

France - Application of the Bayesian spline method to analyze the real-time measurements of ultrafine particle concentration in Parisian subway

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Overview

Identification

ID NUMBER

10.16909-DATASET-26

Version

VERSION DESCRIPTION

Version 1.0

PRODUCTION DATE

2021-04-19

Overview

ABSTRACT

Background

Air pollution in subway environment is a growing concern as it often exceeds WHO recommendations for indoor air quality. Ultrafine particles (UFP), for which there is still no regulation, neither standardized exposure monitoring method, are the strongest contributor to this pollution when the number concentration is used as exposure metric.

Objectives

We aimed to assess the real-time UFP number concentration in the personal breath zone (PBZ) of three types of underground Parisian subway professionals and analyze it using a novel Bayesian spline approach. Consecutively, we investigate the effect of jobs, week days, subway stations, worker location and some events on UFP number concentration.

Methods

The data collection procedure, originating from a longitudinal study, lasted for a total duration of 6 weeks from 7 October 2019 to 15 November 2019, two weeks per type of subway professionals. Time-series were built from the real-time particle number concentration (PNC) measured in the PBZ of professionals during their work-shifts. Complementarily, contextual information expressed as Station, Environment and Event variables were extracted from activity logbooks completed for every work-shift by study technicians. Subsequently, the Bayesian spline approach was applied to model PNC within a Bayesian framework as a function of the latter contextual information.

Results

Overall, the Bayesian spline approach seems well suited to model real-time personal PNC data. The model enabled estimating the differences in UFP exposure between subway professionals, between stations, and different locations. Our results suggest that the PNC is higher the closer to the subway tracks with the highest PNC at the subway station platforms. Studied events had a lesser influence, as well as the day of the week

Conclusion

The application of the Bayesian spline method to investigate the individual exposure to UFP in the underground subway setting was shown feasible. This method is informative for better documenting the magnitude and variability of UFP exposure and for understanding its determinants in view of its further regulation and control.

KIND OF DATA

One script of statistical analysis using R (Suppl_file_1_BUGS_model.R)

Three csv files:

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The first one (Suppl_file_2_Summary_airborne_sample.csv) presents the summary statistics of particle number concentration per time-series, sampling type and job.

The second file (Suppl_file_3_Summary_PNC_for_Day_Station_Environment_Event.csv) regroups the descriptive summary of Particulate Number Concentration (PNC) for the following variables: days, stations, environments and events.

Finally, the third file (Suppl_file_4_Bayesian_Spline_coefficient.csv) presents the Summary statistics for coefficients δ and $\sigma(\text{Day})$, Summary statistics for coefficients $\mu\delta(\text{Job})$ and $\sigma\delta(\text{job})$, Summary statistics for coefficients $\alpha(\text{Station})$ and Summary statistics for coefficients $\beta(\text{Environments})$.

UNITS OF ANALYSIS

Particle Number Concentration (#/cm³)

KEYWORDS

Subway, Underground workplace, Exposure, Ultrafine particles, Exposure assessment, Bayesian Inference

Coverage

GEOGRAPHIC COVERAGE

Paris, France

Producers and Sponsors

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Metadata Production

METADATA PRODUCED BY

Name	Abbreviation	Affiliation	Role
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Center for Primary Care and Public Health (Unisanté), University of Lausanne, Switzerland	Unisanté		Data publisher
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Version 1.0 (December 2020)

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Sampling

Sampling Procedure

Questionnaires

Overview

Data Collection

Data Collection Dates

Start	End	Cycle
2019-09-01	2021-03-30	N/A

Data Collection Mode

Questionnaires

Data Processing

Data Editing

Data Appraisal

No content available