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A farm level tool coupling farm, cropland and grassland models to assess the effect of farming practices on reactive nitrogen emissions and greenhouse gas balance and to define mitigation strategies

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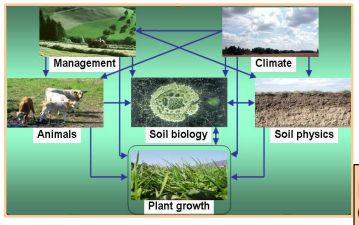
Context

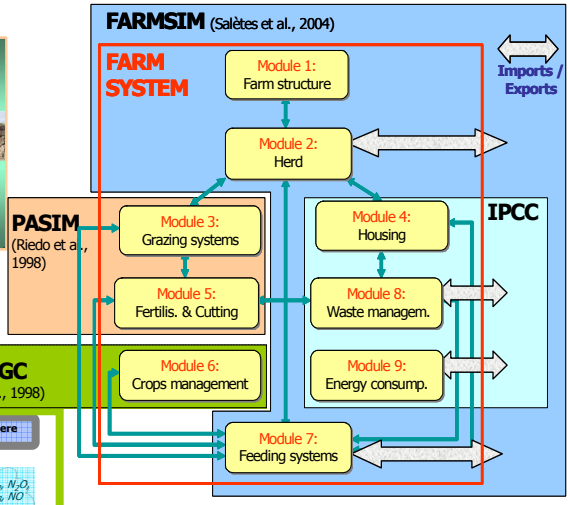
Agricultural systems, especially livestock systems, are a large source of emissions of greenhouse gas (nitrous oxide N_2O, methane CH_4, carbon dioxide CO_2) and reactive nitrogen (ammonia NH_3, nitrogen oxides NO_x, nitrates NO_3^-) in Europe. A lot of mitigation options have been suggested in the literature, but they have mainly focused on a single gas and have generally dealt with isolated processes. An approach at the whole farm system is needed to account for several options at the same time.

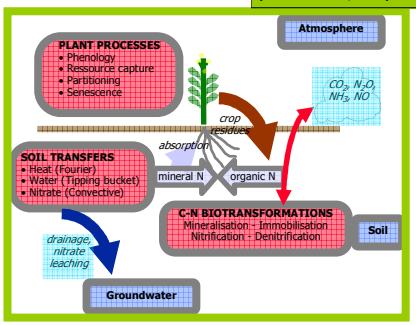
Objectives

→ To develop an integrated modelling tool to assess the effect of farm practices on reactive nitrogen emissions, the greenhouse gas (GHG) balance and carbon sequestration at the whole farm level
→ To assess the contribution of a mechanistic crop model instead of crop emission factors to simulate nitrogen emissions and the GHG balance
→ To use this modelling tool to assess the impact of mitigation options on the farm GHG balance

Coupling FARMSIM / PASIM / CERES-EGC models







Java interface

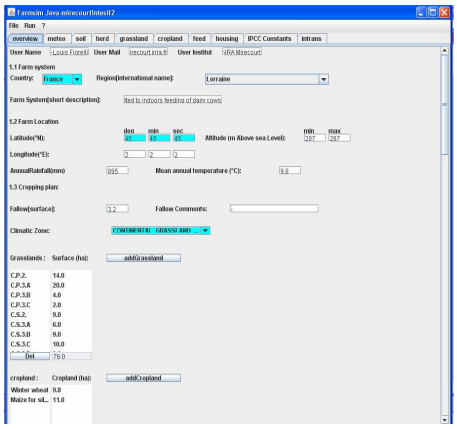
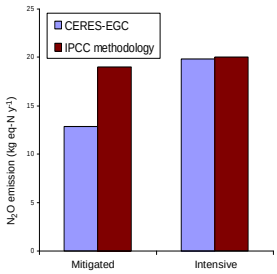


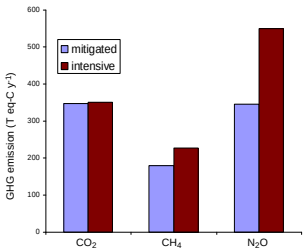
Illustration of the coupled model behaviour

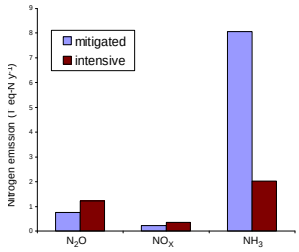
Case study of the Mirecourt farm

Comparing CERES-EGC/IPCC methodology



Comparing intensive and mitigated farming systems





The Mirecourt farm

(north-east France, GREENGRASS network)

→ Re-building of a crop livestock system from description of farming practices within an intensive dairy farm

→ Conception of a mitigated farming system:
- reducing fertiliser supply
- changing pasture composition
- changing the cropping system for self-sufficiency
- reducing stocking rate
- reducing steer production

Conclusions - Perspectives

→ Further assess the capability of the FARMSIM/PASIM/CERES-EGC model to predict nitrogen and carbon fluxes at the farm level
→ To analyse the sensitivity of model outputs (e.g., the farm greenhouse gas balance) to model parameters
→ To assess the impact of mitigation options (e.g., various scenarios of N management) on farm GHG balance
→ To compare different farm operating systems using scenarios on several years

References

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