A NEW APPROACH FOR MINIMIZING COMPUTATION TIME IN PUFF DISPERSION MODELS: A PLUME RECONSTRUCTION ALGORITHM

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Abstract: The computing time is a strong constraint of the atmospheric dispersion models when one wishes to simulate the dispersion of a cloud of pollutants in the context of crisis management. Indeed, in the event of accident or malicious act, it is necessary as soon as possible to have cartographies of concentration in order to optimize the decision-making (displacement of population, management of the rescue, etc).
To answer these constraints, Gaussian puff dispersion models are well adapted because they make it possible to take into account the non stationary of the release and require a weak computing time. In the context of an urban environment, it is possible to use models with Gaussian puffs in which the puffs interact with the zones of recirculation to form secondary sources (e.g. UDM, SIRANERISK). But that results in an increase of the number of puffs to be treated and thus the computing time. In this context, we have developed an algorithm of minimization of the number of puffs called "plume reconstruction algorithm".
In a model with standard puffs, the puffs are emitted at regular time steps. The value of this step of time is defined so that the puffs overlap sufficiently and that the plume resulting from the superposition of these puffs presents a continuous aspect. This constraint is more particularly strong close to the source, where the puffs have a weak standard deviation. But when one moves away from the source, the rate of overlapping of the puffs becomes unnecessarily high because their standard deviation increases whereas their spacing remains constant.
The algorithm developed within the framework of this work makes it possible to limit the number of puffs necessary to describe a plume by modifying spacing between these puffs when their standard deviation increases (cf. Fig. 1). The determination of the characteristics of the new puffs (transported mass, position, standard deviations) was the subject of a particular treatment. This algorithm makes it possible to reduce very appreciably the number of puffs to be treated in the model and thus the time computing necessary.

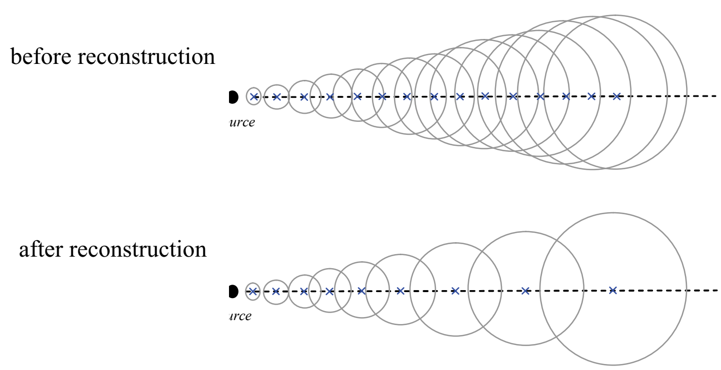

Figure 1: Puff dispersion model before and after plume reconstruction algorithm.