



A comparison of disaggregated nitrogen budgets for Danish agriculture

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Introduction

Spatially detailed information on nitrogen (N) budgets is relevant to identify regions where N pollution needs to be reduced. However, consistent reliable data are generally lacking. Therefore most models applied in Europe use national or even European scale data as model input. There is lack of insight in the reduction in uncertainty that could be achieved by using higher resolution input data. We thus compared spatially disaggregated agricultural N budgets for Denmark for the period 2000-2010 with the Integrator model using high spatial resolution national data and default European data.

Approach

1. Integrator calculates N and GHG emissions from industrial sources, housing and manure storage systems, agricultural and non-agricultural soils and surface waters. It includes ca 40,000 Nitrogen Classification Units (NCUs) being unique combinations of soil mapping units, slope classes and NUTS3 regions.
2. Spatially disaggregated agricultural N budgets for Denmark for the period 2000-2010 were generated by the European scale model Integrator, using: (i) default European scale data (Integrator-EU) and (ii) high spatial resolution national data for Denmark (Integrator-DK).
3. To derive Integrator-DK we performed the following changes: (i) adaptation of the boundaries of the NCU, (ii) adaptation of the manure implemented module and (iii) linking Integrator-EU with detailed Danish activity data and emission- and excretion factors.

Results

Results (Table 1) show Large differences between the national N budgets calculated by both versions of the model and independently derived N budgets .

Table 1. National N balance for DK in 2000 and 2010 based on Integrator EU (Int-EU) simulations with default European data and Integrator DK (Int-DK) simulations with disaggregated Danish data.

Source	N budget for Denmark (kton N yr ⁻¹)			
	Int-EU 2000	Int-DK 2000	Int-EU 2010	Int-DK 2010
Manure excretion	247	232	247	251
Fertilizer	233	234	197	194
N biosolids	-	-	4	-
Deposition	37	34	36	34
Fixation	17	14	17	14
Mineralisation	86	48	84	48
Total input	620	561	584	542
Uptake	383	282	356	284
Emission NH ₃	63	58	57	61
Emission N ₂ O	6	6	6	6
Emission NO _x	3	2	3	2
Emission N ₂	86	107	85	85
Leaching + runoff	77	106	78	85
Total output	620	561	584	542

Results

The spatial distributions of Integrator-DK clearly differ from those of Integrator-EU. A comparison at NCU level show a rather poor correspondence for manure application and a moderate correspondence for NH₃ emission (Figure 2 and Figure 3).

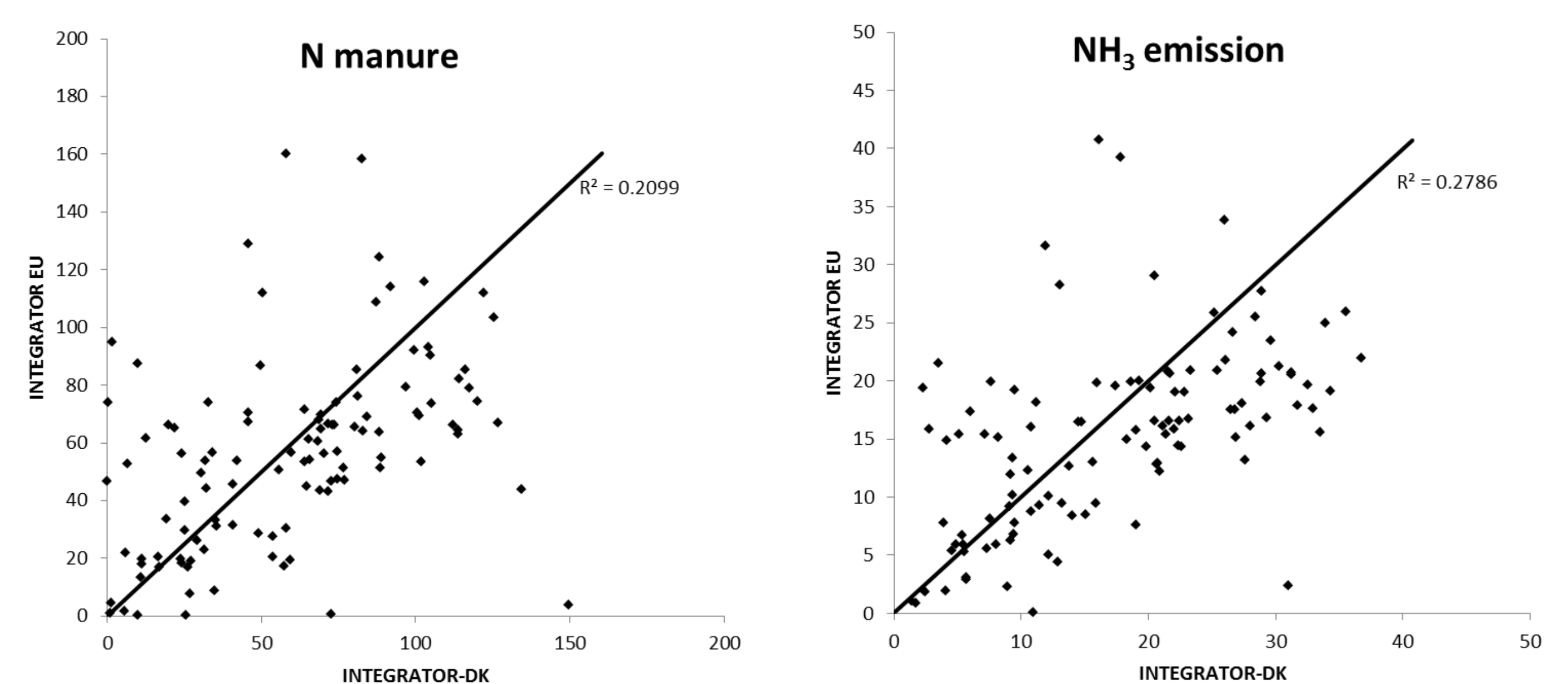


Figure 2. XY-plots for N input by animal manure and NH₃-N emission at 113 plots in 2010 derived by Integrator-EU versus averaged values with Integrator-DK.

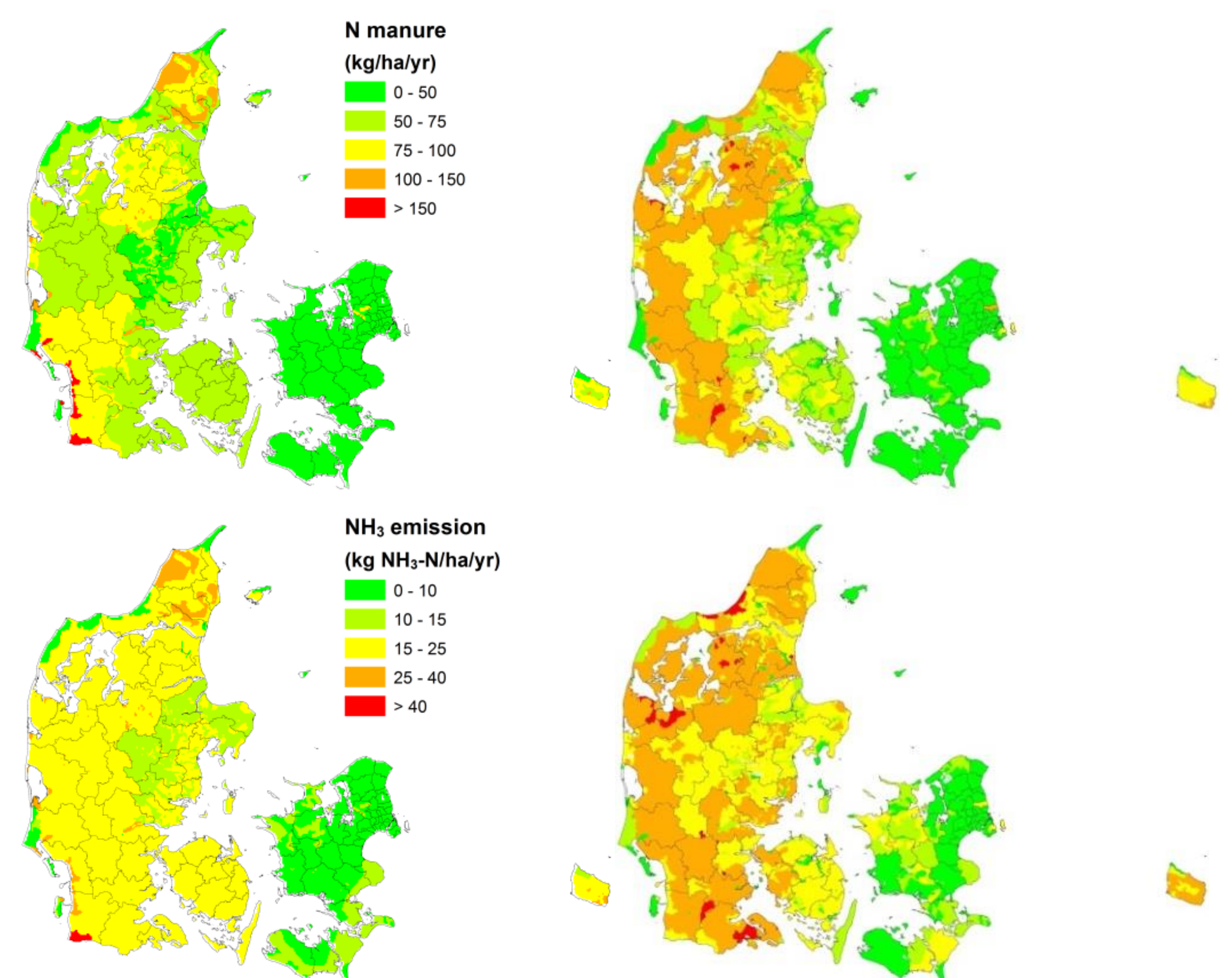


Figure 3. Total N animal manure input (top) and total NH₃ emission (bottom) from agriculture for the year 2010 with Integrator-EU (left) and Integrator-DK (right).

Conclusions

- Manure distribution and N losses from Integrator-DK are closer to observed distributions than those from Integrator-EU.
- There is a need for collection of high resolution data from all Member States.

Acknowledgements

This project has been supported by the www.dnmark.org Strategic Research Alliance DNMARK funded by The Danish Council for Strategic Research (reference 12-132421).

