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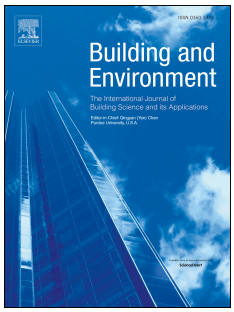

Ten questions concerning modeling of near-field pollutant dispersion in the built environment

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Ten questions concerning modeling of near-field pollutant dispersion in the built environment

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Abstract

Outdoor air pollution is a major current environmental problem. The precise prediction of pollutant concentration distributions in the built environment is necessary for building design and urban environmental assessment. Near-field pollutant dispersion, involving the interaction of a plume and the flow field perturbed by building obstacles, is an element of outdoor air pollution that is particularly complex to predict. Modeling methodologies have been discussed in a wide range of research fields for many years. The modeling approaches are categorized into field measurements, laboratory (wind and water tunnel) experiments, (semi-) empirical models, and computational fluid dynamics (CFD) models. Each of these approaches has advantages and disadvantages. It is therefore important to use due consideration for the underlying theory and limitations when applying these modeling approaches. This paper considers some of the most common questions confronting researchers and practitioners in the modeling of near-field pollutant dispersion in the built environment.

Keywords

Built environment; Computational fluid dynamics (CFD); Modeling technique; Near-field; Pollutant dispersion; Wind tunnel Experimentation

1. Introduction

Outdoor air pollution is a major environmental problem. In the built environment, both the outdoor exposure of pedestrians and the indoor exposure of building inhabitants to airborne pollutants are of interest [1]. The dispersion regions for pollutants in these scenarios are rather small, comprising the vicinity of the emitting building within a few hundred meters of the source, as opposed to a region of impact over the entire neighborhood. Such dispersion processes are called “near-field” pollutant dispersion, which differ significantly in properties from far-field dispersion, in which horizontal motion prevails over vertical motion and the influence of individual buildings on the dispersion field is small. Near-field pollutant dispersion concerns local