SOME ALGORITHMS FOR SIMULATING SIZE-RESOLVED AEROSOL DYNAMICS MODELS

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The objective of this presentation is to show some algorithms used to solve aerosol dynamics in 3D dispersion models.

INTRODUCTION

The gas phase pollution has been widely studied and some models are now available . The situation is quite different with respect to atmospheric aerosols . However atmospheric particulate matter significantly influences atmospheric properties such as radiative balance, cloud formation, gas pollutants concentrations (gas to particle conversion), and has an impact on man health.

As aerosols properties (optical, hygroscopic, noxiousness) depend mainly on their size, it appears important to be able to follow the aerosol (or particle) size distribution (PSD) during time. This former is modified by physical processes as coagulation, condensation or evaporation, nucleation and removal. Aerosol dynamics is usually modelized by the well-known General Dynamics Equation (GDE) [1].

MODELS

Several models already exist to solve this equation. Multi-modal models are widely used [2] [3] because of the few parameters needed, but the GDE is solved only on its moments and the PSD is assumed to remain in a log-normal form.

On the contrary, size-resolved models implies a discretization of the aerosol size spectrum into several bins and to solve the GDE within each one. This step can be performed either by resolving each process separately (splitting), for example coagulation can be resolved by the well-known "size-binning" algorithms [4] and condensation leads to an advection equation on the PSD [5], or by coupling all processes, what the finite elements [6] and stochastic methods [7] allows.

Stochastic algorithms may not be competitive compared to deterministic ones with respect to the computation time, but they provide reference solutions useful to validate more operational codes on realistic cases, as analytic solutions of the GDE exist only for academic cases.

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