CSS-CropEnviron: a module of CSS (Cropping System Simulator model) for the GHGs dynamic balance of crops

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Abstract

Croplands may play an important role in climate change mitigation. Therefore, it is fundamental to do a precise estimate of their CO_2-eq emissions. Agriculture contributes to the increase of atmospheric greenhouse gases (GHGs) through disturbance of soil and vegetation C pools (e.g. ploughing/tillage and management of crop residues) and the biospheric fluxes of other GHGs, but also through field or farm operations (e.g. emission of fossil fuels from energy sources needed for tillage practices or in the application of organic amendments and chemicals). A complete description of all ecosystem C-eq fluxes is really expensive in terms of field measurements. Moreover, it is often no longer obtainable from already concluded survey data collection.

This work presents *CSS-CropEnviron*, the module for dynamically estimating components of the GHG budget in Cropping System Simulator (*CSS*) model. *CSS* is a model, written in the SEMoLa language, formed by a collection of modules that simulate, at daily step, crop and soil biogeochemical processes and their interactions with the environment. *CSS-CropEnviron* computes daily CO_2 autotrophic and heterotrophic respiration, net and gross primary production, in order to estimate yearly ecosystem C related balances (NEP and NBP, i.e. ΔSOC). The GHG budget considering both C and N CO_2-eq emissions, is based at farm scale. The module has been evaluated on 3-year continuous maize crop intensively monitored for CO_2 ecosystem fluxes (a combination of Eddy covariance and soil respiration continuous monitoring).

Key words: modelling, cropping system, GHGs, environment, emissions