Responses of soil $\text{N}_2\text{O}$ emissions and nitrate leaching on climate input data aggregation: a biogeochemistry model ensemble study

Overview

1) Scaling exercise (done by Holger, Matthias and Balázs)

2) Scaling effects on N-cycle

3) Preliminary results

4) Outlook and future work
Scaling exercise

Nitrogen cycle in arable systems

- Regional inventory for N2O and NO3
- Identical soil properties for all grid cells on all scales
- Identical agricultural management
  - Maize monoculture
    - N-fertilization 30 + 208 kg mineral N, 10 % of straw as residuals
  - Wheat monoculture
    - N-fertilization 130 + 52 + 26 kg mineral N, 10 % of straw as residuals
- Regional model simulations including nutrient limitations on all scales
- Aggregated climate input data (100, 50, 25 10 and 1 km resolution)
Domain on different scales

9 / 24 / 80 / 410 / 34 168 grid cells
Ensemble Models simulations

**N2O:**
- Apsim
- Apsim_modified
- Coup
- DayCent
- LandscapeDNDC
- EPIC
- Monica
- N2O-Mode
- N2O-SOC
- STICS

**NO3:**
- Apsim
- Apsim_modified
- Coup
- DayCent
- LandscapeDNDC
- EPIC
- Hermes
- Monica
- STICS
Preliminary results N2O emissions
Preliminary results NO3 leaching
Preliminary results: Regional distributions of average N2O emissions

APSIM2

DNDC

STICS
Preliminary results: Regional distributions of NO3 leaching

APSIM2

DNDC

EPIC
Preliminary results: Regional distributions of NO3 leaching

HERMES

MONICA

STICS
Preliminary results yearly $\text{N}_2\text{O}$ emissions Maize

N2O yearly, Climate 1 km

N2O yearly, Climate 10 km

N2O yearly, Climate 25 km

N2O yearly, Climate 50 km

N2O yearly, Climate 100 km
Preliminary results yearly NO3 leaching Maize

NO3 yearly, Climate 1 km

NO3 yearly, Climate 10 km

NO3 yearly, Climate 25 km

NO3 yearly, Climate 50 km

NO3 yearly, Climate 100 km
Preliminary results yearly N\textsubscript{2}O emissions Wheat

N\textsubscript{2}O yearly, Climate 1 km

N\textsubscript{2}O yearly, Climate 10 km

N\textsubscript{2}O yearly, Climate 25 km

N\textsubscript{2}O yearly, Climate 50 km
Preliminary results yearly NO3 leaching Wheat

NO3 yearly, Climate 1 km

NO3 yearly, Climate 10 km

NO3 yearly, Climate 25 km

NO3 yearly, Climate 50 km

NO3 yearly, Climate 100 km

Edwin Haas
Conclusions

Nitrogen cycle in arable systems

- Quality assurance and control
- Evaluation and comparison of the drivers for N2O emissions and NO3 leaching
  - Soil water content & percolation, N balance, plant N uptake, …
- Include temporal evolution of N2O emissions and NO3 leaching
  - Identify drivers for N2O and NO3 hot moments
- Identify the optimal scale for N2O and NO3 inventories
  - Develop a measure to correlate climate subscale variability with N2O / NO3
Thanks to the team of University of Bonn
Frank Ewert
Holger Hoffmann
Gang Zhao