(1) CNMM-DNDC – Catchment Nutrients Management Model - DeNitrification-DeComposition Model; a process-oriented hydro-biogeochemical model enabling simulation of the gaseous carbon and nitrogen emissions and hydrologic nitrogen losses from a catchment (process model for simulation of biosphere–atmosphere–hydrosphere exchange processes at site and regional scale)

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(3) Available modes for the model runs: Research & Semi-Operational

(4) Components & processes: Atmosphere, Hydrosphere, Pedosphere, Biosphere & Physical, Chemical, Biological, Hydrological
-> linking to impact assessment

(5) Brief model description

The CNMM-DNDC model was established by incorporating the core biogeochemical processes of DNDC for carbon and nitrogen transformation (including decomposition, nitrification, denitrification and fermentation) into the hydrologic framework of CNMM, which in turn is a process-oriented catchment nutrient management model. In addition to the entire hydrologic framework, other modules for determining additional dimensions of biogeochemical fields, such as those of soil microclimate and plant growth, were also directly inherited from CNMM.

The CNMM-DNDC model can simulate the complex interactions of water, carbon and nitrogen at catchment scale, especially the lateral water flows and their influences on nitrogen transportation and thus production and emissions of carbon and nitrogen gases (including CO_2, CH_4, NH_3, NO, N_2O and N_2) which are regulated intensively by environmental factors as well as management practices. This model has been validated in a small subtropical catchment with comprehensive field observations (Fig. 1). Meanwhile, the initial simulation of the catchment showed scientifically logical predictions of ecosystem productivity, net emissions of individual carbon and nitrogen gas species and hydrologic losses of nitrogen from an entire catchment or its individual landscape units (Fig. 1). The satisfactory performance implicates the model's promising capability of predicting ecosystem productivity, hydrologic nitrogen loads, losses of reactive gaseous nitrogen and emissions of greenhouse gases within a subtropical catchment and the potential application of the model for establishing sustainable landscapes.

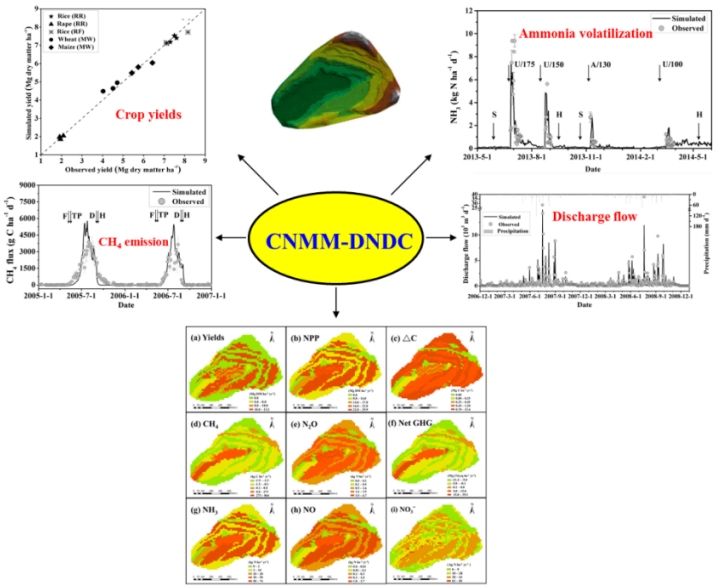

Fig. 1: The model performance of CNMM-DNDC

References:

Zhang W, Li Y, Zhu B, Zheng X, Liu C, Tang J, Su F, Zhang C, Ju X, Deng J. (2018): A process-oriented hydro-biogeochemical model enabling simulation of gaseous carbon and nitrogen emissions and hydrologic nitrogen losses from a subtropical catchment. Sci Total Environ., 616-617:305-317. doi: 10.1016/j.scitotenv.2017.09.261