



Review

The development of China-DNDC and review of its applications for sustaining Chinese agriculture



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ABSTRACT

During the past century Chinese agriculture has been struggling to produce more food to support the ever growing population, while dealing with the increased degradation of air, water and soil quality in the agricultural regions. Lessons learnt from the long-term efforts indicated that scientifically sound methodology could play a crucial role in understanding the complex interactions among climate, soil, water and farming management practices, all of which collectively control the agroecosystem services including crop yield, greenhouse gas emissions, nutrient loading and other environmental issues. Therefore, the development of a more process-based approach is needed. The process-based model, DNDC (Denitrification-Decomposition) has been widely used internationally to simulate detailed carbon and nitrogen biogeochemical cycles occurring in agricultural systems. However, this model is not fully suitable for China as it lacks a number of features which are crucial for representing Chinese agro-ecosystems, including paddy rice cultivation, complex and multiple cropping systems, and intensive management practices, etc. Recently a new version of DNDC, China-DNDC, was developed. The new model improved its capability of predicting the fluxes of all three terrestrial greenhouse gases: nitrous oxide (N₂O), carbon dioxide (CO₂), and methane (CH₄), as well as other important indicators such as crop phenology, soil C sequestration, and nutrient leaching from different cropping systems across all the major agricultural regions in China. This paper reported how China-DNDC was developed, tested and applied for sustaining Chinese agriculture. And then, it identified the weaknesses and potential improvements for the model.

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