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EXPLORING INPUT PARAMETER EFFECTS ON AIR POLLUTION DISPERSION MODELS: UNCERTAINTY AND IMPLICATIONS FOR ENVIRONMENTAL ASSESSMENTS

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Abstract

Air pollution poses a significant risk to public health and ecosystems. The analysis of air pollution frequently employs sophisticated numerical models to predict pollutant concentrations and guide policy decisions for effective mitigation strategies. The reliability of these models partially hinges on their sensitivity to variations in input parameters. This sensitivity can introduce significant uncertainty, particularly when these input parameters inherently exhibit variability. In this study, we analyse the uncertainty of an integrated model system for the case of the International Athens Airport, Greece, by evaluating the relationship between input parameters and air pollution dispersion outcomes and uncovering new aspects of this relationship while confirming and clarifying previously known dependencies. Wind speed has the most significant effect on concentrations, with small differences, such as 0.5m/s, leading to concentration decrease by 50%. The time of day, which reflects prevailing vertical turbulence conditions, was also found to significantly impact pollutant concentrations. For identical emission sources, emission rates, temperature, and wind characteristics, lower concentration levels were observed during the daytime, while much higher concentrations were recorded before sunrise and after sunset. Ambient temperature can also significantly influence model results, but only during certain hours of the day. Under convective conditions, a temperature range from 3.3 to 40 °C can result in a concentration decrease of over 50%. Based on these findings, we offer specific recommendations for regulators and scientists involved in environmental impact assessments to enhance the accuracy and reliability of air pollution modelling.

Key words: air pollution, EDMS, environmental impact assessment, sensitivity analysis

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