Karlsruher Institut für Technologie

Responses of soil N_2O emissions and nitrate leaching on climate input data aggregation: a biogeochemistry model ensemble study

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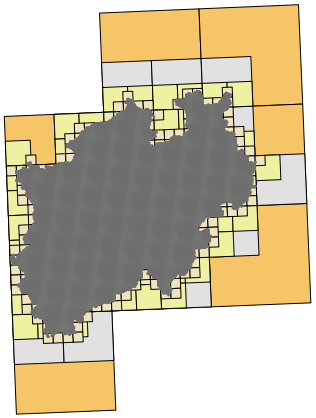
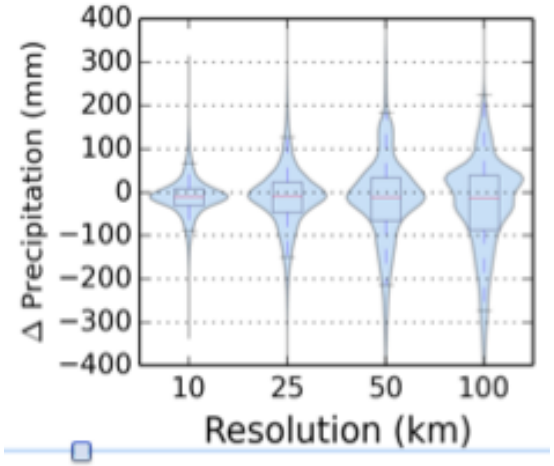
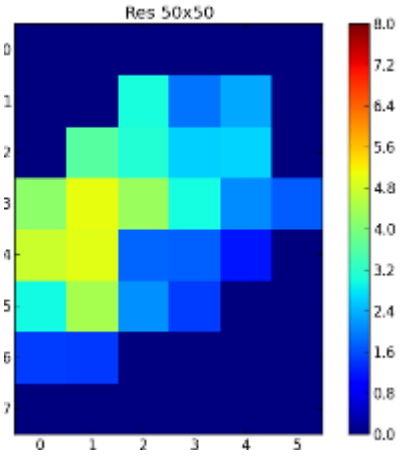
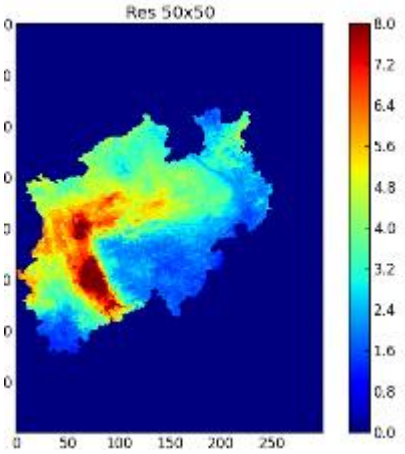
KIT - Institute of Meteorology and Climate Research









Overview

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

2) Scaling effects on N-cycle

3) Preliminary results

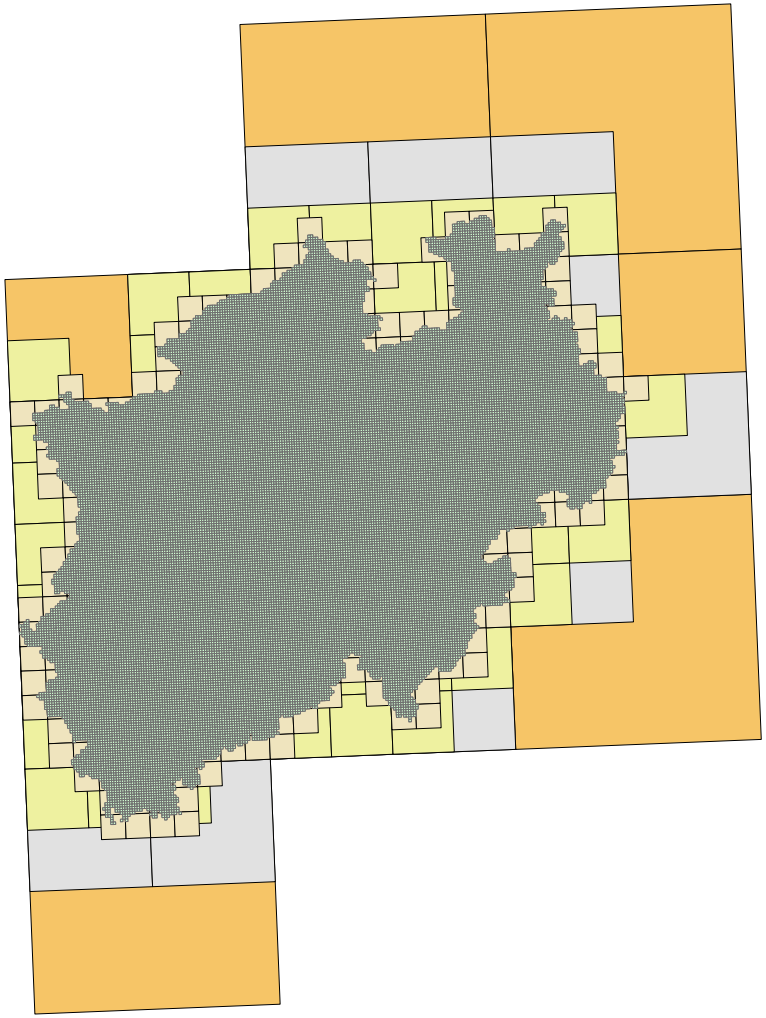
4) Outlook and future work

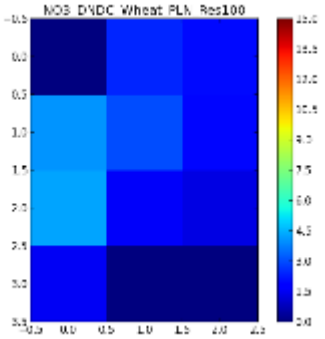
Scaling exercise

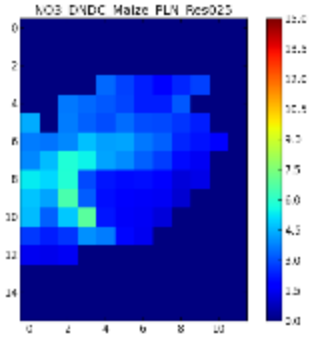
Nitrogen cycle in arable systems

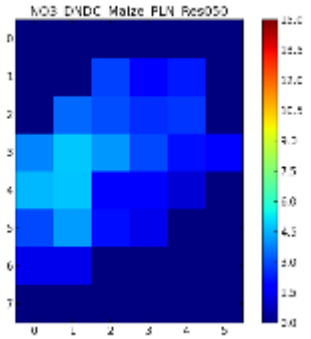
- Regional inventory for N2O and NO3
- Identical soil properties for all grid cells on all scales
- Identical agricultural management
  - Maize monoculture
    - N-fertilization 30 + 208 kg mineral N, 10 % of straw as residuals
  - Wheat monoculture
    - N-fertilization 130 + 52 + 26 kg mineral N, 10 % 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)

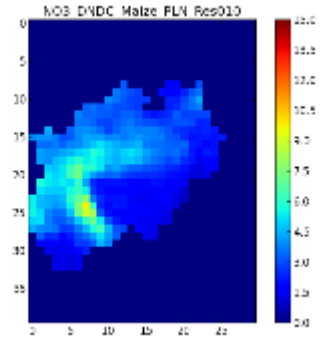
Domain on different scales

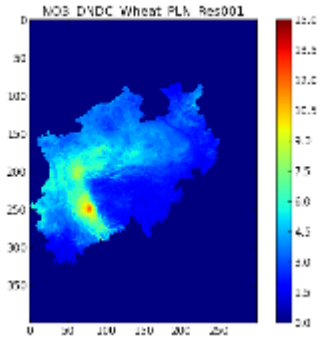










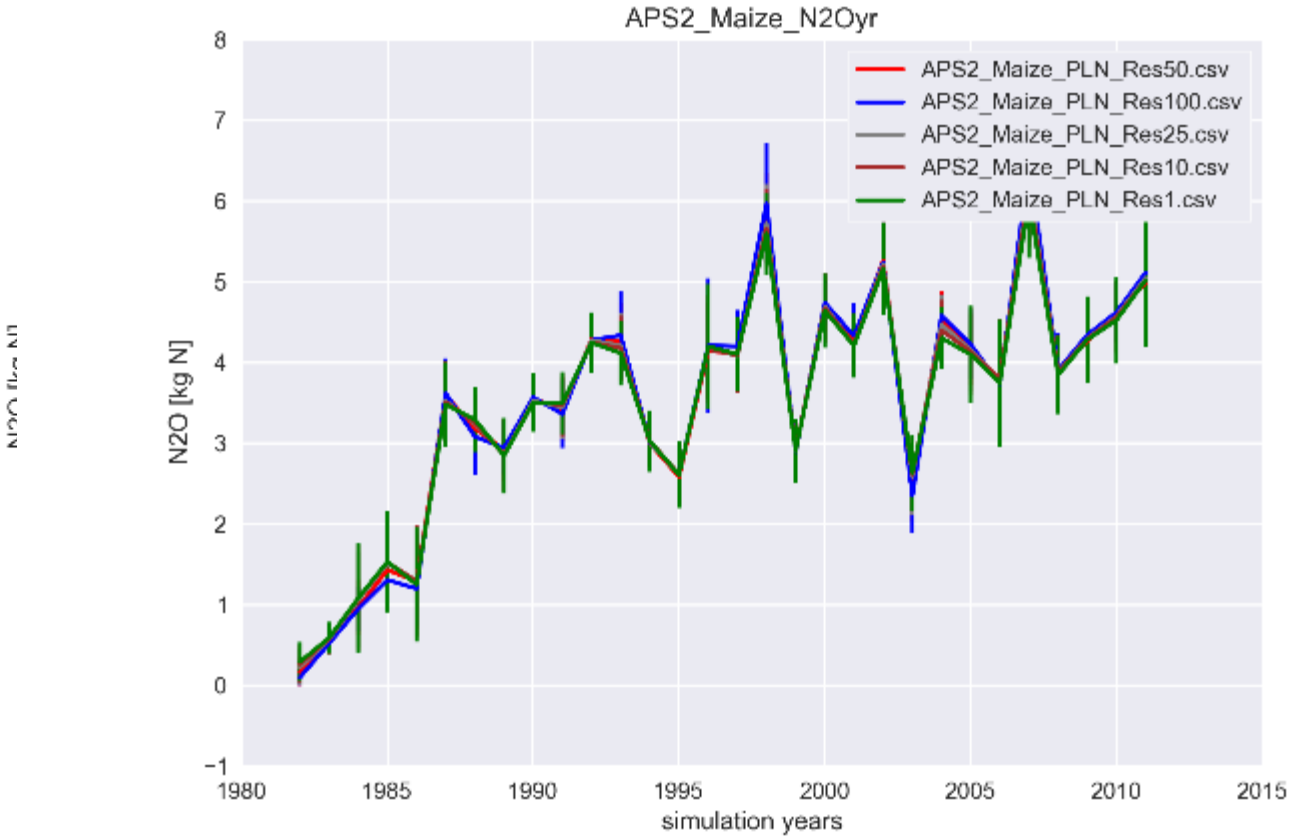


9 / 24 / 80 / 410 / 34 168 grid cells

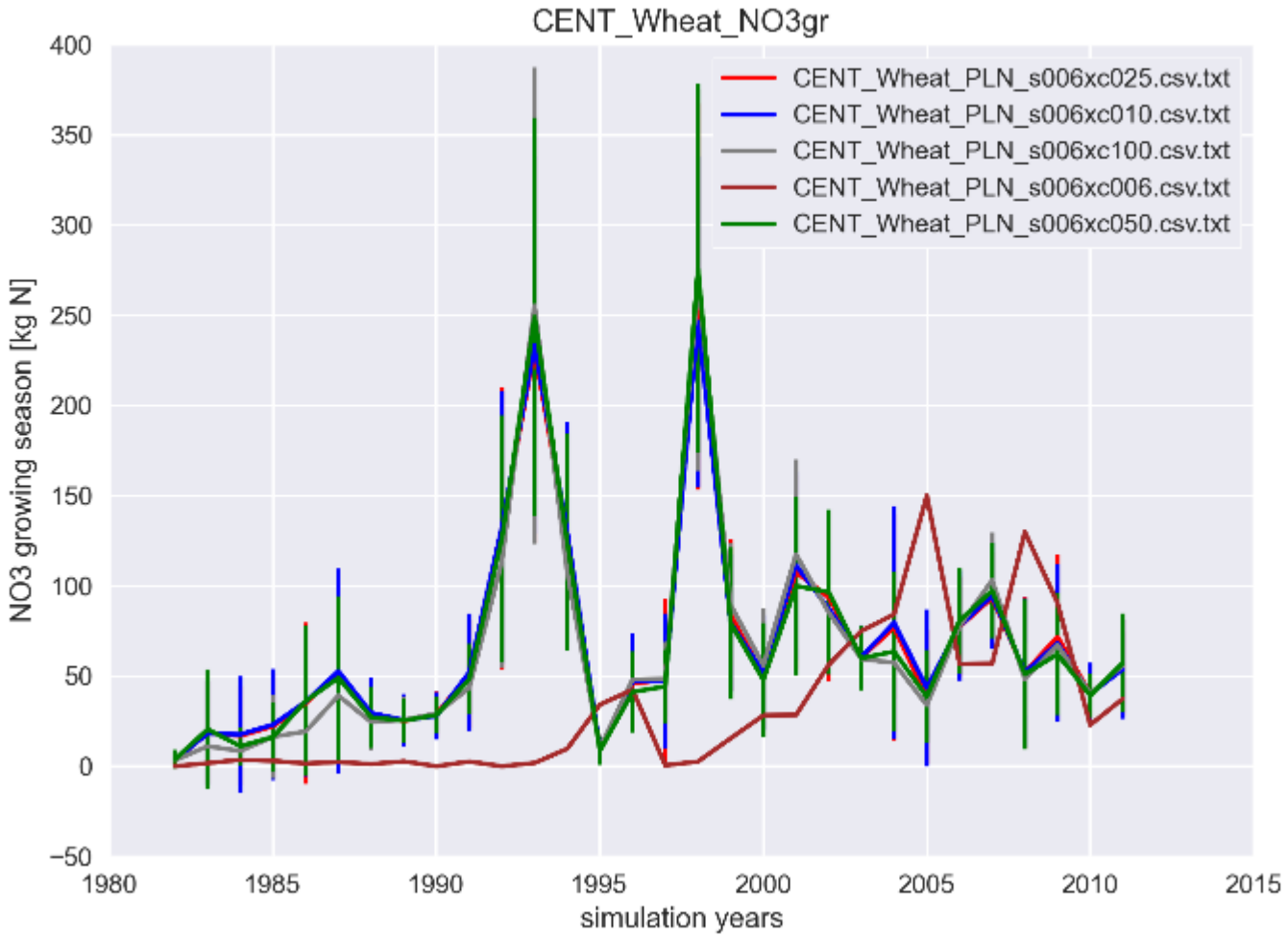
Ensemble Models simulations

- 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

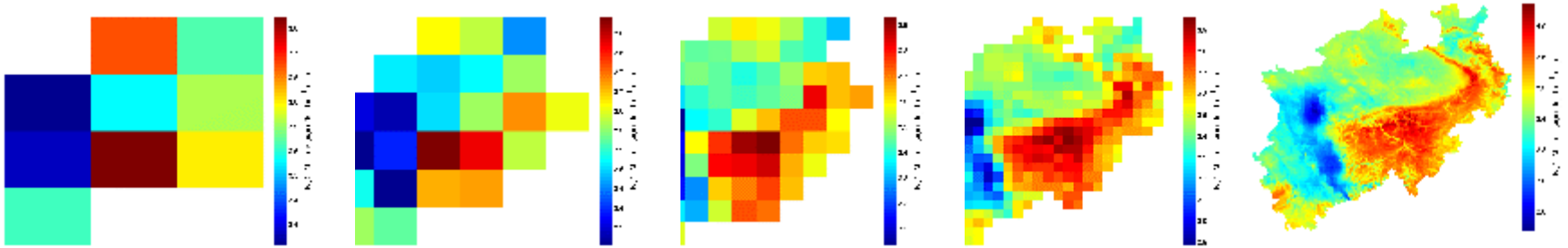


Preliminary results NO3 leaching

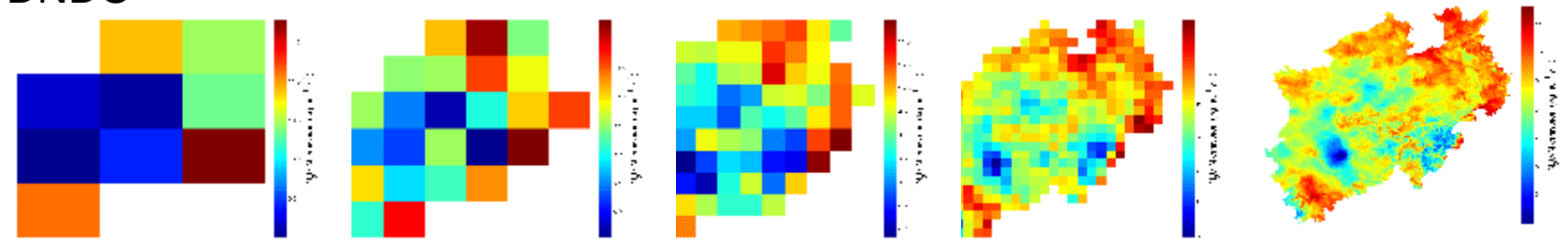


Preliminary results: Regional distributions of average N2O emissions

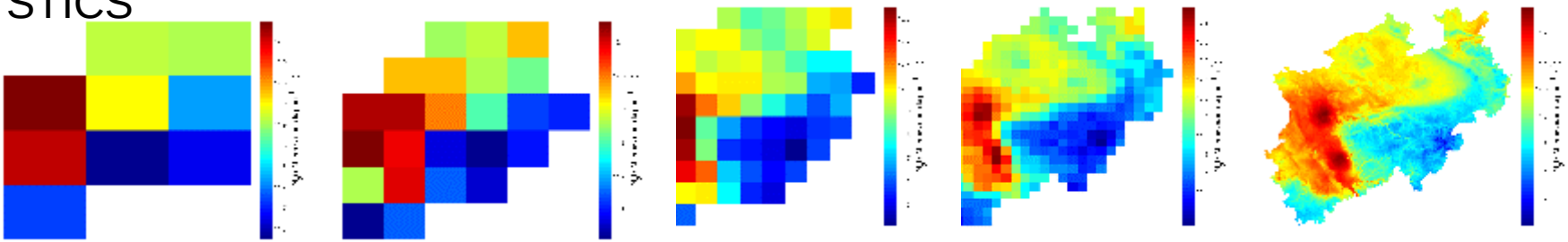
APSIM2



DNDC

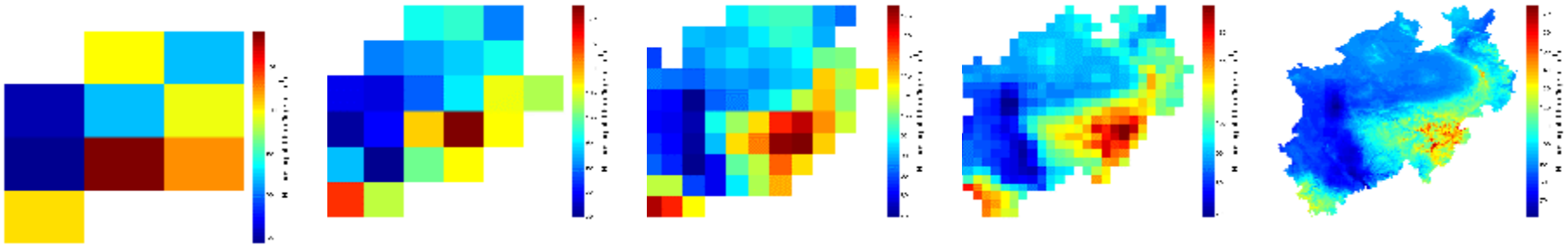


STICS

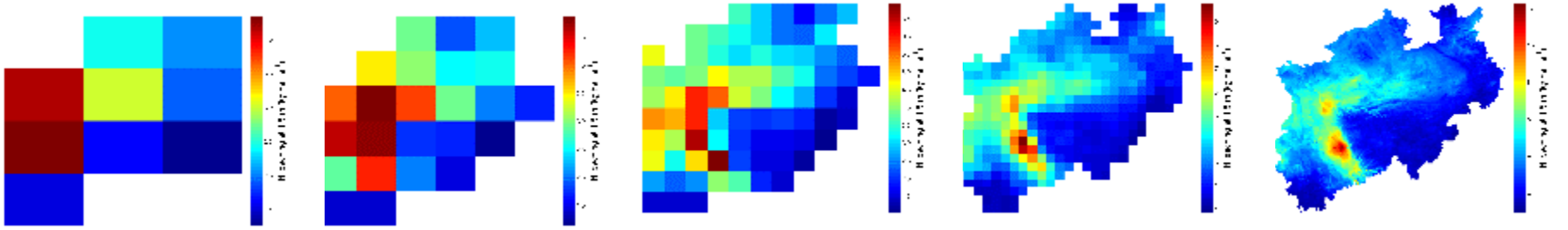


Preliminary results: Regional distributions of NO3 leaching

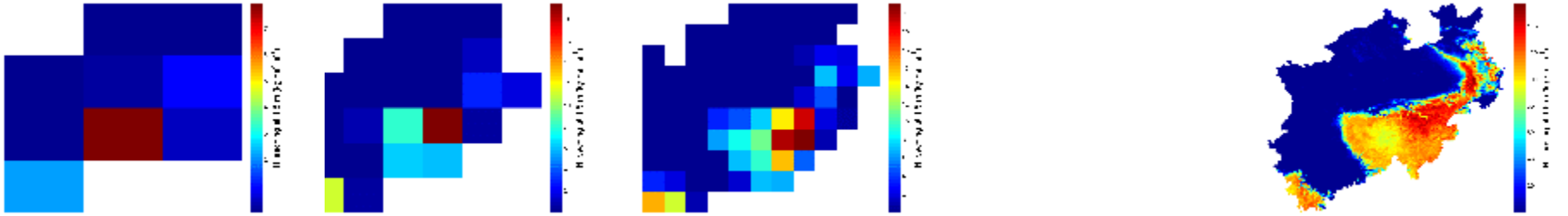
APSIM2



DNDC

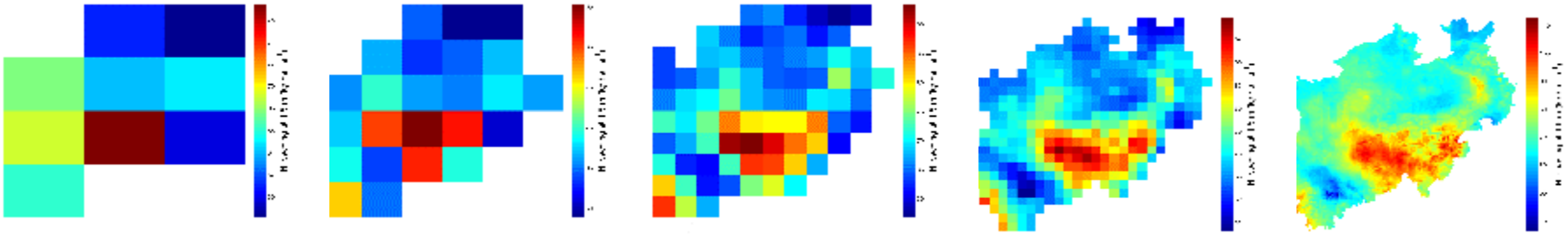


EPIC

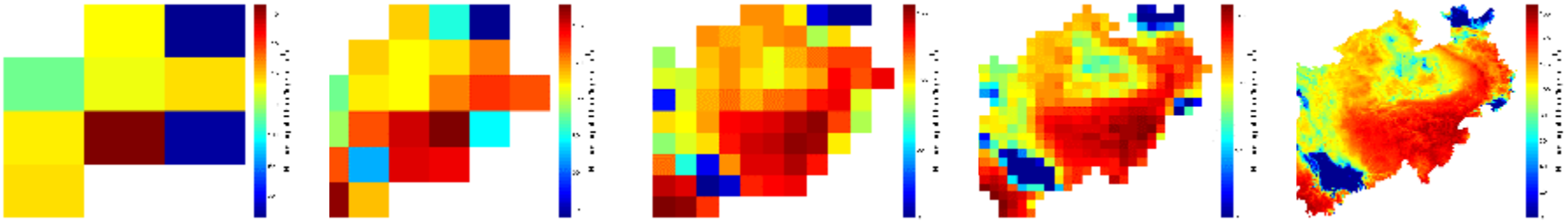


Preliminary results: Regional distributions of NO3 leaching

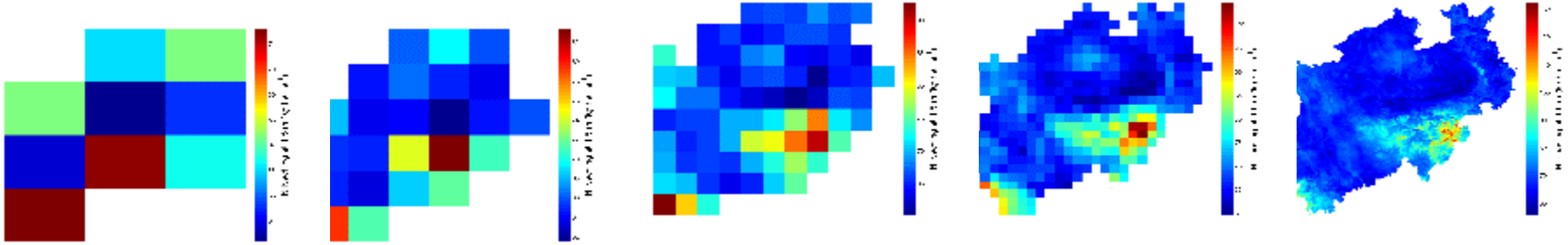
HERMES



MONICA

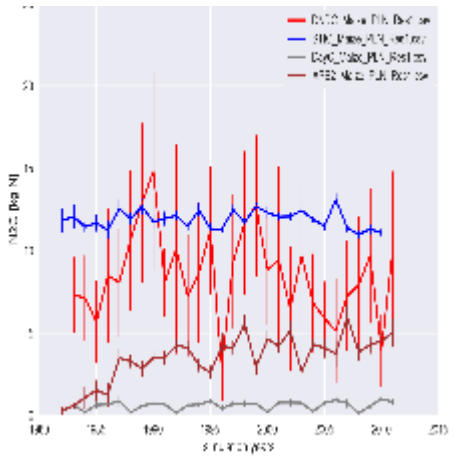


STICS

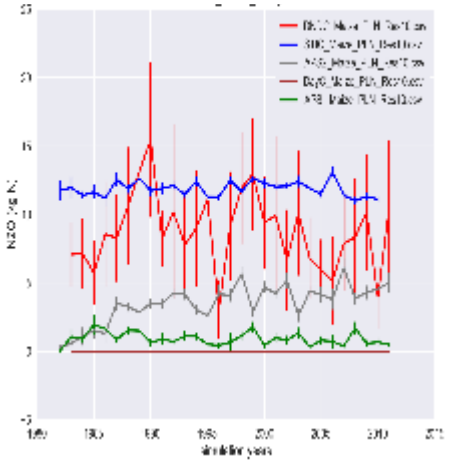


Preliminary results yearly N_2O emissions Maize

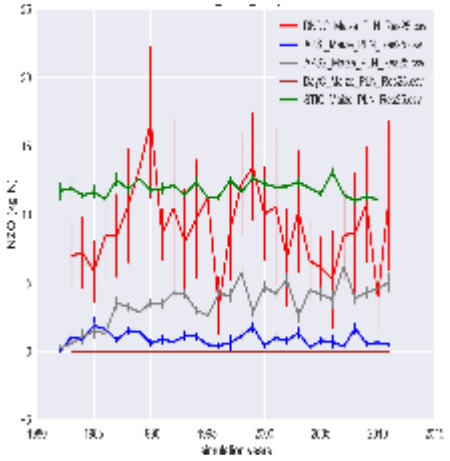
N2O yearly, Climate 1 km



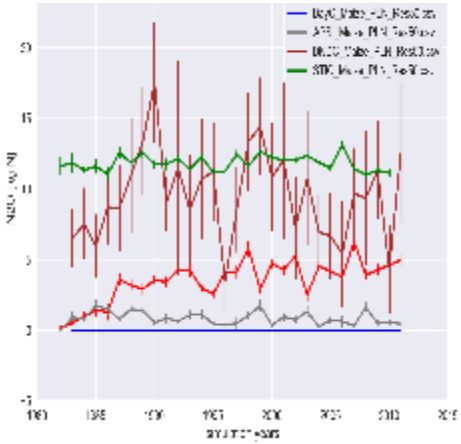
N2O yearly, Climate 10 km



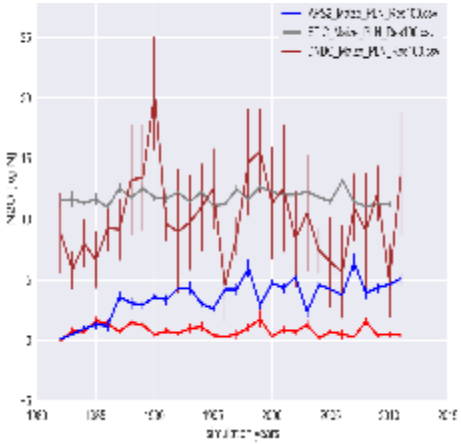
N2O yearly, Climate 25 km



N2O yearly, Climate 50 km

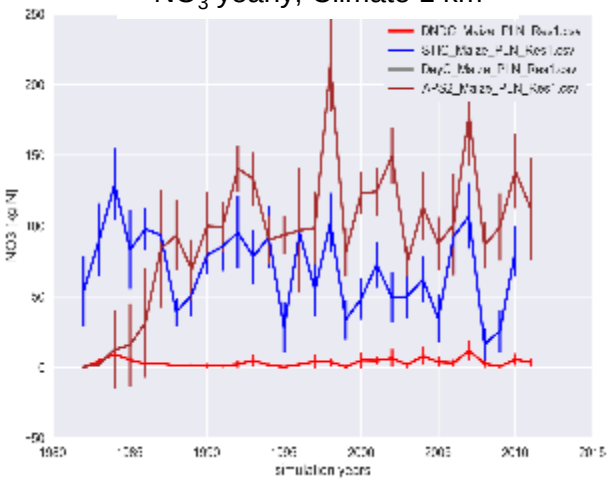


N2O yearly, Climate 100 km

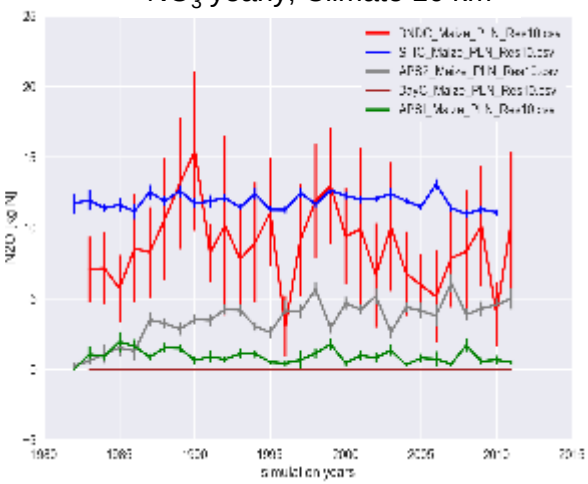


Preliminary results yearly NO3 leaching Maize

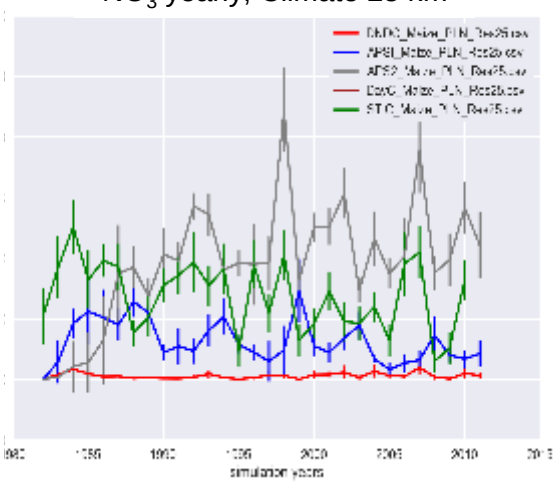
NO_3 yearly, Climate 1 km



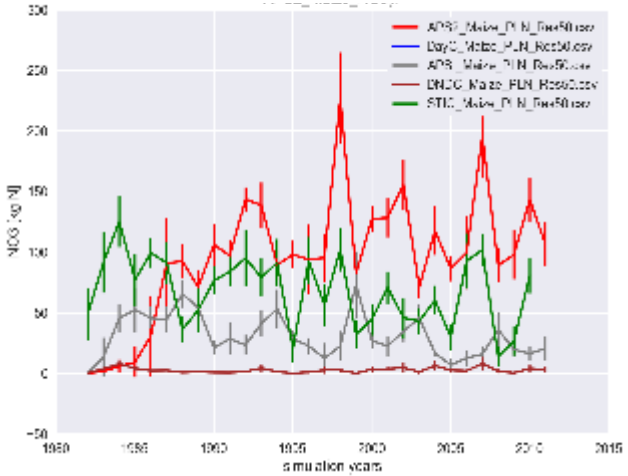
NO_3 yearly, Climate 10 km



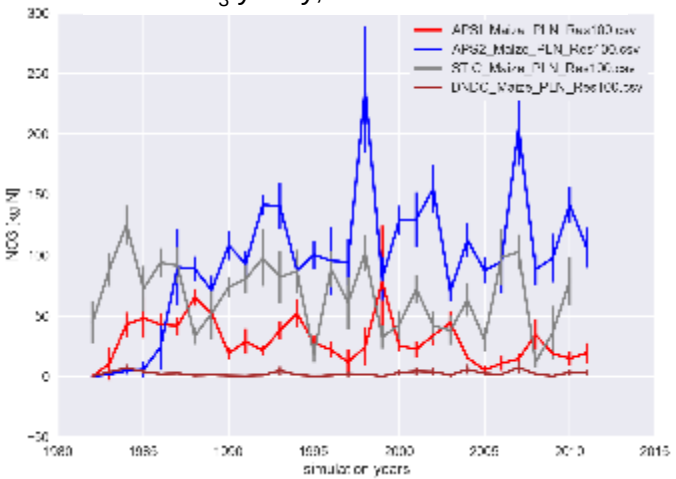
NO_3 yearly, Climate 25 km



NO_3 yearly, Climate 50 km

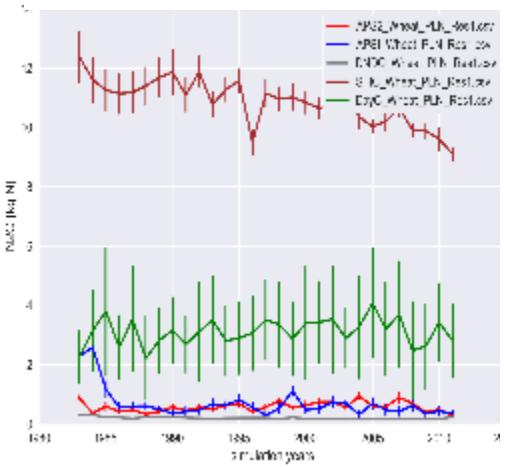


NO_3 yearly, Climate 100 km

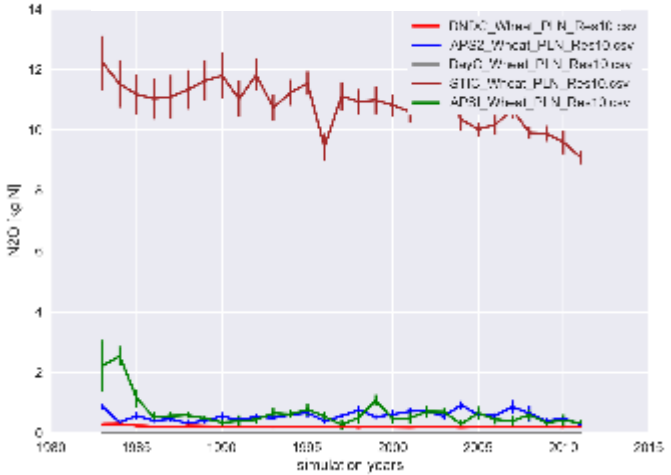


Preliminary results yearly N_2O emissions Wheat

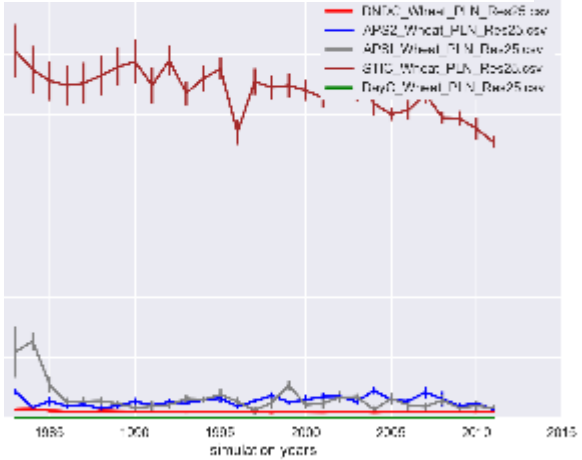
N2O yearly, Climate 1 km



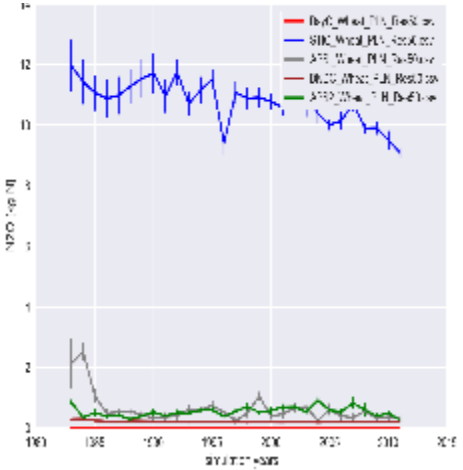
N2O yearly, Climate 10 km



N2O yearly, Climate 25 km

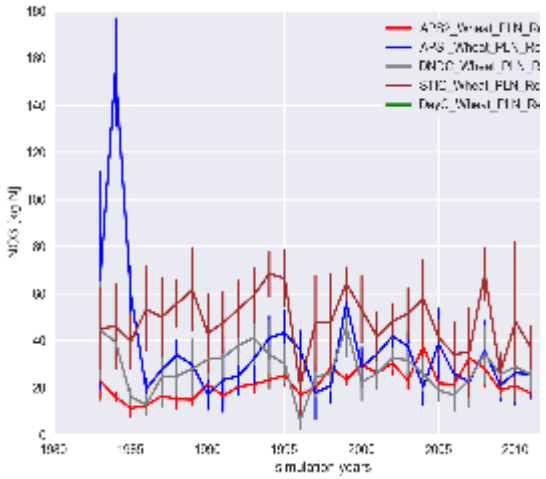


N2O yearly, Climate 50 km

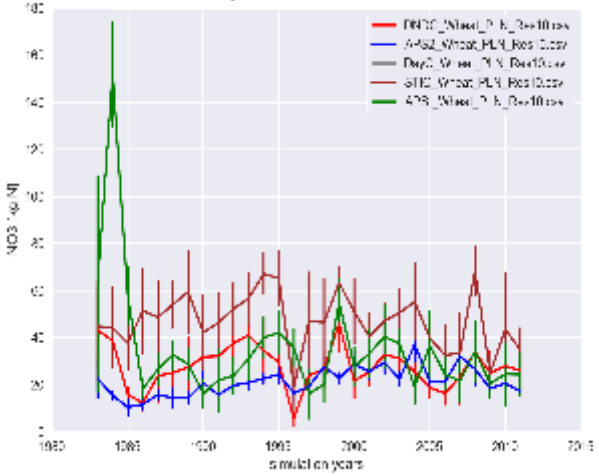


Preliminary results yearly NO3 leaching Wheat

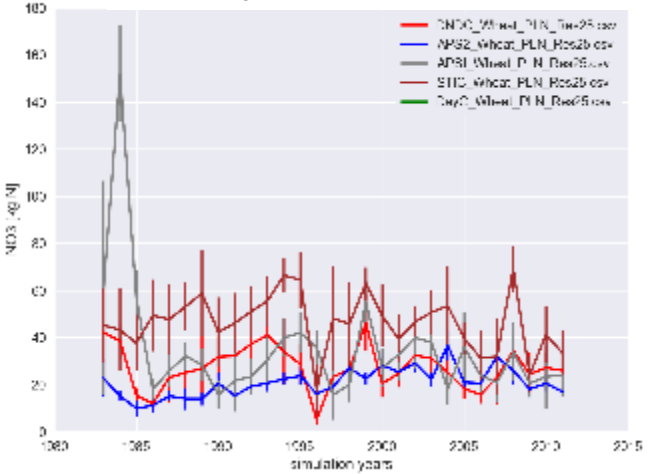
NO_3 yearly, Climate 1 km



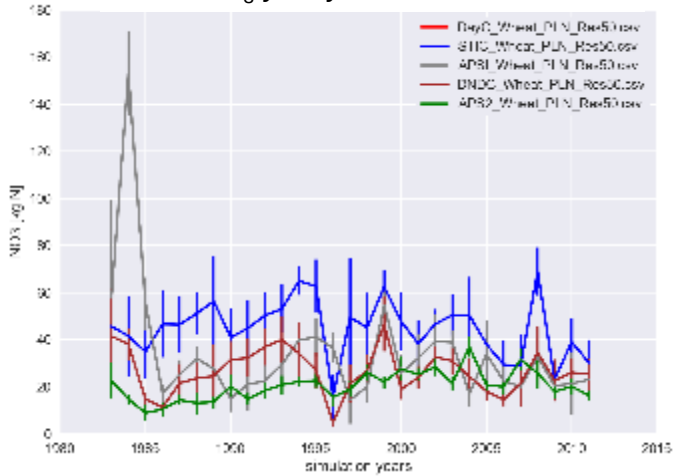
NO_3 yearly, Climate 10 km



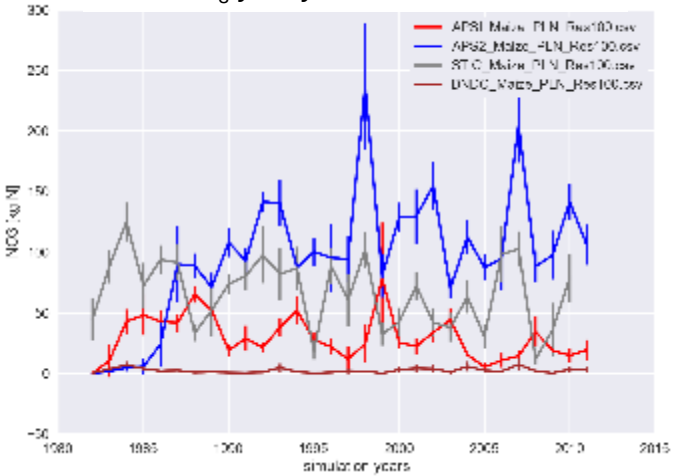
NO_3 yearly, Climate 25 km



NO_3 yearly, Climate 50 km



NO_3 yearly, Climate 100 km



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

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Holger Hoffmann

Gang Zhao