CFD MODELLING OF FLOW AND POLLUTANT DISPERSION IN URBAN AREAS, TAKING INTO ACCOUNT THE RADIATIVE EFFECTS OF THE BUILDINGS

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In order to estimate the impact of buildings on flow and pollutant dispersion, three-dimensional numerical simulations are performed at full scale over an idealized urban area. The simulations are performed with the Computational Fluid Dynamics model Mercure_Saturne (developed by CEREA), which is adapted to atmospheric flow and pollution dispersion. In this work, we use an eulerian approach and a k-eps turbulence closure.

The concentration variability induced by turbulent mixing can be important in many applications, such as in risks assessments when the hazardous effects can be on the order of a second or in reactive plume studies. Therefore, we study both concentration means and their fluctuations, predicting the concentration variance using a model based on the transport equation.

The results are validated in detail with the near full-scale experiment MUST (Mock Urban Setting Test), which was conducted for the Defense Threat Reduction Agency in Utah's West Desert. It consists of neutral gas releases in an array of shipping containers regularly spaced in the field and provides numerous measurements.

In many applications, considering the atmosphere in neutral conditions can be inaccurate. Hence, in order to take into account atmospheric radiation in built up areas and the thermal effects of the buildings, we have implemented in Mercure_Saturne a three-dimensional radiative model adapted to complex geometry. This model, adapted from a scheme used for thermal radiation, solves the radiative transfer equation in a semi-transparent media, using the discrete ordinate method. The new scheme is validated with idealized cases for the solar and infrared schemes and the results are compared to thermal measurements available for some of the cases in the MUST experiment.

EXTENDED ABSTRACT NOT SUPPLIED