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# INFLUENCE OF ANTHROPOGENIC AND METEOROLOGICAL DRIVERS ON TEMPORAL PATTERNS OF AMMONIA EMISSIONS FROM AGRICULTURE IN THE UK

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Emissions of trace gases originating from anthropogenic activities are vital input data for chemical transport models (CTMs). Other key input datasets such as meteorological drivers, and biogeochemical and physical processes have been subject to detailed investigation and research in the recent past, while the representation of spatio-temporal aspects of emission data in CTMs has been somewhat neglected. Arguably, this has less impact on the regional to hemispheric or global scale, where the grid sizes of currently applied CTMs represent well mixed average concentrations or deposition values. Evaluating model output against ground-based observations or remote sensing results on these spatial levels may not to be overly sensitive to the temporal (and spatial) profiles of emission input data.

With increasing level of detail and spatio-temporal resolution, CTMs applied to determine national or local scale air quality are likely prone to be more sensitive to the spatial and temporal patterns of anthropogenic emissions. The location and timing of emission events - for instance peaks of ammonia emissions following the spring and autumn application of manure and mineral fertilisers - may well determine local concentration or deposition episodes, while not necessarily affecting seasonal or even annual mean values.

In the case of agriculture, both anthropogenic activities (e.g. manure spreading and fertilizer application) and meteorological factors (e.g. temperature and seasonality) have been investigated regarding their influence on the spatiotemporal distribution of $NH_3$ emissions (see for instance [1], [2], [4], [5] and [6]). The discussion of results in this case will focus on the impact on the deposition of acidifying and eutrophying substances, as well as the contribution to the formation of ammonium nitrates and sulphates and hence ambient concentrations of secondary particulate matter.

This paper discusses results of the application of the EMEP4UK CTM on a 5 km x 5 km resolution for the whole of the United Kingdom. To evaluate the effect of changing the temporal profiles, three different model setups, e.g. using rather coarse and potentially outdated temporal profiles of the EMEP unified model, with varying degrees of detail (in this case, a monthly profile (cf. [3]) vs. 3 hourly emission values[6]) are evaluated against the

AGANET measurement network stations across the UK. The discussion of results will focus on (a) the effect of temporal emission profiles on modelled vs. measured concentration/deposition values, (b) the influence on deposition of reactive nitrogen on ecosystems near ammonia sources and (c) the magnitude of influence of anthropogenic activity vs. meteorology for the dispersion of ammonia from agriculture.

The results presented in this paper will help to determine the appropriate degree of detail with regard to the temporal profiles of anthropogenic emission data, as collecting detailed statistical data on anthropogenic activities for high spatially resolved model applications can be very time consuming and expensive. In addition, the effect on improving the temporal representation of emissions influenced by both anthropogenic activities and meteorological parameters can contribute to reducing uncertainties in model results that are highly relevant for policy development, e.g. covering aspects of critical load exceedance in vulnerable ecosystems or the exceedance of concentrations of PM.

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