
VISUALIZATION OF AIR POLLUTION (PM₁₀, PM_{2.5}, NO₂, O₃) AND ITS HEALTH IMPACT IN SLOVENIA

INTERACTION AND INFORMATION DESIGN

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PROJECT TITLE & RESEARCH MOTIVATION

- **Research domain:** Interactive visualization of environmental and health data
 - **Problem statement:** Despite the availability of open data (ARSO, EEA), the public lacks a comprehensive visual tool to understand long-term PM₁₀, PM_{2.5}, NO₂, O₃ trends and their impact on health. A tool that connects available data from relevant sources and combines everything into one visualization.
 - **Motivation:** Air pollution remains one of the main environmental health risks in Europe (WHO, 2023). In Slovenia, PM₁₀ levels often exceed WHO recommendations, especially during winter.
 - **Expected contribution:** An interactive, visually engaging dashboard presenting history of PM₁₀, PM_{2.5}, NO₂, O₃ data across Slovenian cities, linked to scientific findings on health outcomes.
- Data sources:**
- ARSO – [Outdoor Air and Precipitation Quality Data](#)
 - EEA – [Air Quality Download Service](#)
 - ARSO Indicator – [Population Exposure to PM₁₀](#)

RESEARCH BACKGROUND

- **Seminal paper:**

Beelen et al. (2014), *Effects of Long-Term Exposure to Air Pollution on Natural-Cause Mortality, The Lancet*

- **Core idea:** Long-term exposure to $PM_{2.5}$ and PM_{10} increases mortality risk even below current EU limit values.

- **Impact:** The groundbreaking ESCAPE study, which forms the basis for European guidelines for health and air quality.

- **Limitations:** There is no localized, interactive visual interpretation for Slovenia.

- **Supporting literature:**

- [Lehtomäki et al. \(2018\)](#): *Health impacts of ambient air pollution in five Southern European countries (including Slovenia)*

- [Khomenko et al. \(2021\)](#): *Premature mortality due to air pollution in European cities*

- [Beelen et al. \(2014\)](#): *ESCAPE – Long-term mortality study*

IDENTIFIED RESEARCH GAP AND OUR GOALS

- **Gap:** There is no public, interactive visualization linking PM_{10} , $PM_{2.5}$, NO_2 , O_3 trends to scientific evidence on health impacts.
- **Objectives:**
 - Visualization of PM_{10} , $PM_{2.5}$, NO_2 , O_3 changes in Slovenian regions (2001–2025)
 - Linking concentration data to epidemiological health indicators (mortality, respiratory diseases)
 - Development of an intuitive, educational visualization for public awareness

• **Hypothesis:** Interactive visualizations of long-term pollution trends improve public understanding of environmental health risks.

Data sources:

- [ARSO Daily Air Quality Data](#)
- [EEA AirBase Historical Dataset \(2000–2012\)](#)
- [EEA e-Reporting \(2013–2025\)](#)

OUR PROPOSED METHODOLOGY

- **Approach type:** Combination of existing data analysis and visualization methods (D3.js, Vega-Lite).

- **Data / Tools / Methods:**

- **Data:** ARSO XML + EEA CSV (PM_{10} , $PM_{2.5}$, NO_2 , O_3 , etc.)

- **Tools:** Python (pandas), D3.js, Vega-Lite, Observable, Overleaf

- **Expected outcomes:**

- Interactive time-series graphs and maps of PM_{10} , $PM_{2.5}$, NO_2 , O_3 levels (2001–2025)

- Visualization of EU/WHO threshold values and health impacts

- Clear visual storytelling about air quality improvement and risks

- **Evaluation plan:**

- Validate data consistency (ARSO vs EEA)

- Conduct user experience tests

- Compare results with NIJZ public health indicators

LITERATURE MAPPING & NEXT STEPS

- **Citations overview:**

- Beelen et al. (2014) – ESCAPE long-term mortality
 - Raaschou-Nielsen et al. (2013) – Air pollution and lung cancer
 - Lehtomäki et al. (2018) – Health burden in Southern Europe
 - Khomenko et al. (2021) – Mortality in European cities
- **How it fits:** The project bridges scientific findings on PM₁₀ health impacts with real-time, open environmental data and interactive design.

- **Next steps:**

- Weeks 1–2: Data cleaning (ARSO, EEA)
- Weeks 3–4: Structuring datasets and preliminary visualization
- Weeks 5–7: Dashboard implementation and interactivity
- Week 8: Evaluation, final report, and short demo video