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The use of a photochemical trajectory model for modelling gaseous and particulate ammonia: Comparisons with the PUMA field measurement campaign in the UK West Midlands

H.L. Walker, R.G. Derwent, **J. Baker**

University of Birmingham, Division of Environmental Health and Risk Management, School of Geography, Earth and Environmental Sciences, Edgbaston, B15 2TT, UK (j.baker@bham.ac.uk)

Ammonia is the most abundant alkaline gas found in the atmosphere and is highly important in neutralising acidifying pollutants such as sulphur dioxide and nitrogen oxides over continental regions, hence impacting on acid deposition and leading to the formation of ammonium particulates which contributes to continental PM10. In addition it is also a key component of atmospheric nitrogen deposition, which leads to nutrient fertilisation of soils and in some instances eutrophication. In this work the UK Photochemical Trajectory Model (PTM) is coupled with the Master Chemical Mechanism (MCM v3) and developed for the treatment of atmospheric ammonia and ammonium. This is achieved with the inclusion of an ammonia emissions inventory covering the European region and a chemical scheme to account for multiphase chemistry. The model is run with a series of back-trajectories arriving in Birmingham, UK, for a winter time and summer time period during the Pollution in the Urban Midlands Atmosphere (PUMA) field measurement campaign 1999-2000. Modelled results are compared with measurements with a focus on gaseous ammonia and nitric acid and particulate ammonium, nitrate and sulphate. The model results and measurements are of the same order of magnitude with reasonably good agreement for gaseous and particulate ammonia, while the model tends to overestimate the particulate nitrate. A model sensitivity study was also carried out and model limitations identified. The re-

sults are discussed in light of the influence of ammonia on the mass concentrations of nitrate and sulphate secondary particulate matter.