MODELLING OF AMMONIA CONCENTRATIONS AND DEPOSITION OF REDUCED NITROGEN IN POLAND WITH THE FRAME MODEL

Key words: ammonia, FRAME model, Poland, pollutant deposition

Summary

Over the last ten years the acid and nitrogen deposition have decreased in Poland as a result of decreased emissions. However, the relative contribution of ammonia deposition shows an increasing trend. To support the national monitoring of ammonia concentration and deposition of reduced nitrogen, numerical models have been developed.

Here, the gridded emissions and meteorological data for 2002 were applied to estimate the concentration and deposition of NH\textsubscript{x} for Poland with the FRAME model (Fine Resolution Atmospheric Multi-pollutant Exchange model). FRAME is a Lagrangian model with high spatial (5 x 5 km) and horizontal resolution (33 layers) and was originally developed for the United Kingdom. Because of its high spatial resolution, the model considers the seeder-feeder effect (the washout of polluted hill cloud droplets by raindrops from upper layers), which is largely responsible for enhanced wet deposition over mountainous areas.

FRAME results were compared with available data from the monitoring sites and with the EMEP and IMGW/IOŚ estimates of wet and dry deposition. The results show close agreement with measurements (with R\textsuperscript{2} of 0.71 for wet deposition). Due to the fine spatial resolution of the FRAME model, the spatial distribution of NH\textsubscript{3} concentration and NH\textsubscript{x} deposition shows a complex pattern which can not be noticed in the coarser resolution EMEP model. The FRAME national deposition budget is in close agreement with the EMEP and IMGW estimates.

The modelled reduced nitrogen wet deposition is overestimated in the Tatra Mts. This is because of the more continental climate and the seeder-feeder process being less effective, if compared with the UK. This suggests that the efficiency of the seeder-feeder effect, included into the model, should vary spatially.

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