

UNCERTAINTY ANALYSIS FOR CFD MODELLING OF POLLUTANT DISPERSION INFLUENCED BY BUILDINGS

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Abstract: Characterisation and quantification of uncertainty linked to input variables in atmospheric dispersion modelling may be of critical importance, especially when used in risk assessment. In that way, several methods have been developed since the last decades to provide a good description of uncertainty and sensitivity linked to input or model parameters. Nevertheless, these methods remain scarcely used for Computational Fluid Dynamics (CFD) models, because of the large computational cost of the simulations. These CFD models are increasingly used, especially when complex geometries are present, as in urban or industrial built-up areas. Thanks to the increasing computational power and the development of alternative methods, this type of study becomes feasible.

In this work, two approaches are presented to assess both the quantification of uncertainty on variables of interest (here concentration at ground level) and the ranking of five selected uncertainty sources on the inputs to the model, in term of importance.

The first one consists in Monte Carlo uncertainties propagation, involving five input factors, which provides a quantitative measure of the uncertainty on the results. The second one is the application of the Morris' randomised one-a-time (OAT) design method, one of the known screening method, which gives a qualitative measure of the importance of these input parameters.

The uncertainty analysis is carried out for the study-case of an hypothetical accidental release in an industrial built-up area. CFD simulations are performed with the model Mercure_Saturne (developed by CEREA and EDF R&D) with a RANS approach and a k- ϵ s turbulence closure, for complex geometry and topography, including the most relevant buildings and hills. This study estimates uncertainty in terms of ground-level concentration and focuses on usual sources of uncertainty, such as parameters used to model the input meteorological profiles (Monin-Obukhov length, roughness length, wind deviation angle), the source localisation and the roughness length used for the wall-law boundary conditions.