POLLUTANT DISPERSION THROUGH AN OBSTACLE ARRAY: NUMERICAL MODELLING AND EXPERIMENTAL INVESTIGATION

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ABSTRACT

In the last years, the accidental release of pollutant and toxic substances in urban environment has become a main topic of interest, especially in relation to the transportation and the storage of hazardous materials and to terrorist attacks.

In order to manage the risk related to these problems, modelling tools are required, which have to be able to take into account for all elements characterising an urban area (flow through a group of obstacles) in operational conditions: few input data and poor computational means.

In this perspective, a new dispersion model, called SIRANERISK, has been developed, in order to describe unsteady dispersion of hazardous releases at the neighbourhood scale. The model represents the urban canopy as a street network. A box model in unsteady conditions is applied in each street and turbulent mass fluxes at street intersections and at roof level are parameterized by means of simple relations. The pollutant dispersion above roof level is modelled by means of a puff gaussian model.

The SIRANERISK results have been compared to wind tunnel experiments data. The behaviour of a neutrally buoyant plume through an obstacle array has been studied focusing on the influence of the wind direction on its lateral and vertical spreading. The array consisted in aligned blocks, measuring Hx5Hx5H and equally spaced at a distance H, in order to simulate an idealized urban neighbourhood. The external flow simulated a neutral atmospheric boundary layer, whose depth was about 10H. Velocity measurements within and above the obstacle array were performed by means of Laser Doppler Anemometry. Ethan was used as a passive scalar and was ejected by a point source placed with the obstacle array. Concentration measurements were performed by means of a Flame Ionisation Detector.

Velocity and passive scalar concentration fields were obtained for different wind directions.

Comparisons between experimental data and SIRANERISK simulations are discussed, in order to show performances, limitations and potentialities of the model.

EXTENDED ABSTRACT NOT SUPPLIED