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Supplementary Materials for

Article

Modeling Climate Change Effects on Rice Yield and Soil Carbon Under Variable Water and Nutrient Management

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DNDC model is a process-based model that consists of two overarching components.[1] The first component, comprised of soil-climate, crop-growth, and decomposition, integrates climate, soil, crop and management factors, while the second component consists of nitrification, denitrification, and fermentation sub-models (Figure S1). The input parameters are shown at Table S1. The DNDC model divided the simulated soil into several pools of organic matter. Decomposition can simultaneously occur in three organic matter pools: decomposable residues (mainly plant residues), microbial biomass, and humads; each pool has a labile and resistant component. Soil organic carbon (SOC) are defined as the sum of microbial biomass, humads, and humus[2]. The modeled soil is divided into a series of horizontal layers and each layer is assumed to have a uniform temperature and moisture content, assigned to a point at the middle of the layer. For each time step, water fluxes and heat flows between layers are determined by the gradients of soil water potential and soil temperature, respectively. In addition, evapotranspiration (ET) is calculated as monthly average values using the Thornthwaite formula[1]. DNDC models the effects of soil temperature and water content on microbial activity with reduction factors (taken as the product of temperature and moisture) which retard the decomposition rate for nonoptimum conditions. Moreover, plants additionally produce biomass, including yield and litter, which affects carbon pools of soil[3].

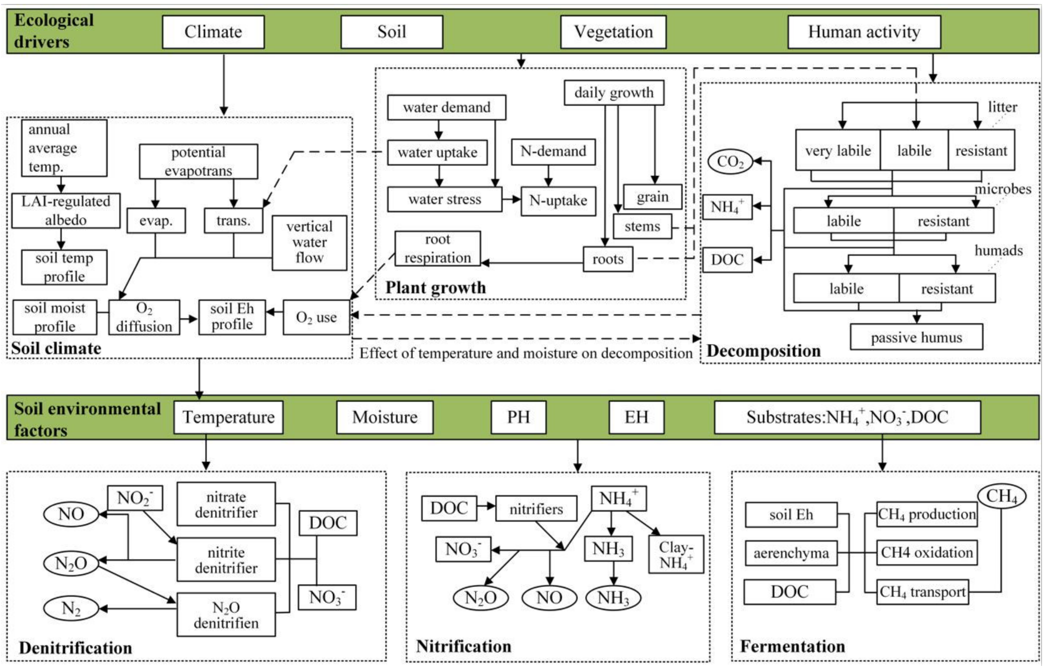

Figure S1. Structure of the DNDC model (https://www.dndc.sr.unh.edu/).

Table S1. Input parameters required for regional simulation with DNDC.

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Items	Input parameters
Climate	Maximum temperature, minimum temperature, precipitation, rainfall N concentration
Soil	SOC at surface soil (0-10 cm), soil texture, pH, bluk density, nitrate, ammonium
Crop parameters	Maximum yield, biomass C/N, thermal degree days, water demand, growing degree days
Management	Planting date, harvest date, fertilizer application rate, irrigation, film mulch, manure amendment, tillage, residue incorporation

Reference

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3. Zhang, Y.; Niu, H., The development of the DNDC plant growth sub-model and the application of DNDC in agriculture: A review. *Agriculture, Ecosystems & Environment* **2016,** 230, 271-282.