Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union










Atmos. Chem. Phys., 4, 2161-2170, 2004
www.atmos-chem-phys.net/4/2161/2004/


# A Lagrangian model with simple primary and secondary aerosol scheme 1: comparison with UK $PM_{10}$ data

K. M. Emmerson[1], A. R. MacKenzie[2], S. M. Owen[2], M. J. Evans[3], and D. E. Shallcross[4]
[1]Environment Department, University of York, YO10 5DD, UK
[2]Dept. of Environmental Science, Lancaster University, LA1 4YQ, UK
[3]Harvard University, Cambridge, MA 02138, USA
[4]School of Chemistry, University of Bristol, BS8 1TS, UK

Abstract. A Lagrangian trajectory model used to simulate photochemistry has been extended to include a simple parameterisation of primary and secondary aerosol particles. The model uses emission inventories of primary particles for the UK from the NAEI (National Atmospheric Emissions Inventory for the UK), and for Europe from the TNO (Institute of Environmental Sciences, Energy Research and Process Innovation, the Netherlands) respectively, to transport tracers representing $PM_{10}$. One biogenic and two anthropogenic organic compounds were chosen as surrogates to model the formation of condensable material suitable for the production of secondary organic aerosol (SOA). The SOA is added to the primary $PM_{10}$ and compared to measured $PM_{10}$ at one urban and two rural UK receptor sites. The results show an average under-prediction by factors of 4.5 and 8.9 in the urban and rural cases respectively. The model is also used to simulate production of two secondary inorganic species, $H_2SO_4$ and $HNO_3$, which are assumed, as a limiting case, to be present in the particle phase. The relationships between modelled and measured total $PM_{10}$ improved with the addition of secondary inorganic compounds, and the overall model under-prediction factors are reduced to 3.5 and 3.9 in the urban and rural cases respectively. Nevertheless, our conclusion is that current emissions and chemistry do not appear to provide sufficient information to model $PM_{10}$ well (i.e. to within a factor of two). There is a need for further process studies to inform global climate modelling that includes climate forcing by aerosol.

Final Revised Paper (PDF, 287 KB) Discussion Paper (ACPD)

Citation: Emmerson, K. M., MacKenzie, A. R., Owen, S. M., Evans, M. J., and Shallcross, D. E.: A Lagrangian model with simple primary and secondary aerosol scheme 1: comparison with UK $PM_{10}$ data, Atmos. Chem. Phys., 4, 2161-2170, 2004. Bibtex EndNote Reference Manager