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- Title and Author Search

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Stochastic fields method for sub-grid scale emission heterogeneity in mesoscale atmospheric dispersion models

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Abstract. The stochastic fields method for turbulent reacting flows has been applied to the issue of sub-grid scale emission heterogeneity in a mesoscale model. This method is a solution technique for the probability density function (PDF) transport equation and can be seen as a straightforward extension of currently used mesoscale dispersion models. It has been implemented in an existing mesoscale model and the results are compared with Large-Eddy Simulation (LES) data devised to test specifically the effect of sub-grid scale emission heterogeneity on boundary layer concentration fluctuations. The sub-grid scale emission variability is assimilated in the model as a PDF of the emissions. The stochastic fields method shows excellent agreement with the LES data without adjustment of the constants used in the mesoscale model. The stochastic fields method is a stochastic solution of the transport equations for the concentration PDF of dispersing scalars, therefore it possesses the ability to handle chemistry of any complexity without the need to introduce additional closures for the high order statistics of chemical species. This study shows for the first time the feasibility of applying this method to mesoscale chemical transport models.

Final Revised Paper (PDF, 948 KB)   Discussion Paper (ACPD)

Citation: Cassiani, M., Vinuesa, J. F., Galmarini, S., and Denby, B.: Stochastic fields method for sub-grid scale emission heterogeneity in mesoscale atmospheric dispersion models, Atmos. Chem. Phys., 10, 267-277, 2010.   Bibtex   EndNote   Reference Manager