AN INTERCOMPARISON OF MODELS USED TO SIMULATE THE ATMOSPHERIC DISPERSION AND DEPOSITION OF AGRICULTURAL AMMONIA EMISSIONS

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INTRODUCTION

Ammonia (NH₃) emitted into the atmosphere from agricultural sources can have an impact on nearby sensitive ecosystems either through elevated ambient concentrations or dry/wet deposition to vegetation and soil surfaces. Environmental impact assessments are often carried out using short-range atmospheric dispersion models to estimate mean annual atmospheric concentrations and total annual deposition of NH₃ at the ecosystem location. A range of different atmospheric dispersion models are used for these assessments depending on the location and experience of the assessors and have, until now, been compared for these types of assessments. This poster compares and validates concentration predictions of four commonly used models (ADMS v4.1, AERMOD v070206, LADD and OPS-st1) for dispersion from agricultural sources using hypothetical and real case studies.

MATERIALS & METHODS

Intercomparison for hypothetical scenarios

- Modelling domain: 2 x 2 km agricultural land cover, source in centre
- Meteorological data: Lyneham (UK), one year (1995)
- Source description: 10 000 kg NH₃ yr⁻¹. Four scenarios; see Figure 1
- Receptor details: Receptor grid (100 m spacing), 0.5 m above ground

Figure 1: Schematic representation of the agricultural source types used in the four scenarios

Model validation using real case studies

Diffusion tube measurements of atmospheric NH₃ concentrations from two field experiments were used to validate the models (Figures 2a and 2b).

Results

Sc1: ground level area source

Figure 3a: Receptor NH₃ concentrations for scenario Sc1 (ground-level area source).

Sc4: elevated point sources

Figure 3b: Receptor NH₃ concentrations for scenario Sc4 (elevated point sources).

Model Validation

Figures 4a and 4b show the comparison of the predicted concentrations with the measured data for the two pig farms. According to the model acceptability criteria of Chang and Hannaa all of the models performed acceptably for the Danish case study, except for the LADD model, which generally over-predicted concentrations. For the USA case study, all models performed acceptably.

CONCLUSIONS

The intercomparison of four short-range atmospheric dispersion models used for simulating local impacts of NH₃ has shown that there are significant differences between the concentration predictions of the models, especially for elevated point sources. However, in spite of these differences, the models generally perform acceptably, except for the LADD model when used to simulate elevated point sources.

References