Contribution ID: **86** Type: **not specified**

Air Quality Monitoring: Combining Different Types of Concentration Measures to Correct Physicochemical Model Outputs

Tuesday, 12 September 2023 18:10 (20 minutes)

Our work deals with air quality monitoring, by combining different types of data. More precisely, our aim is to produce (typically at the scale of a large given city), nitrogen dioxide or fine particulate matter concentration maps, at different moments. For this purpose, we have at our disposal, on the one hand, concentration maps produced by deterministic physicochemical models (such as CHIMERE or SIRANE) at different spatiotemporal scales, and on the other hand, concentration measures made at different points, different moments, and by different devices. These measures are provided first by a small number of fixed stations, which give reliable measurements of the concentration, and second by a larger number of micro-sensors, which give biased and noisier measurements. Our approach consists in modeling the bias of the physicochemical model (e.g. due to model assumptions that are not satisfied in practice, such as constant altitude) and to estimate the parameters of this bias using all concentration measures data. Our model relies on a division of space into different zones within which the bias is assumed to follow an affine transformation of the actual concentration. Our approach allows us to improve the concentration maps provided by the deterministic models but also to understand the behavior of micro-sensors and their contribution in improving air quality monitoring. The proposed approach is first introduced, then implemented and applied numerically to a real-world dataset collected in the Grenoble area (France).

Keywords

air quality; low-cost sensors; model correction

Classification

Both methodology and application

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Session Classification: CONTRIBUTED Modelling 2

Track Classification: Modelling