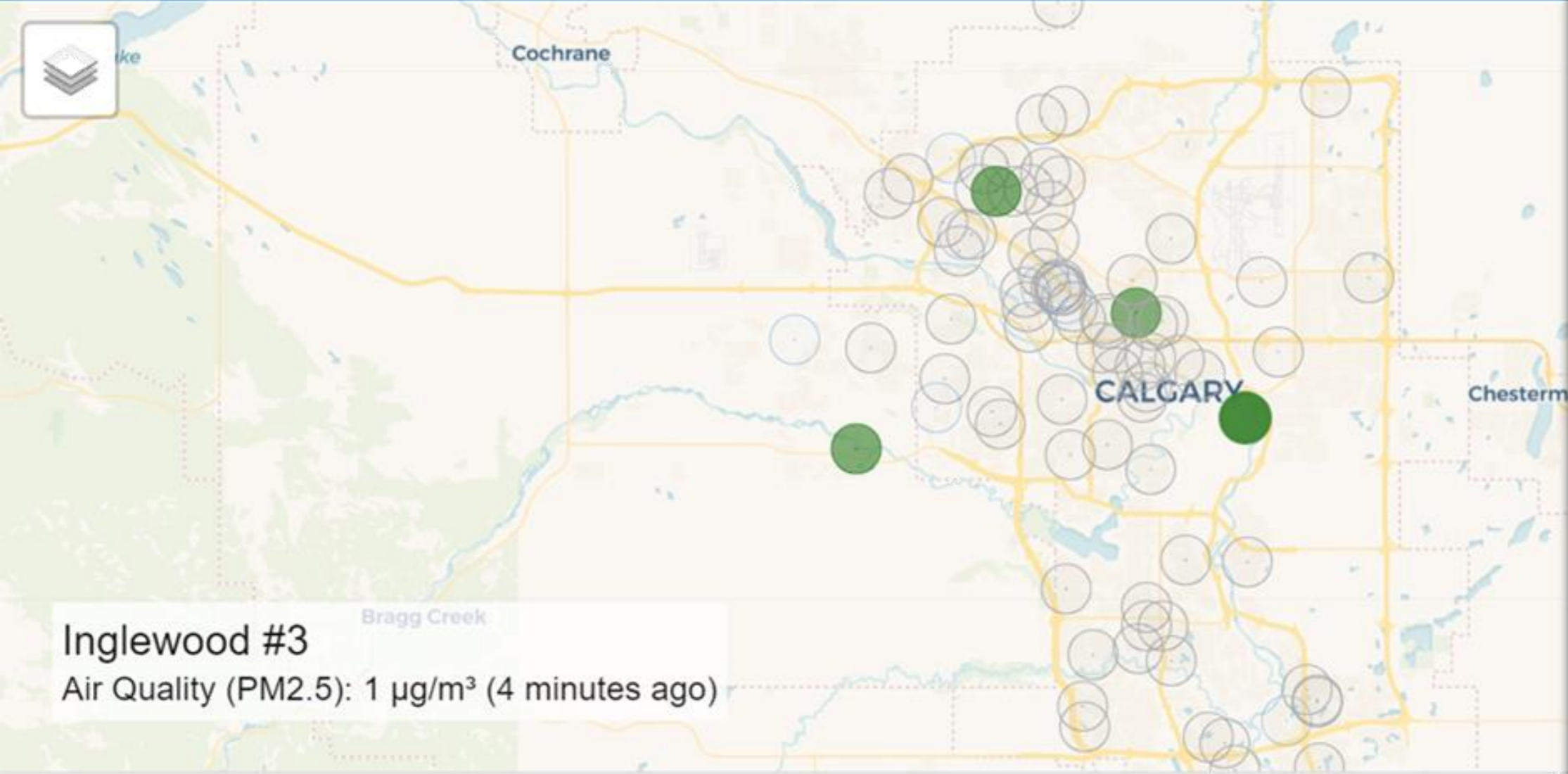
<https://smartcalgary.sensorup.com/>



A SMART CITIES PROJECT BY sensorup

Tue, Sep 26, 2023 9:00 PM

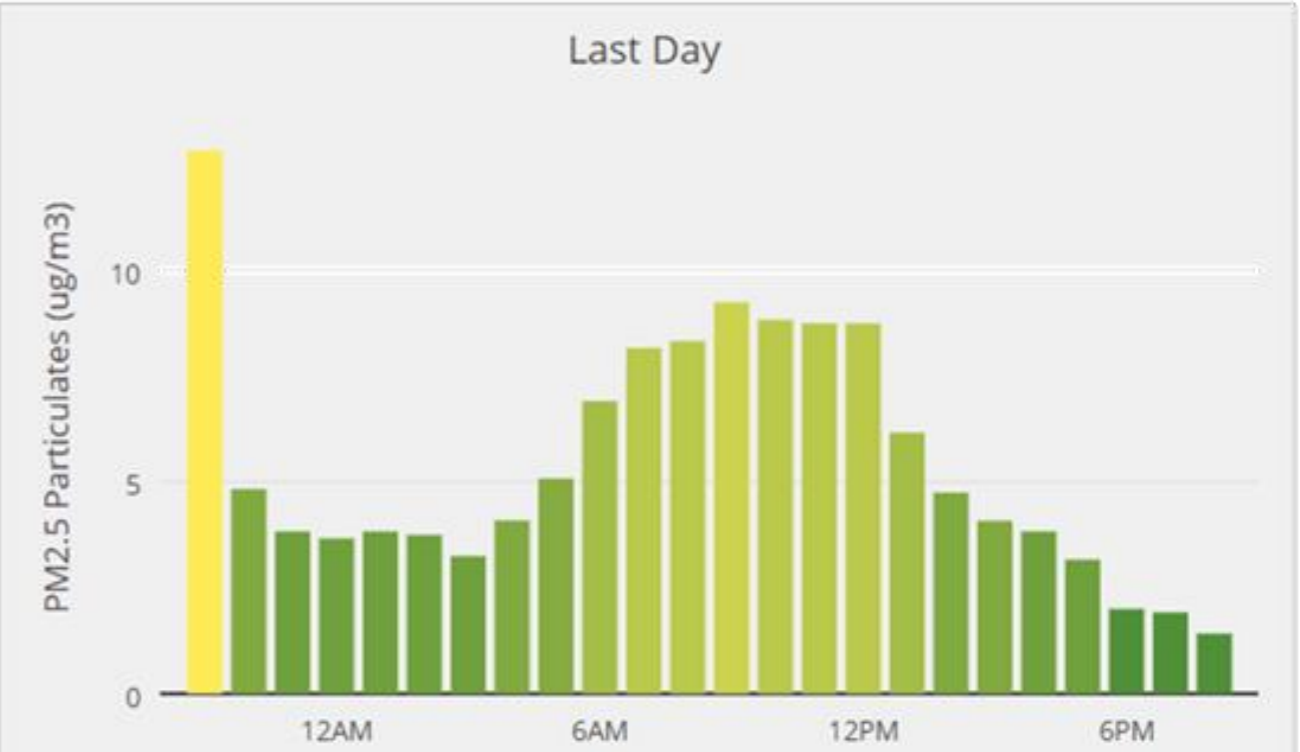
## Air Quality in Calgary



This site include  
been validat

## Inglewood #3

[Mobile page](#)





# Sensor Up (Calgary, CA)

<https://smartcalgary.sensorup.com/>



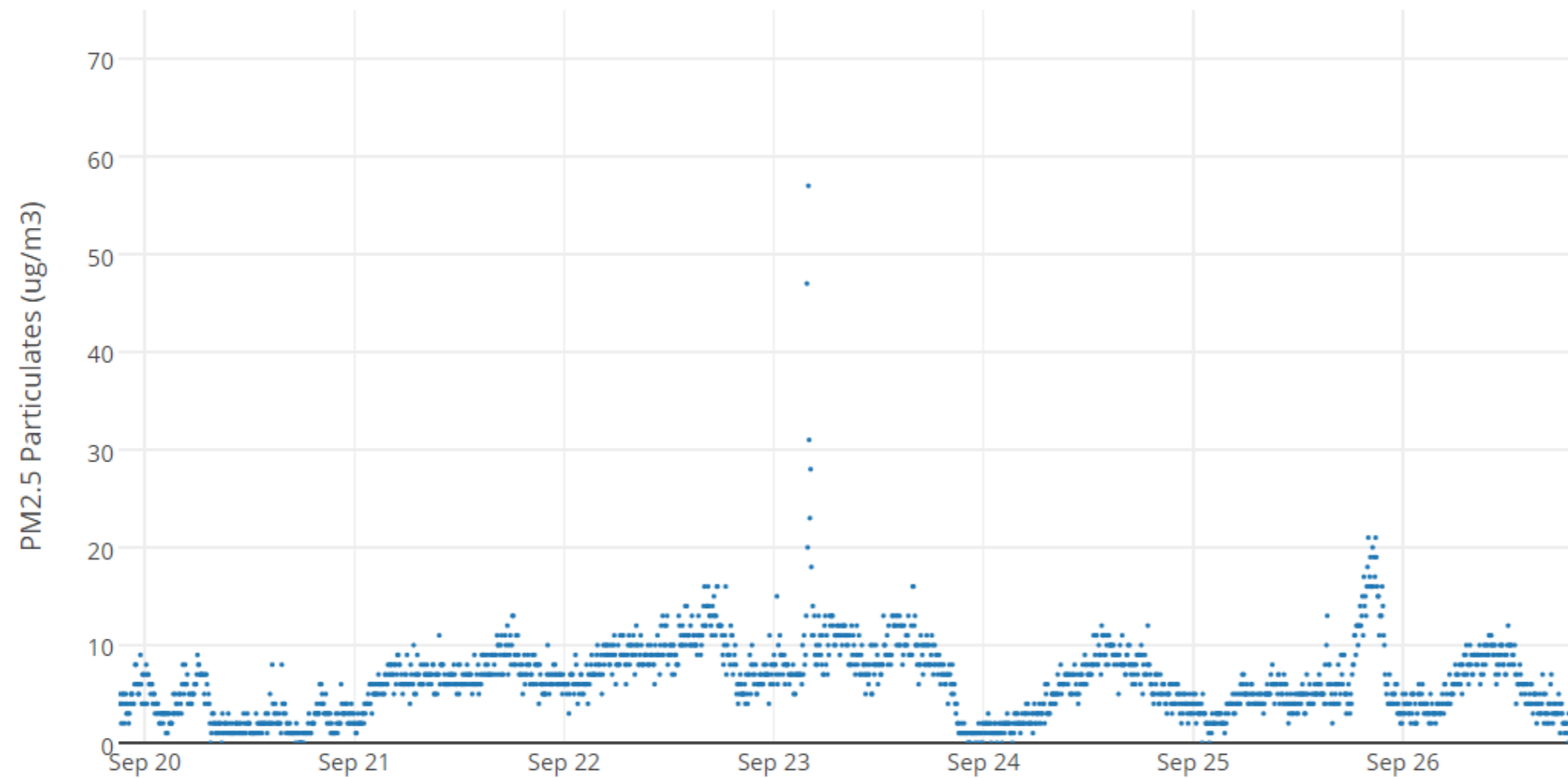
## Little Dots

Tue, Sep 26, 2023 9:00 PM ✕

So, how's our air lately? Let's take a look at some data in pretty raw form.

Inglewood #3 ▼

Fine Particle Levels in Inglewood #3



# Sensor Up (Calgary, CA)

<https://smartcalgary.sensorup.com/>

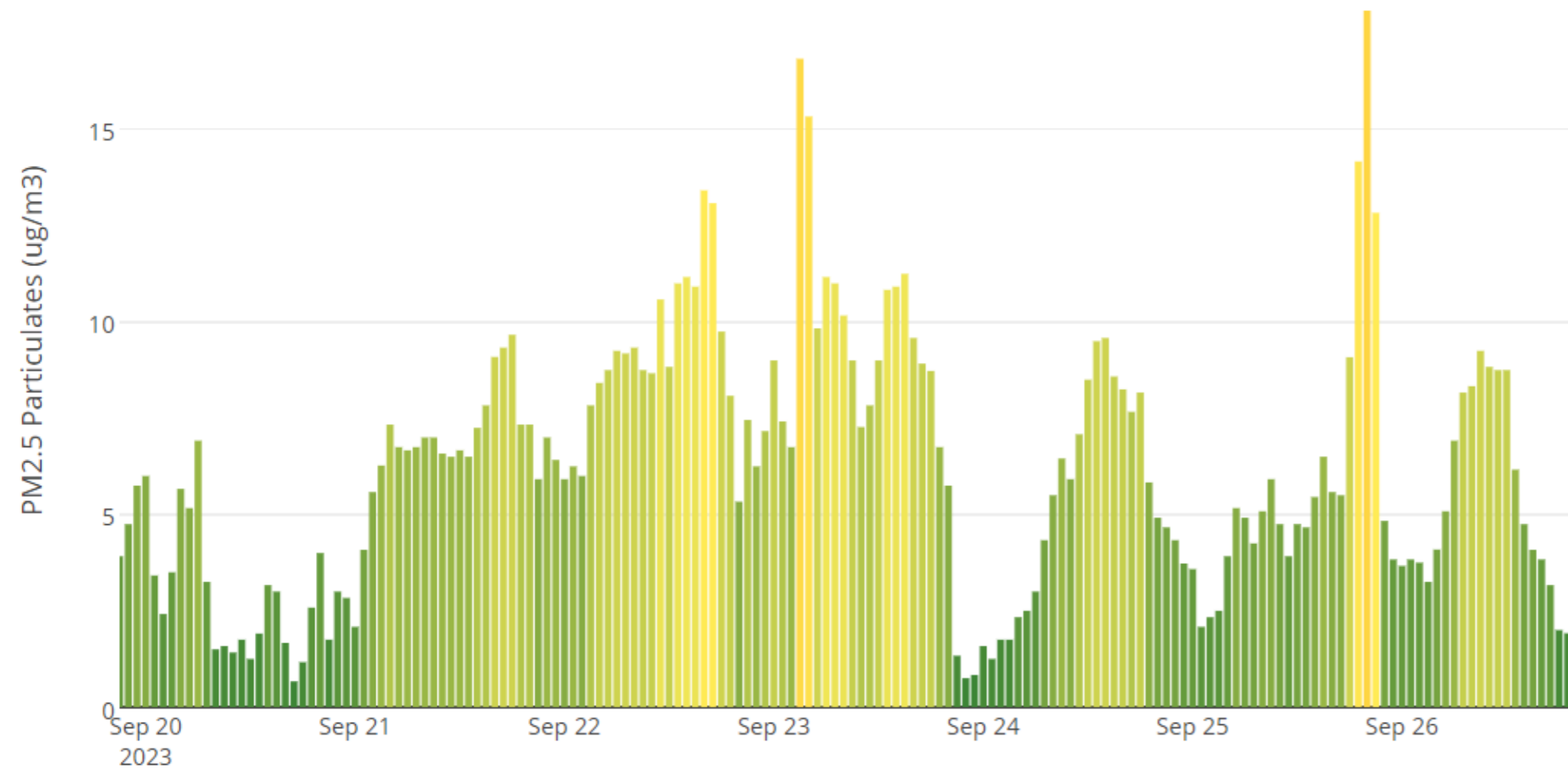


Tue, Sep 26, 2023 9:00 PM

Now, let's look at the data in glorious colour!

Inglewood #3

Hourly PM2.5 Levels in Inglewood #3



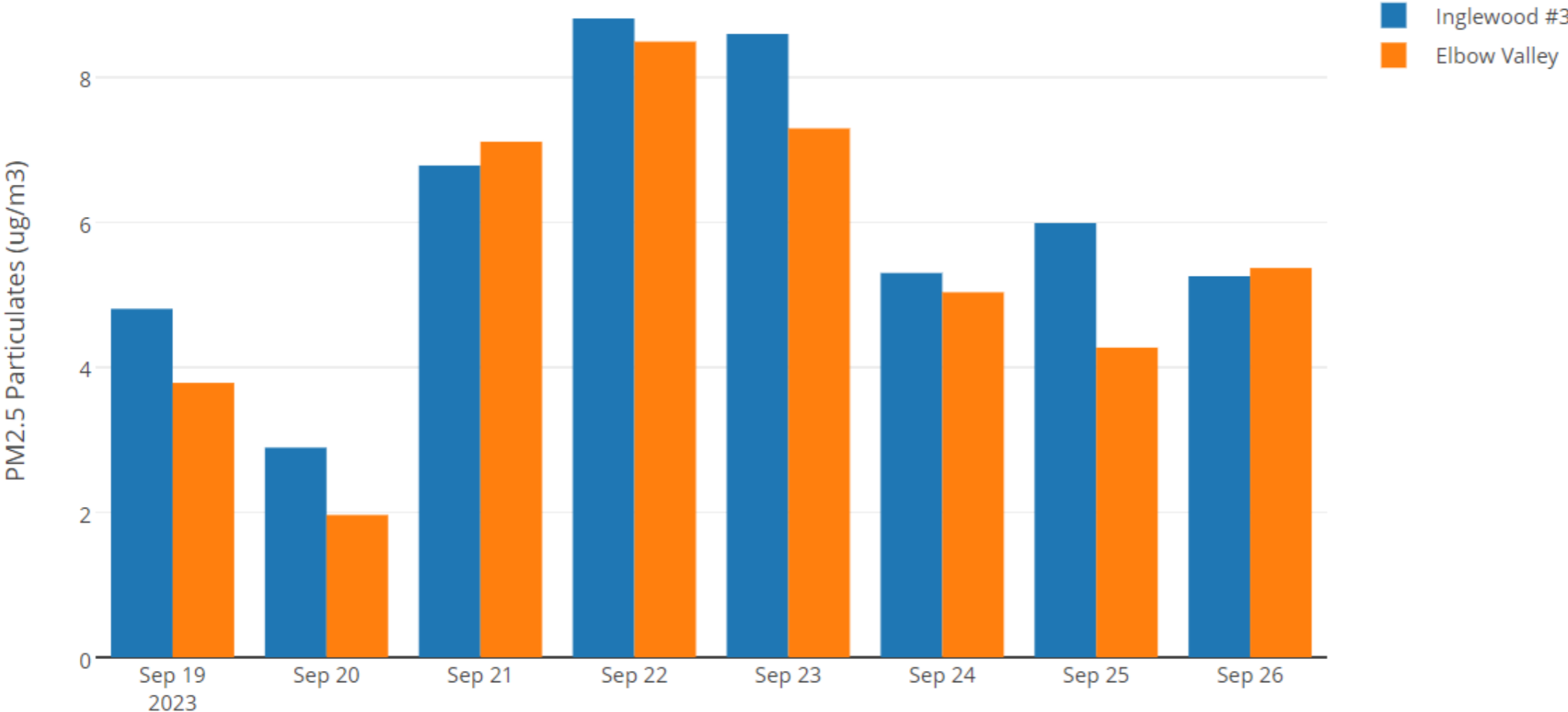
# Dare to Compare

You might be curious how the PM2.5 readings vary in different areas. Not for bragging reasons, of course. You're too mature for that. And not only are you mature, you are also thoughtful, you realize that particulate readings can vary for many reasons, and that comparisons do not necessarily highlight problems in any specific area.

Let's take a look.

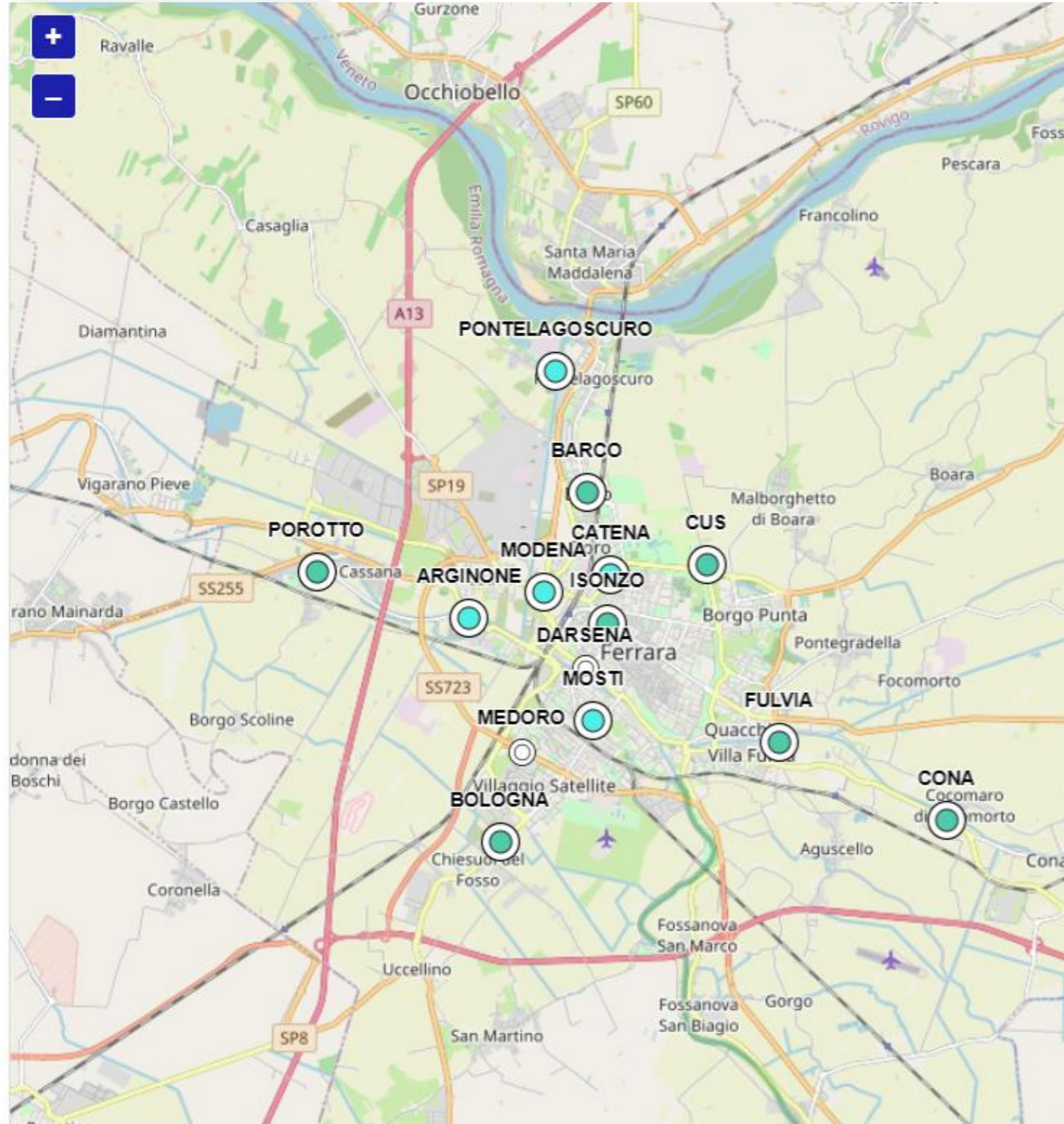
vs

Inglewood #3 vs Elbow Valley  
(lower is better)



# AIR BREAK INDEX (Ferrara, Italy)

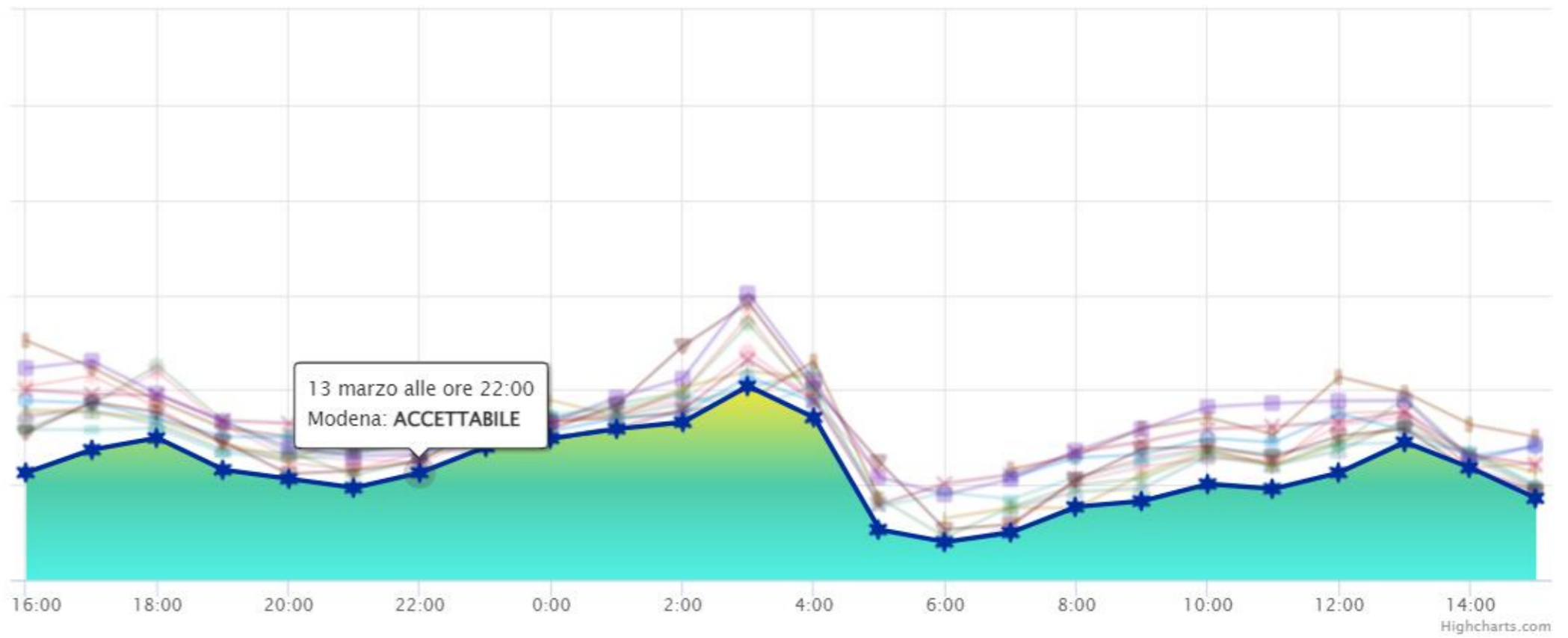
<https://airbreakferrara.net/che-aria-tira/>



- BARCO ×
- MODENA ×
- CATENA ×
- ARGINONE ×
- ISONZO ×
- MOSTI ×
- BOLOGNA ×
- CONA ×
- FULVIA ×
- PONTELAGOSCURO ×
- CUS ×
- POROTTO ×
- MEDORO ×
- DARSENA ×

Nascondi tutte le centraline

Indice AirBreak



# AIR BREAK INDEX (Ferrara, Italy)

<https://airbreakferrara.net/che-aria-tira/>



Calcolati oggi alle 09:00

Polveri sottili  
PM<sub>2.5</sub>



MEDIOCRE

Polveri sottili  
PM<sub>10</sub>



BUONA

Biossido di azoto  
NO<sub>2</sub>



BUONA

Ozono  
O<sub>3</sub>



BUONA

Monossido di carbonio  
CO



BUONA

# AIR BREAK INDEX (Ferrara, Italy)

<https://airbreakferrara.net/che-aria-tira/>



Scegli di  Vedere  Non vedere  l'inquinamento

Ferrara, oggi alle 09:00



Qualità dell'aria



Buona



Accettabile



Mediocre



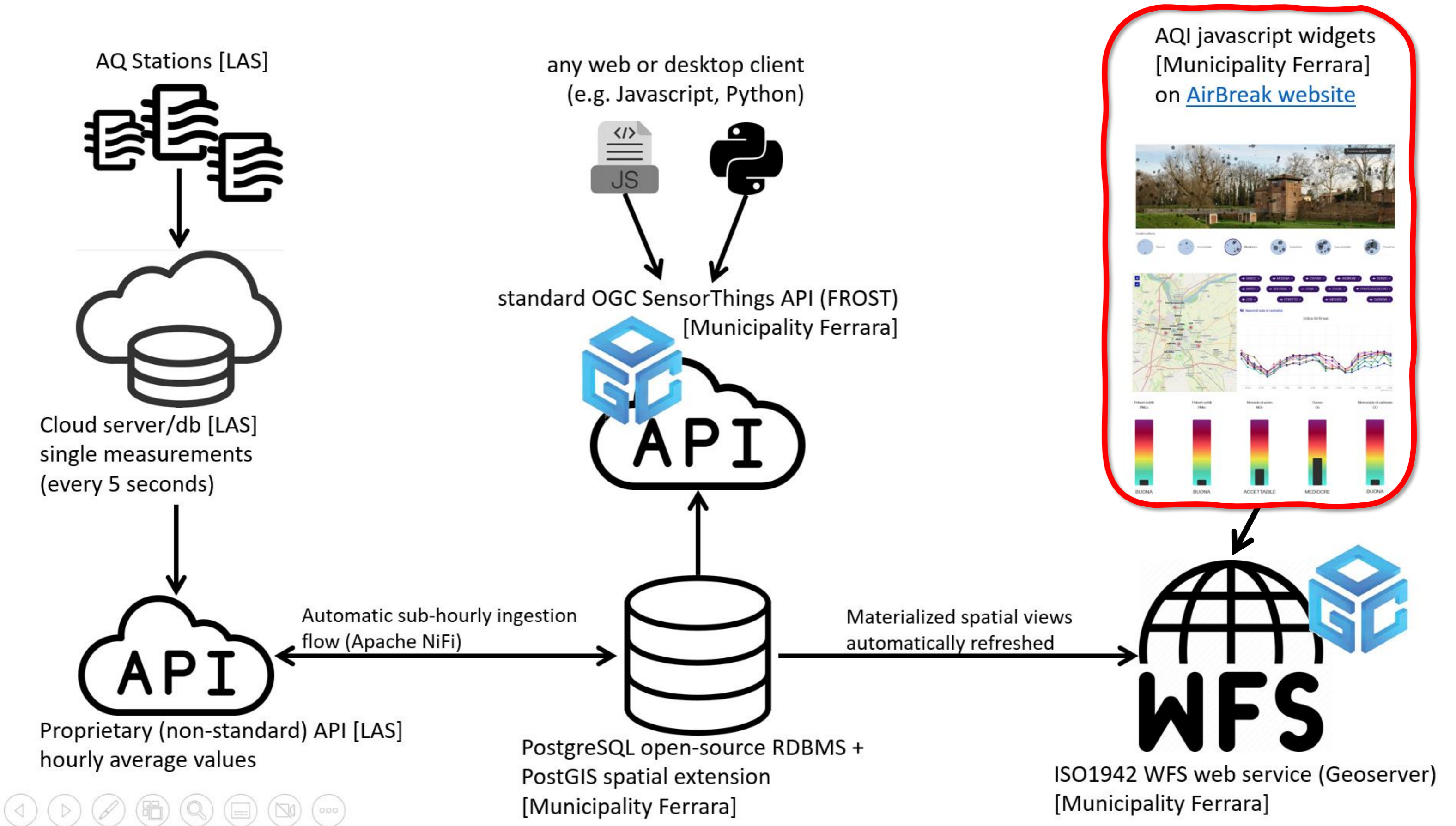
Scadente



Inaccettabile



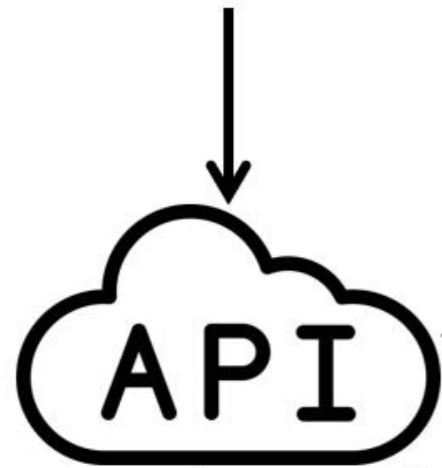
Pessima



AQ Stations [LAS]



Cloud server/db [LAS]  
single measurements  
(every 5 seconds)



Proprietary (non-standard) API [LAS]  
hourly average values

any web or desktop client  
(e.g. Javascript, Python)



standard OGC SensorThings API (FROST)  
[Municipality Ferrara]



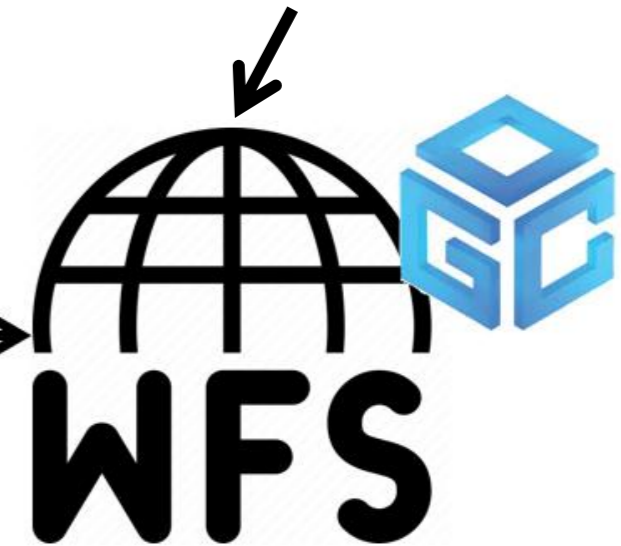
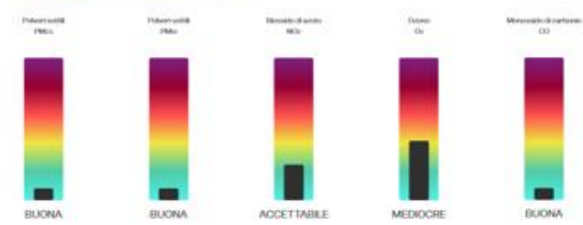
Automatic sub-hourly ingestion  
flow (Apache NiFi)

Materialized spatial views  
automatically refreshed

PostgreSQL open-source RDBMS +  
PostGIS spatial extension  
[Municipality Ferrara]



AQI javascript widgets  
[Municipality Ferrara]  
on [AirBreak website](#)



ISO1942 WFS web service (Geoserver)  
[Municipality Ferrara]

