CAMAERA

NH3 model implementation

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PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

IMPLEMENTED BY ECMWF

FMI

Coordinated by HYGEOS

Essense of the problem

N fertilization from CESM crop model

Fertilizer types from International Fertilizer Association

Manure N production from FAO datasets

?

CLM

Community Land Model

FAN

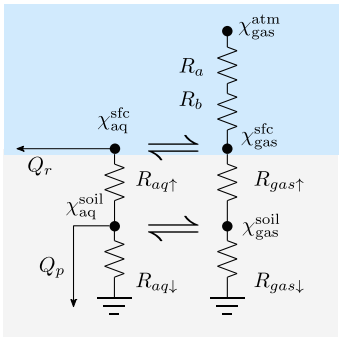
Ammonia emissions across the agricultural sector:

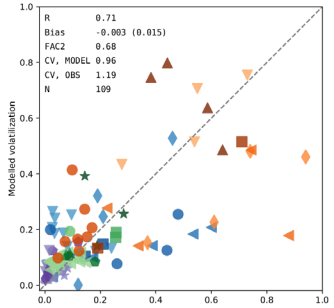
Manure spreading

Manure storage & handling

Grazing

Fertilizer use: urea, nitrate, others



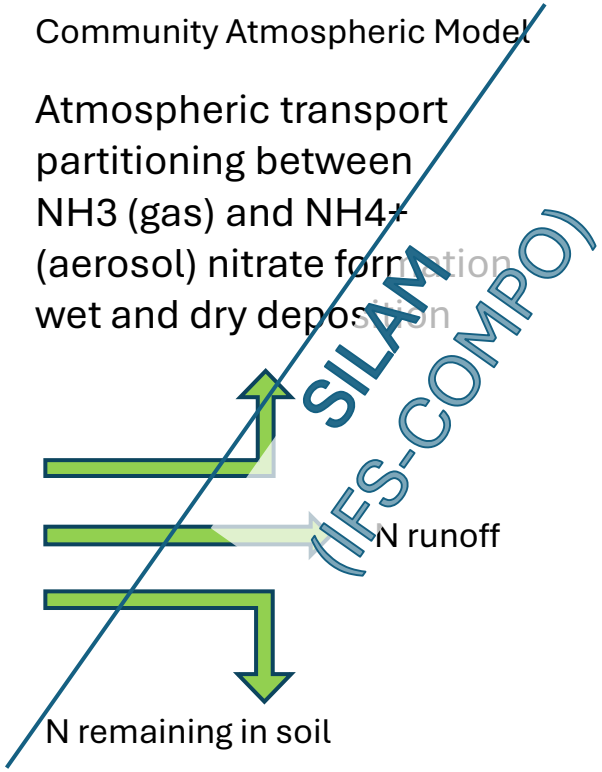


Riddick et al., 2016, Biogeosciences
Vira et al., 2020, Geosc. Model Dev.

CAM

Community Atmospheric Model

Atmospheric transport partitioning between NH3 (gas) and NH4+ (aerosol) nitrate formation wet and dry deposition



Vira et al., 2022, Atmos. Chem. Phys.

Essense of the problem (2)

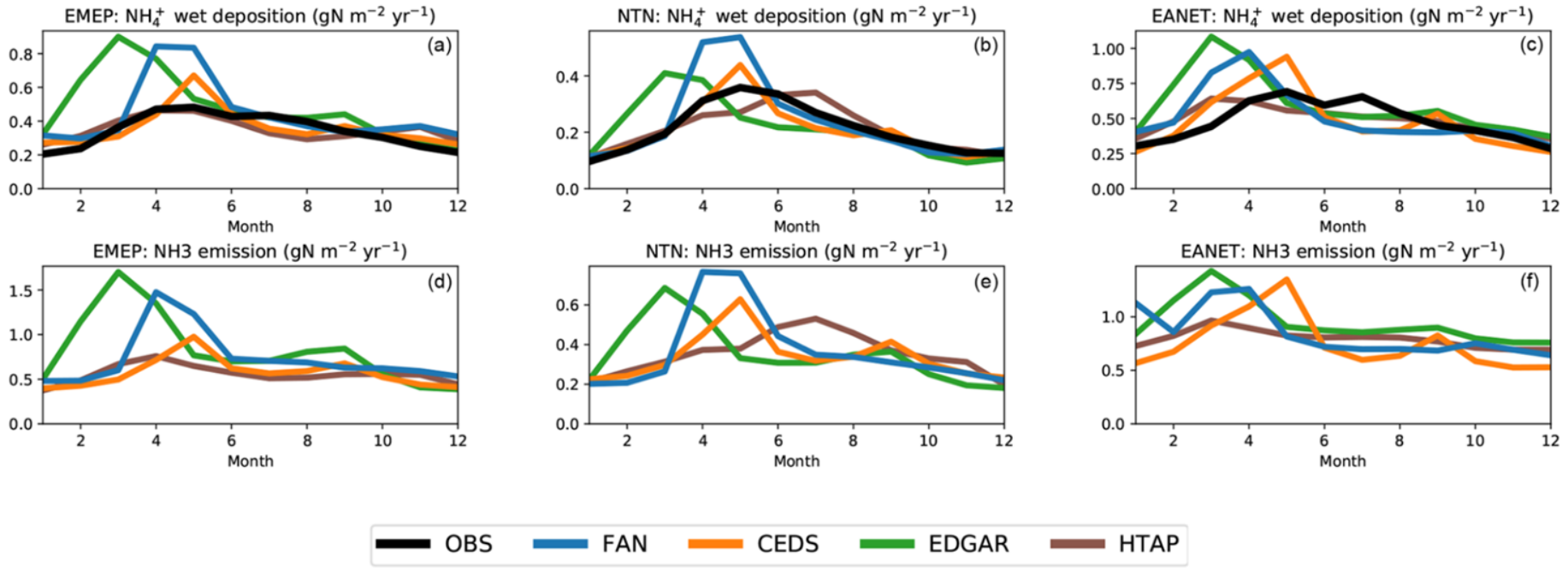


Figure 8. Seasonal profiles of simulated NH_4^+ wet deposition **(a–c)** and and NH_3 emissions for the EANET, EMEP and NTN networks. All values are averaged over the years 2010–2015; the emission fluxes are evaluated for the observed sites.

Solution: new model

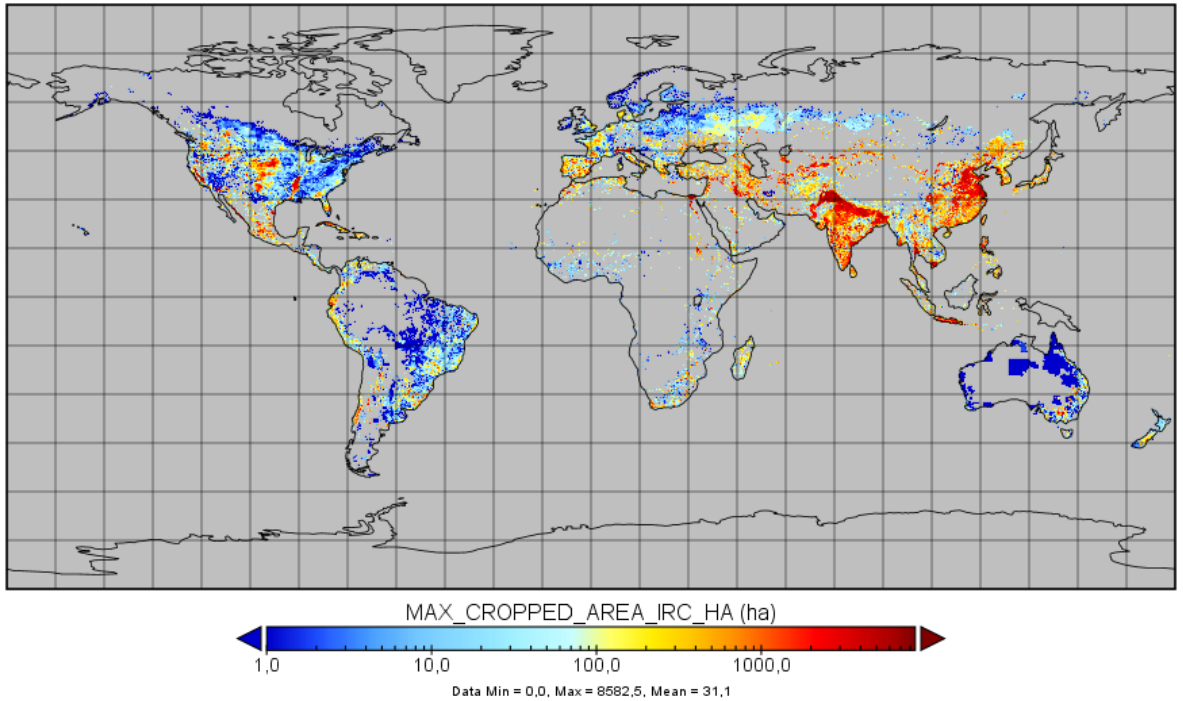
- A model simulating the fertilizer and manure input into soil
- Input data need: spatial distribution, growing season, temporal disaggregation, crop-wise disaggregation
- MIRCA2000: temporal disaggregation, 26 crop types, gridded, countries
- FAO fertilizer and harvested area – country level, annual total for 1961-2023
- Way forwards: use FAO data to rescale MIRCA data back and forth with time.

Problems on the way

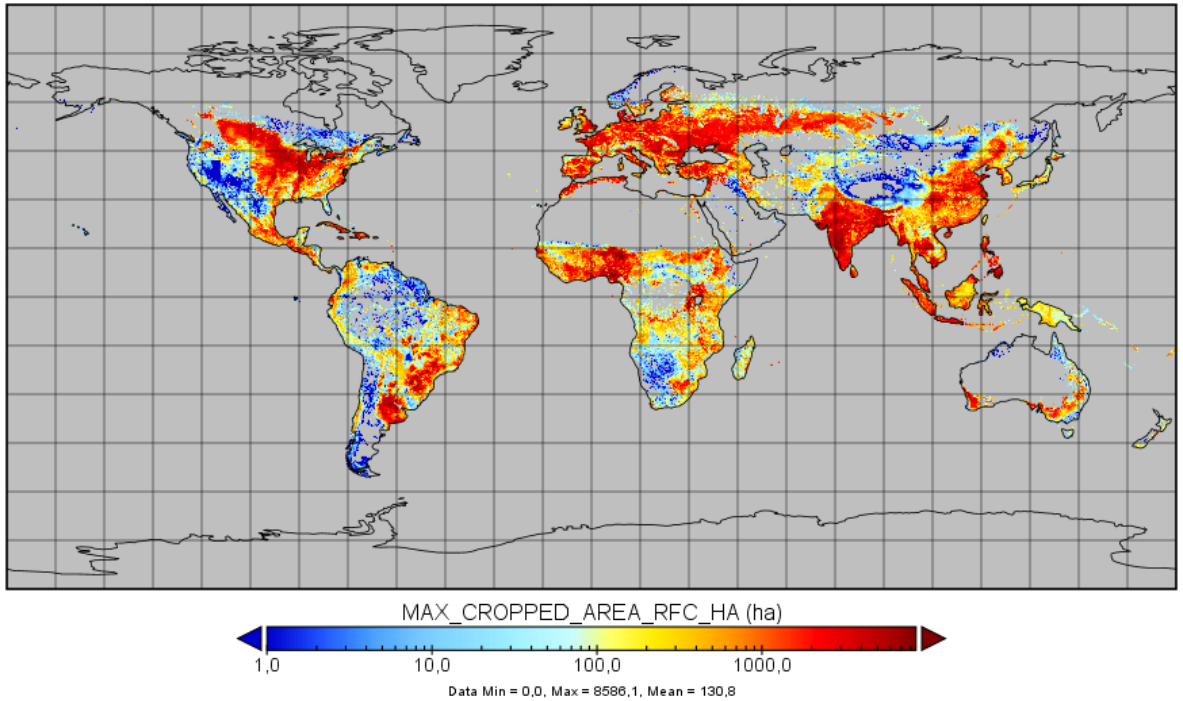
- MIRCA2000 and FAO are not harmonized in any dimension
  - different countries (not follow UN notations)
  - different crops (and different lumping)
  - not entirely consistent total numbers for 2000
- MIRCA2000 has limited list of species
- MIRCA does not have fertilizer-related variable, only start and end of the crop season
  - Assumption: fertilizers are introduced before/at the season start and after the harvest
- Both datasets have some strange features

Crop areas of MIRCA2000

MAX_CROPPED_AREA_IRC_HA

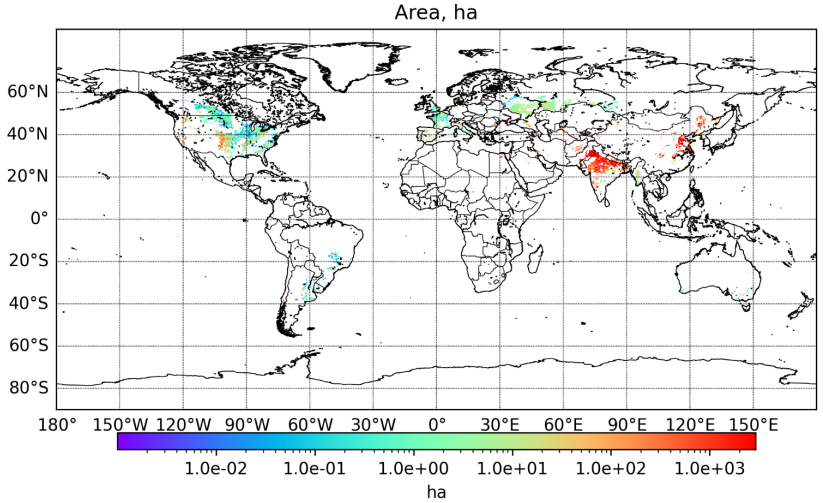


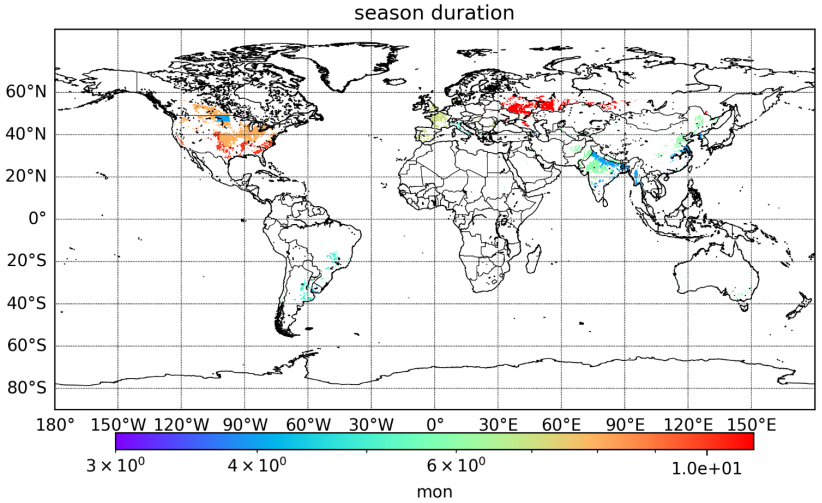
MAX_CROPPED_AREA_RFC_HA

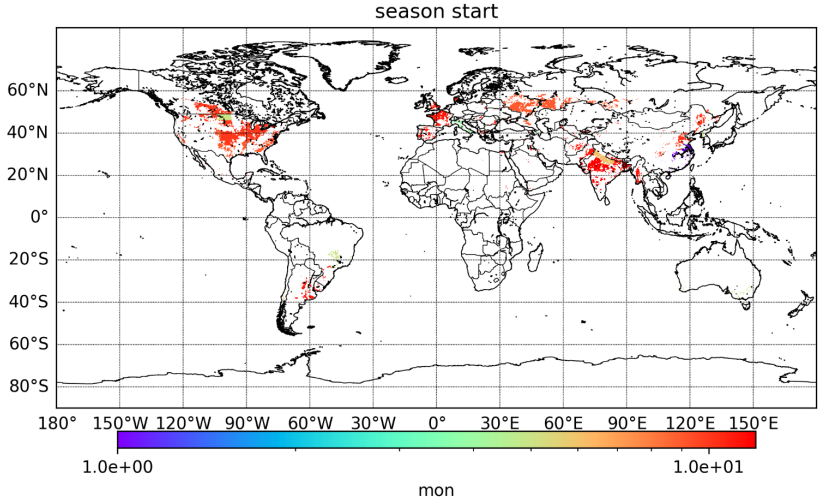


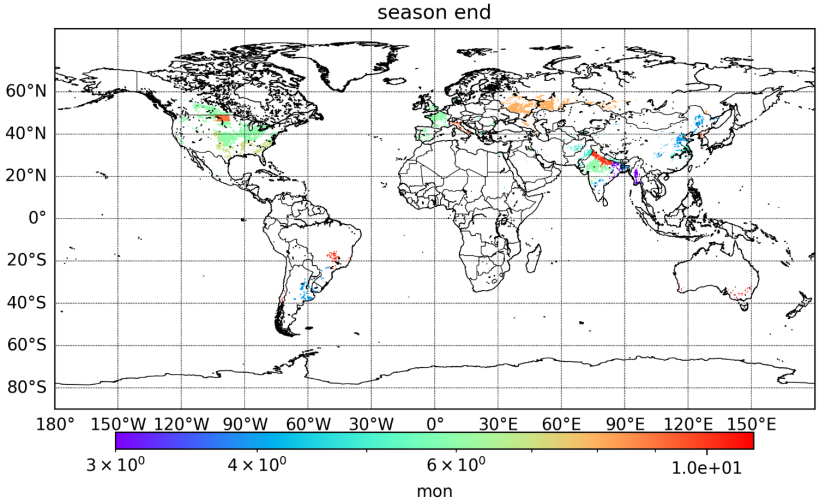
Crop calendars of MIRCA2000

Wheat, irrigated









Calendar of fertilizers, the first try