

## **Network Update: Landscape Management of Agricultural System (LMAS)**

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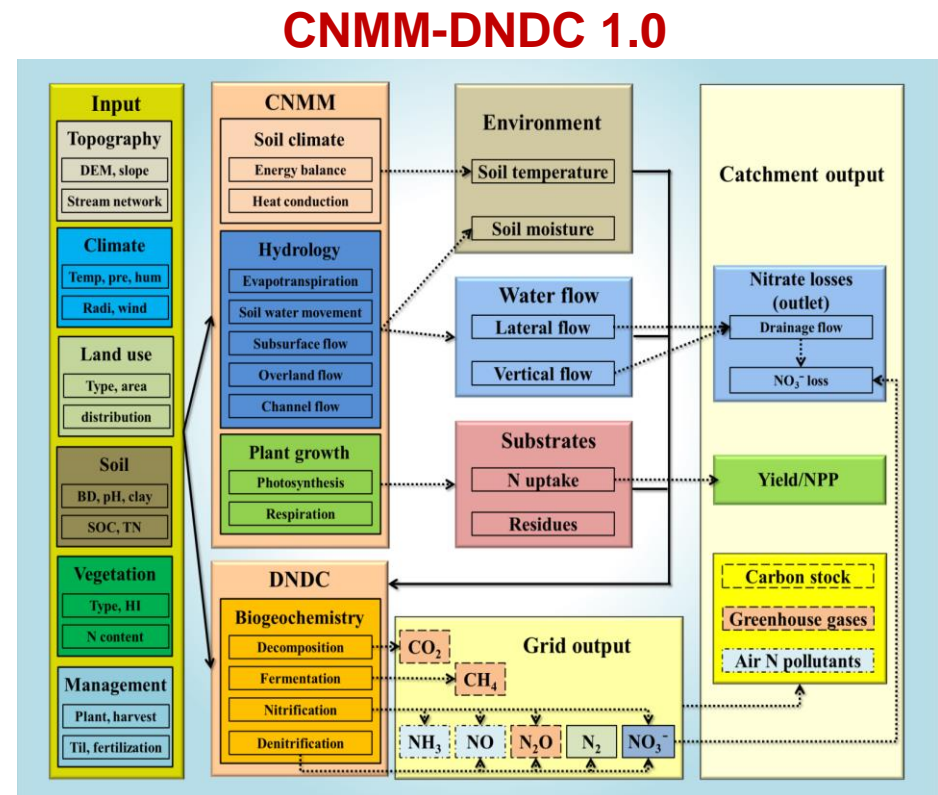
Institute of Atmospheric Physics, Chinese Academy of Sciences (IAP-CAS)

CRG-GRA Annual Meeting, November 14<sup>th</sup>, 2019, San Antonio, USA

# Activities/Accomplishment since last meeting: **LMAS**

## Activities since the last CRG annual meeting

- Implementing the development of **CNMM-DNDC** -- A core working model for the Landscape Management of Agriculture System Network (LMAS)



This initial version of the model was lately built up, validated in a subtropical catchment with a multiple-ecosystem landscape, and published by IAP-CAS (Zhang et al., 2018, Sci. Total Environ.).

# Activities/Accomplishment since last meeting: **LMAS**

The designs of CNMM-DNDC aim at universal applicability for various natural and managed terrestrial ecosystems at plot, ecosystem, landscape, catchment or regional scales.

CNMM-DNDC is:

- a hydro-biogeochemical model;
- spatial distributed, with hourly to daily temporal resolution, and customized spatial resolution;
- desired to work in a single- or three-dimension mode.
- designed as a potential tool for virtual experiments of terrestrial ecosystems/landscapes/catchments to predict carbon and nitrogen processes under variable complex conditions;
- designed as the potential core of a decision-supporting system for identifying the best landscape management strategies.

# Activities/Accomplishment since last meeting: **LMAS**

## ■ **Building the CNMM-DNDC research group (in IAP-CAS) for the LMAS**

- The group currently has 9 scientists in IAP-CAS positions:
  - 4 professors in fixed positions for model development, validation, application (group leaders: X Zheng, K Butterbach-Bahl; leading data observations: C Liu, Z Yao);
  - 2 modellers in 6-year postdoc positions for model development, validation, application (W Zhang, S Li);
  - 1 associate professor in fixed position for model application in inventory compilation ( S Han);
  - 2 assistant professors in fixed positions for data observations, development of better measurement methods (R Wang, K Wang);

# Activities/Accomplishment since last meeting: **LMAS**

- **Building the model development group of CNMM-DNDC (in IAP-CAS) for the LMAS**
- Making efforts to add 2 fixed professor positions of modellers:
  - one applicant has been approved by IAP-CAS (the applicant may take the position in 2020);
  - another applicant is under review (if success, the applicant would come to position in 2020).



# Activities/Accomplishment since last meeting: **LMAS**

## ■ Further development and test of CNMM-DNDC

- Updating from version 1.0 to 2.0 for improved applicability in simulating emissions of GHGs and other nitrogenous gases, through
  - modification by adding plant-mediated soil pH changes (Zhang et al., 2019, to be soon submitted), and,
  - Modification by revising the heat conductivity and energy balance in regions with seasonally/permanently frozen soils (Zhang et al., in preparation).
- Adaptation for applicability of both single- and three-dimension modes with hourly or daily resolutions (Li et al., in preparation);
- Modification and validation for ammonia volatilization from fertilized croplands at multiple fields sites of China (Li et al., in preparation).

# Activities/Accomplishment since last meeting: **LMAS**

- **Other activities related to CNMM-DNDC development**
  - Modified and validated DNDC for ammonia volatilization from croplands at multiple field sites in [UK \(Dubache et al., 2019, Sci. Total Environ.\)](#) and China ([Li et al., 2019, Sci. Total Environ.](#));
  - Proposed and initially tested an approach for the biogeochemical model-based identification of **the best management practices with criteria of least negative environmental impact potential (NIP) and optimum economic benefits**: a case study of a multiple-crop (cotton, summer maize, and winter wheat) rotation system, using DNDC ([Zhang et al., 2019, Biogeosciences](#));

# Activities/Accomplishment since last meeting: **LMAS**

## ■ Other activities related to CNMM-DNDC development

- The CNMM-DNDC development group got 8 projects in 2018-2019:
  - Three research projects focusing on CNMM-DNDC design, calibration, and validation: granted by CAS, NSFC, and the national Earth System Model Platform project (6M CNY  $\approx$  0.8M USD).
  - Four research projects focusing on field experiments and data observations to support model validation: three granted by NSFC alone and one as a Sino-German cooperation project jointly granted by NSFC and DFG (3.1M CNY + 0.2M Euro  $\approx$  0.6M USD).
  - One as a capacity building project granted by the Financial Ministry of China for instrument purchase/development (10M CNY  $\approx$  1.3M USD).

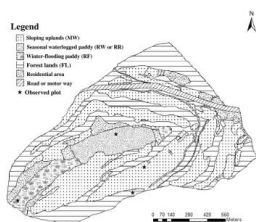
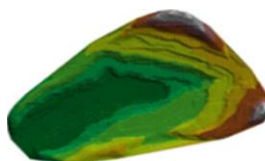
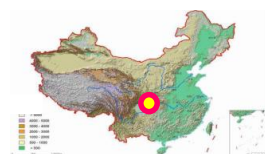


# LMAS network to participate in CRG activities: **Opportunities**

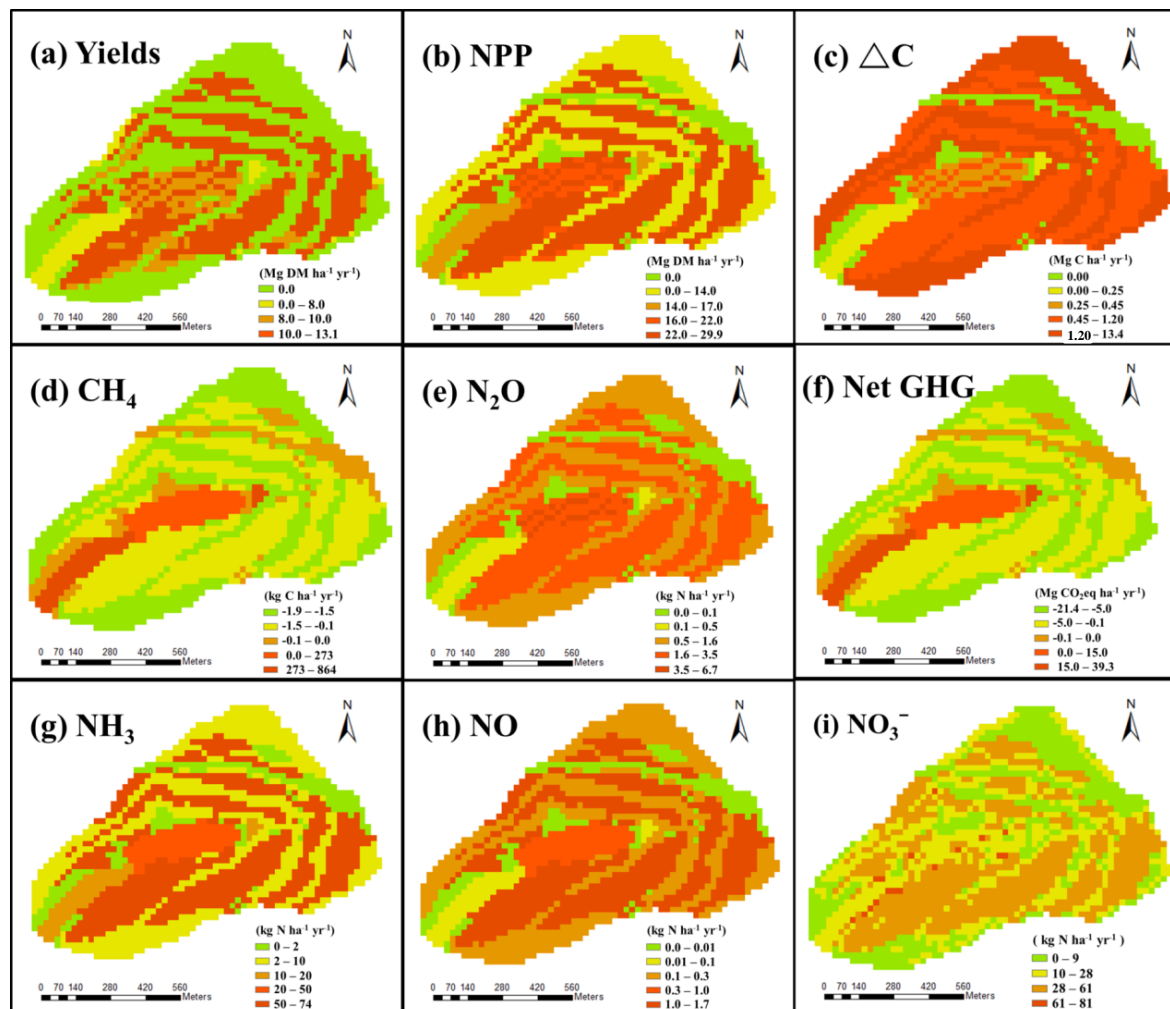
- **Opportunities of project funds, students and postdoc positions to involve in GRA members for the widely validation and application of CNMM-DNDC:**
  - **Bilateral cooperation project:** e.g., the National Natural Science Foundation of China (NSFC) and Chinese Academy of Sciences (CAS) have cooperation agreements with the foundations or institutions many countries or international organizations to support joint research and academic communication;
  - **Scholarships and postdoc programs:**
    - University scholarships; UCAS scholarship: **Open to Ph. D and master students of any country.**
    - National or CAS postdoc programs: **Open to young scientists of any country.**

# CNMM-DNDC performance:

## Subtropical catchment



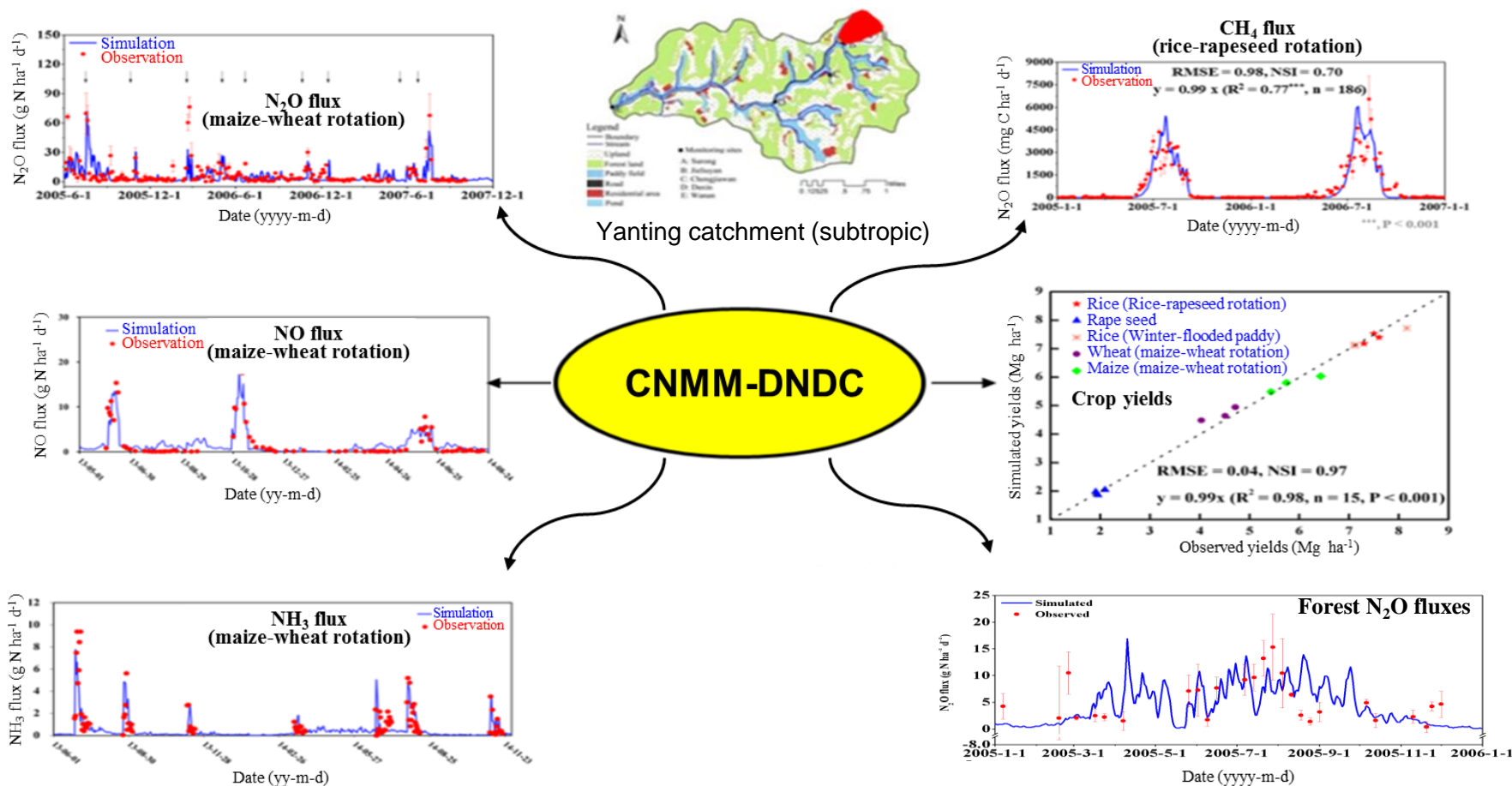
**15×15 m<sup>2</sup>**  
**Yanting**  
**catchment**  
**area: 35 ha**



(Zhang *et al.*, 2018, Sci. Total Environm.)

# CNMM-DNDC performance:

## Subtropical catchment



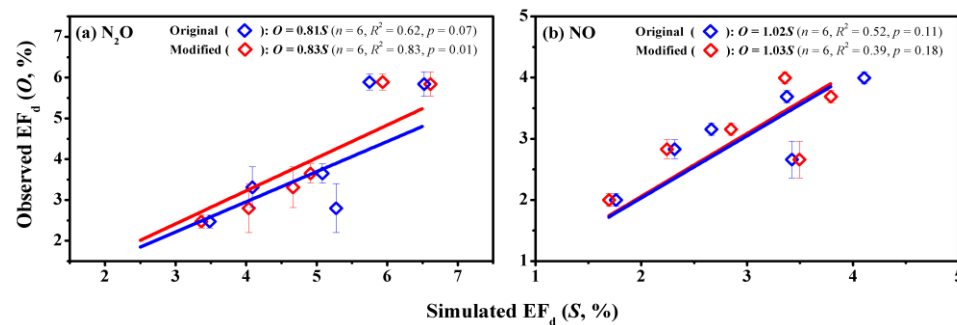
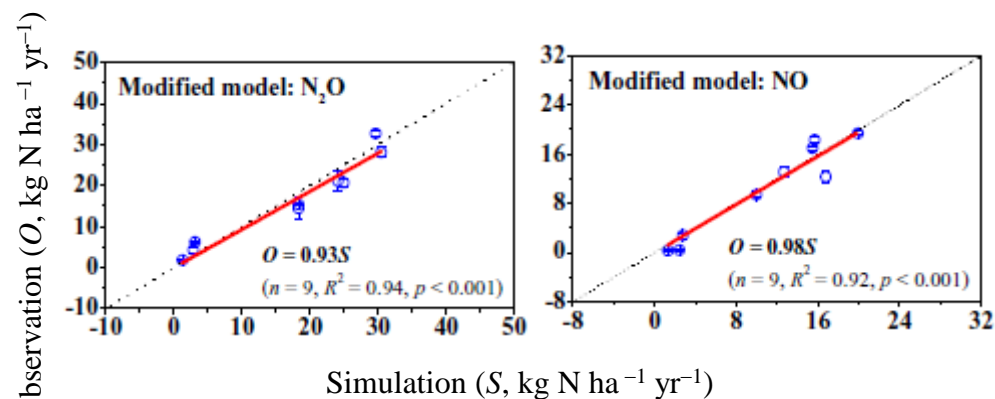
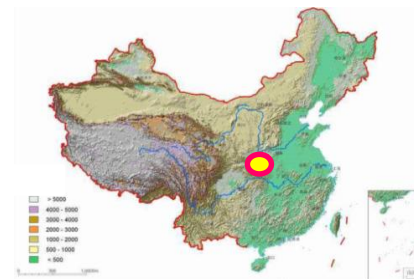
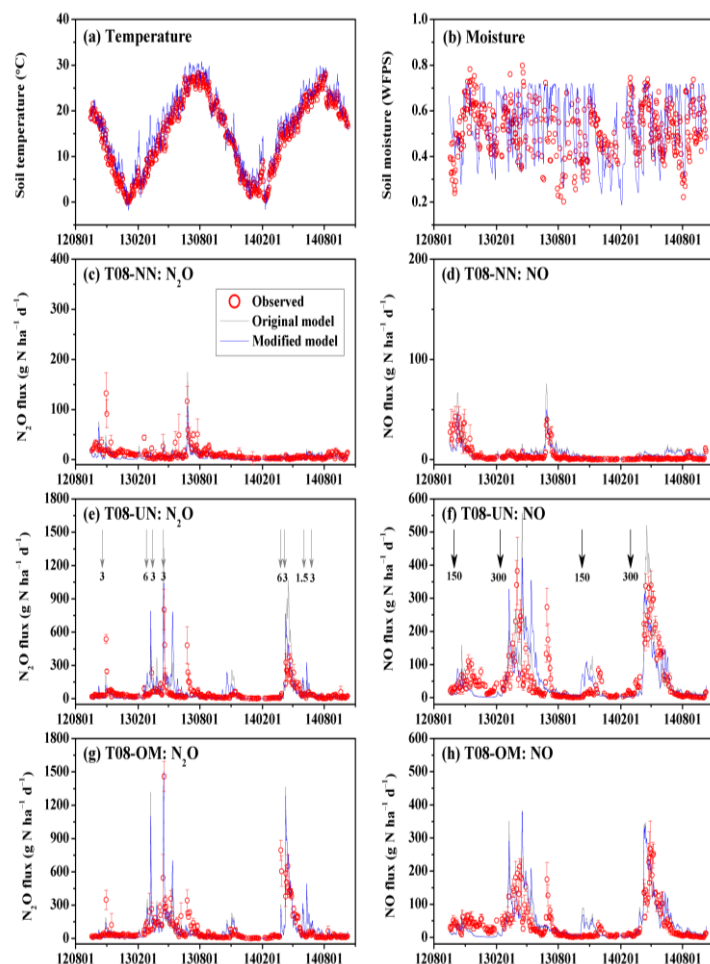
(Zhang *et al.*, 2018, Sci. Total Environm.)

# CNMM-DNDC performance:

## Subtropical tea plantation

GLOBAL  
RESEARCH  
ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES

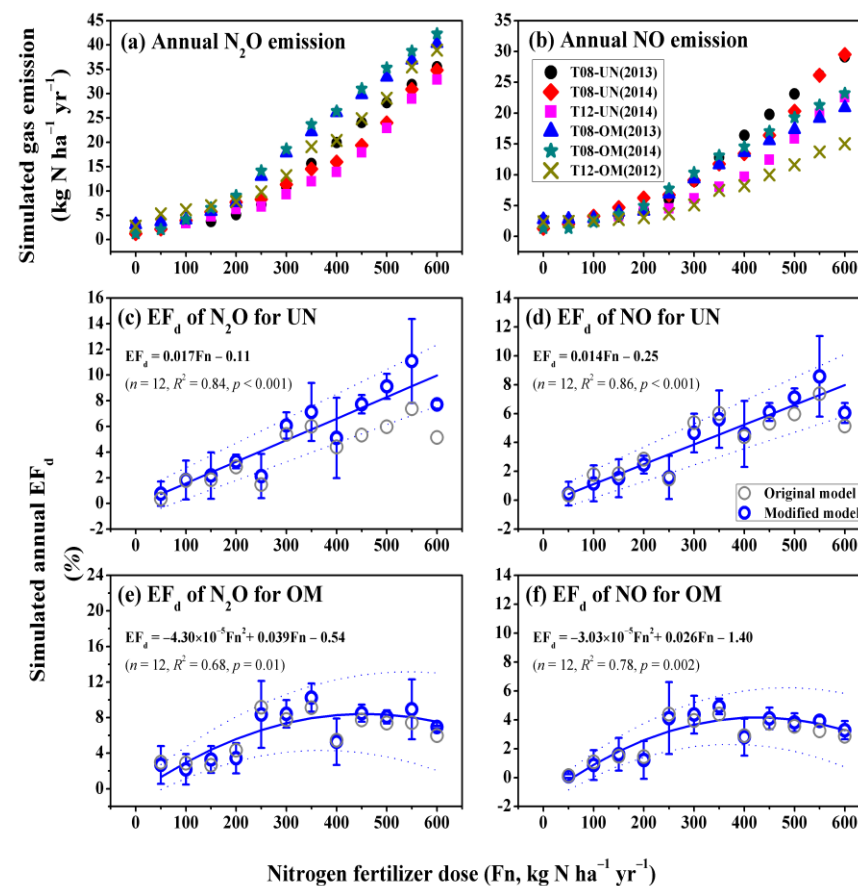
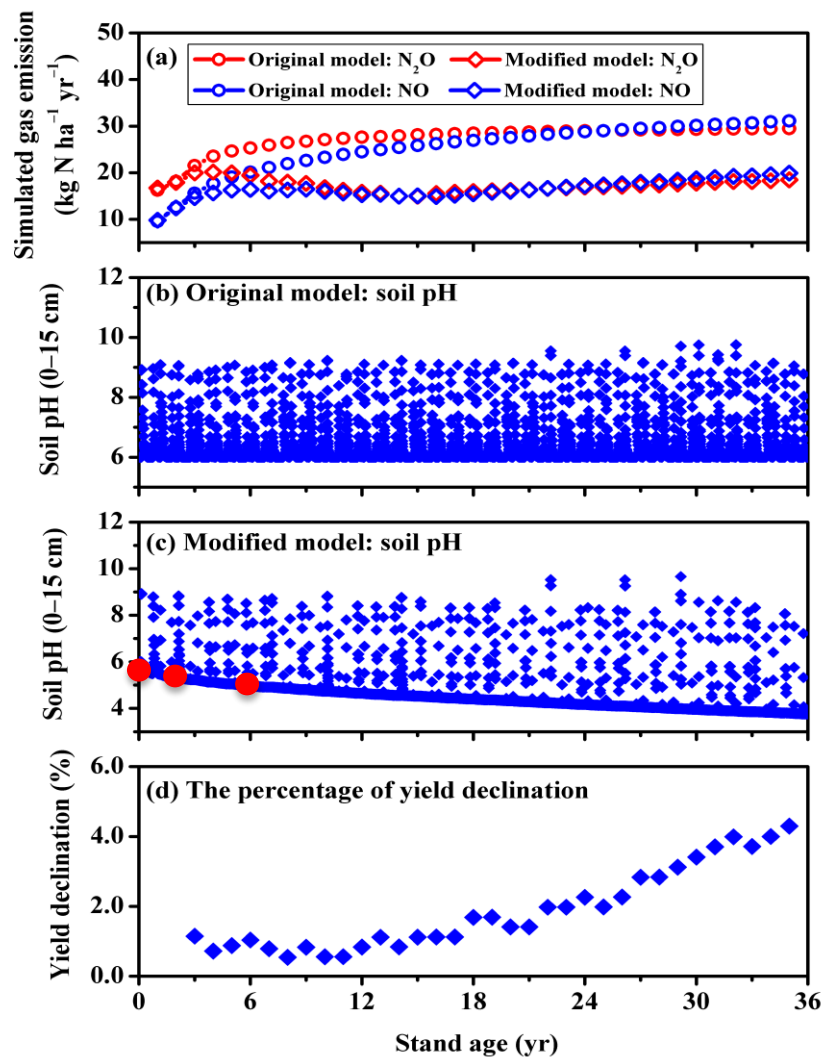


(Zhang *et al.*, 2019, to be submitted)



# CNMM-DNDC performance:

## Subtropical tea plantation



(Zhang *et al.*, 2019, to be submitted)

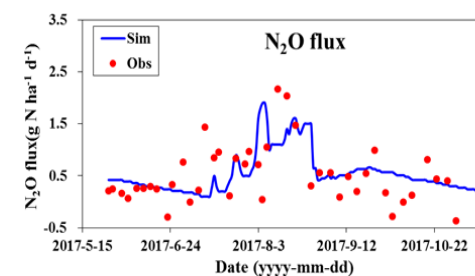
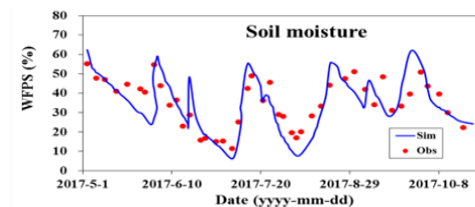
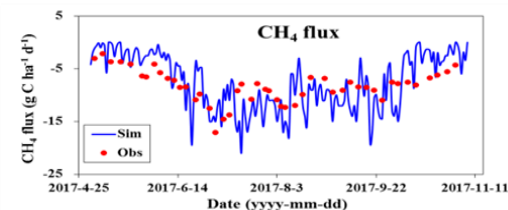
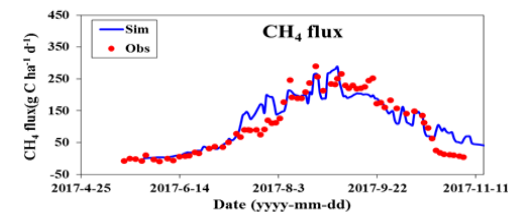
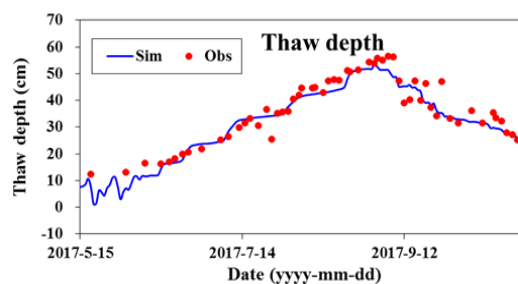
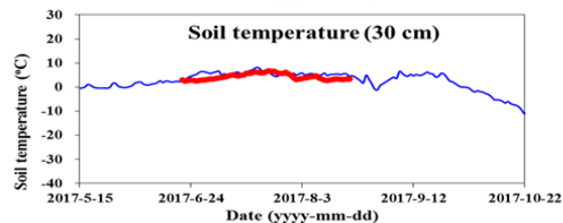
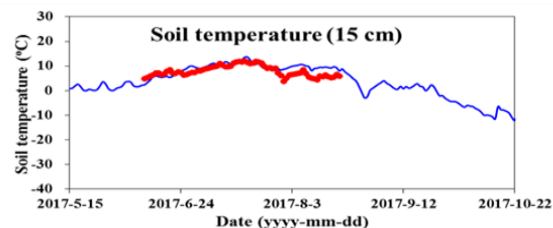
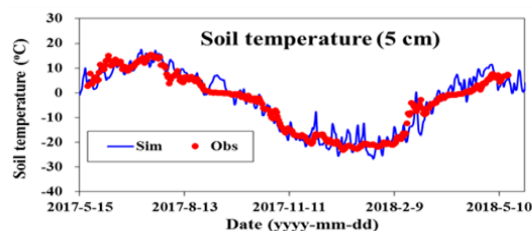
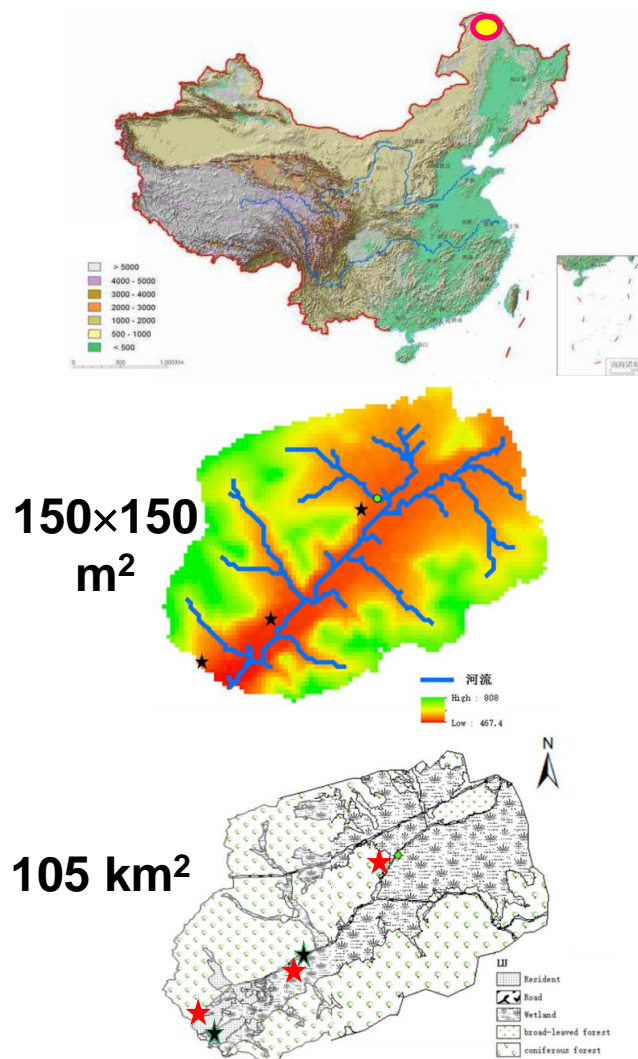


# CNMM-DNDC performance:

## Permafrost catchment

GLOBAL  
RESEARCH  
ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES



(Zhang *et al.*, in preparation)