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## A Lagrangian model with simple primary and secondary aerosol scheme 1: comparison with UK PM<sub>10</sub> data

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**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<sub>10</sub>. 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<sub>10</sub> and compared to measured PM<sub>10</sub> 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<sub>2</sub>SO<sub>4</sub> and HNO<sub>3</sub>, which are assumed, as a limiting case, to be present in the particle phase. The relationships between modelled and measured total PM<sub>10</sub> 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<sub>10</sub> 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.

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