REMSAE: MODELING GHG EMISSIONS, N AND C DYNAMICS IN SPANISH AGRICULTURAL SOILS

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1. Introduction

To date, only few initiatives have been carried out in Spain in order to use mathematical models (e.g. DNDC, DayCent, FASSET y $SIMS_{NIC}$) to estimate nitrogen (N) and carbon (C) dynamics as well as greenhouse gases (GHG) in Spanish agrosystems. Modeling at this level may allow to gain insight on both the complex relationships between biological and physicochemical processes, controlling the mechanisms leading to GHG production and consumption in soils (e.g. nitrification, denitrification, decomposing, etc.), and the interactions between C and N cycles within the different components of the continuum plant-soil-environment. Additionally, these models can simulate the processes behind production, consumption and transport of GHG (e.g. nitrous oxide, N_2O, and carbon dioxide, CO_2) in the short and medium term and at different scales. Other sources of potential pollution from soils can be identified and quantified using these process-based models (e.g. NO_3 y NH_3).

2. Materials and methods

2.1. Aim of the group

In December 2013, the Spanish Group on Agrosystems Modelling (ReMSAE) was created in the framework of the Spanish Network on GHG Mitigation in Agriculture (REMEDIA). The aim of ReMSAE is to modeling GHG, N and C dynamics in agricultural systems using four different process-based models (DNDC, DayCent/CENTURY, FASSET and $SIMS_{NIC}$) in three contrasting Spanish agrosystems: irrigated crops in Central Spain, rainfed crops in the Northeast and grasslands and forage systems in the North.

2.2. Process-based models

DNDC (DeNitrificationDeComposition) (Li, 2000) model is a mechanistic process-based model largely used by the scientific community (i.e. more than 2000 research paper published based on it). Added to the spread use in all continents, and in different ecosystems and conditions, DNDC modelers have produced emission estimates rather similar than the measured ones. On the other hand, the DayCent model (Parton et al., 1998) was developed in the Natural ResourceEcologyLaboratory (NREL) (Colorado, EEUU) in the middle 90´s. It is a dynamic biogeochemical model that allows the simulation of GHG emissions from agricultural soils. DayCent is the daily version of Century model used to simulate changes in organic matter dynamics at monthly basis. FASSET (FarmASSEsmentTool) is a dynamic model at farm level useful to simulate soil processes in a daily basis by using information on the crop growth, cattle management, production and management of farm goods. It was developed in the Agroecology Institute of the Aarhus University (Denmark) (Berntsen et al., 2003). Finally, N and C balances at plot and/or farm scale can be simulated by the mechanistic model $SIMS_{NIC}$ (Nitrogen Simulation in Cropping Systems) (Gallejones et al., en rev.). Of recent creation and focused on crop rotations, this model will be also used by ReMSAE. It was developed, using a mass-balance approach, based on N data from field campaigns (i.e. winter wheat crops) in contrasting Spanish areas, and the effect of weather, soil and crop management are among its outputs.

3. Conclusions

The outcomes of this modeling activity will be focused on validating the mentioned models by comparing the generated estimates with experimental data from field campaigns, already carried out in the framework of national and international projects. Additionally, this work will support the process of calculating emission factors for Spanish agriculture.

4. References

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