High-resolution maps of ammonia concentration and nitrogen deposition for Baden-Württemberg

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Abstract

Maps of wet and dry deposition of reactive nitrogen (N_r) compounds are generated on a hectare raster for Baden-Württemberg (BW), Germany.
An integrative modelling approach is applied, combining interpolation methods for wet deposition, emission maps and statistical dispersion models for ammonia as well as results from atmospheric transport models.
The results are useful input for tasks such as evaluating threads to terrestrial ecosystems by excess atmospheric N concentration (critical level exceedance), N deposition (critical load exceedance), or establishing N balances for valuating excess nutrient loads on agricultural land (critical surplus exceedance).

Keywords: emission maps, chemical transport model, inferential model, forest deposition monitoring data, atmospheric monitoring data

1. Modelling and mapping approach

Air concentration and deposition fluxes of reactive nitrogen in Baden-Württemberg are modelled using the chemical transport model (CTM) EURAD providing a 25 ha grid resolution output, the inferential model PolluMap, GIS based geostatistical modelling, and regression modelling, respectively.

Different modelling approaches are combined in order to derive 1 ha grid maps of air concentration and atmospheric deposition of N_r species. The outline of the model combination is presented in Figure 1. Oxidised nitrogen and reduced nitrogen are modelled separately, due to different emission sources, lifetime and in-atmosphere reactions including production of secondary N_r species.

All atmospheric pathways of N_r from emission over transport , in-air physico-chemical reaction, air concentration and wet and dry deposition fluxes are modelled in hourly time steps for the year 2014 using the CTM EURAD.

The ecosystem level model output resolution (1 ha) for concentration and deposition fluxes of N_r species is achieved by GIS implemented modelling. Where ever possible measurement data are integrated into the modelling approach, minimizing deviations between reliable monitoring data and modelling results.

PolluMap (Meteotest) is used for modelling ammonia concentration and dry deposition using 1 ha local emissions and land use data along with regional CTM EURAD output data including monitoring data of ammonia on an annual base.

Wet deposition, cloud&fog deposition, and dry deposition into forests is calculated using GIS procedures (geostatisical modelling) carried out by INS based on annual forest monitoring data (open field, throughfall, canopy budget

model data) and 1 ha precipitation fields, liquid water content (from EURAD) and land use data.

GIS based regression modelling is applied in order to derive high resolution precipitation data, and N_r wet and dry deposition estimates from monitoring results for forest areas (Interra).

Modelling and mapping results are presented.

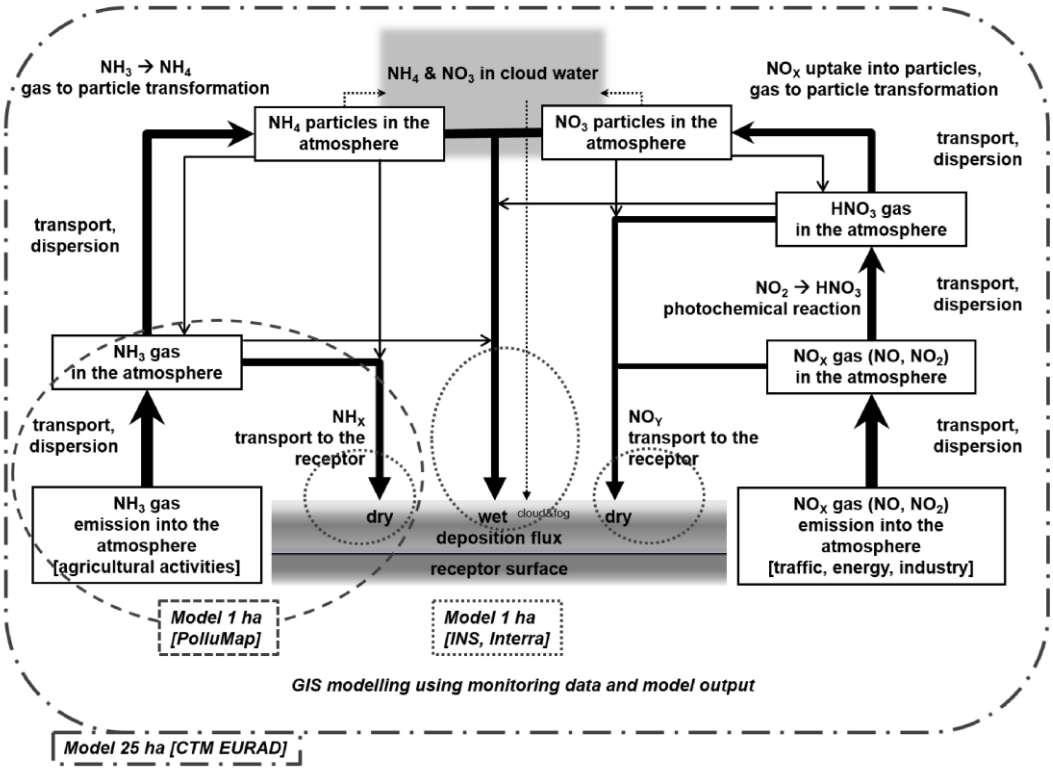

Fig. 1: Outline of the integrated modelling approach [adopted from Hertel (2009); modified]

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