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Estimates of N_2O emissions and mitigation potential from a spring maize field based on DNDC model

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Introduction

- Nitrous oxide (N_2O) has been recognized as one of the most important GHGs
- Croplands may be an important source of N_2O
- Studies have been conducted on N_2O flux measurements from cropping systems
- DNDC has been proved an effective method to predict N_2O emissions from agricultural soils.

Introduction：this study focus

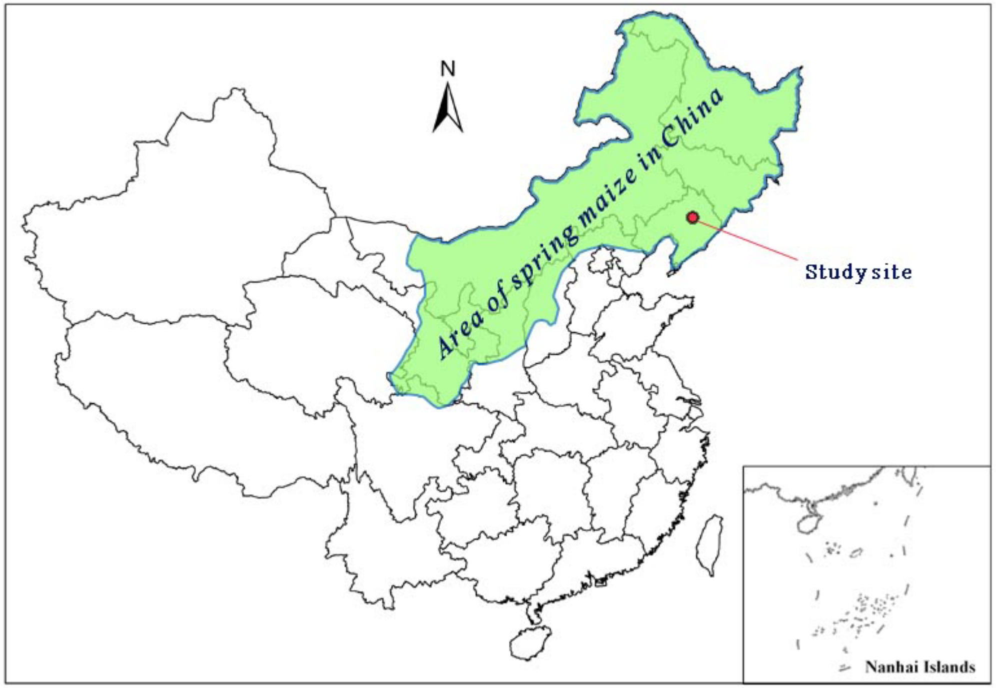
- only very few studies on spring maize system.
- especially applying the DNDC model is seldom reported

Objectives:

- to identify the seasonal variation and main environmental drivers of N_2O emissions under the traditional management practices from a spring maize field in northeast China.
- to test the DNDC model for the simulation of N_2O emissions using the observed data.
- to assess the total seasonal amount of N_2O emissions and EFs by integrating field and model methods.
- to devise feasible strategies to reduce N_2O emissions.

Methods: Experimental site

- The study site was at Yangjia Town, Dalian City in northeast China.
- Mean temp. 8.3~10.3℃, annual precip. 650 mm.
- Brown soil, with bulk density 1.38 g cm^{-3}, pH 7.6, SOM 12.3 g $kg^{-1}$for the top 20 cm soil profile.
- Two treatments, with and without fertilizer application (i.e., **FP and CK**).
- 270 kg N /ha(180 kg N as basal and 90 kg N as additional fertilizer. **No irrigation**

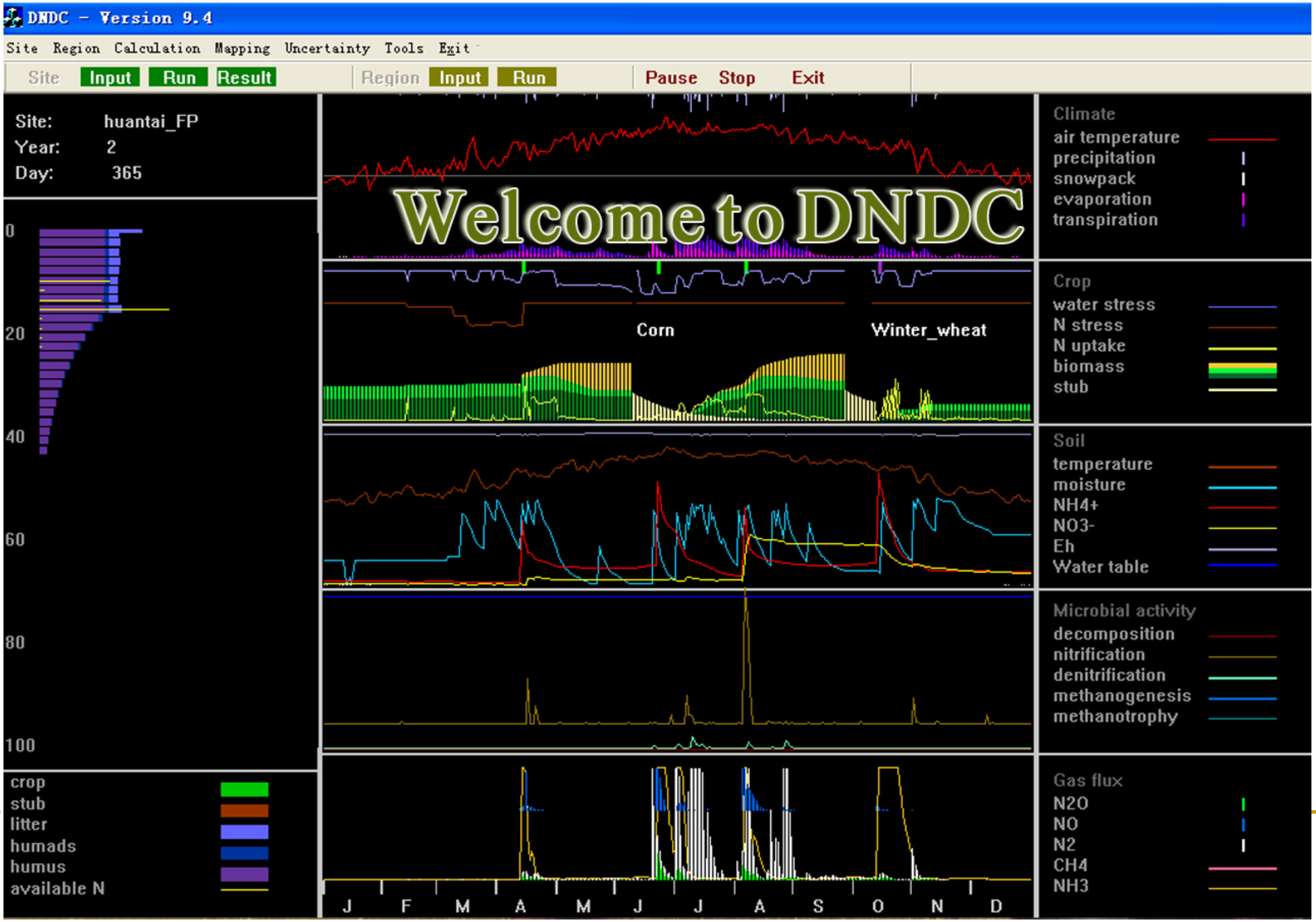


Measurements of N_2O

- Gas sampling: Static chamber method



The DNDC model

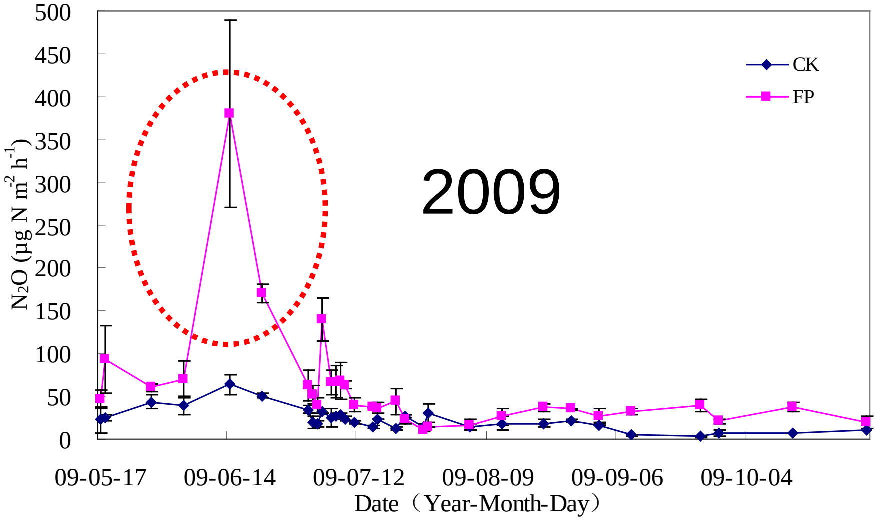


Validation of the model

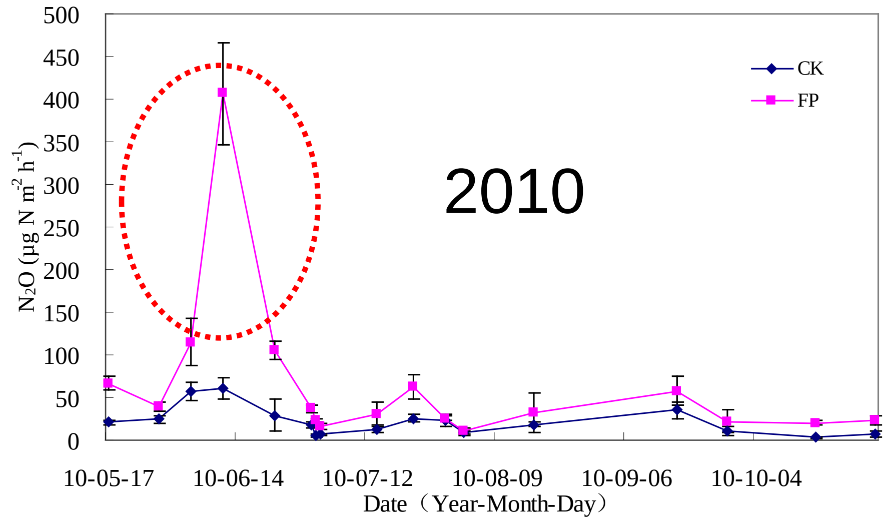
- **Many validation tests from different cropping systems on** crop growth/yield, soil climate, soil C dynamics, and N fluxes.
- Compare the goodness of fit between the field and model of N2O emissions

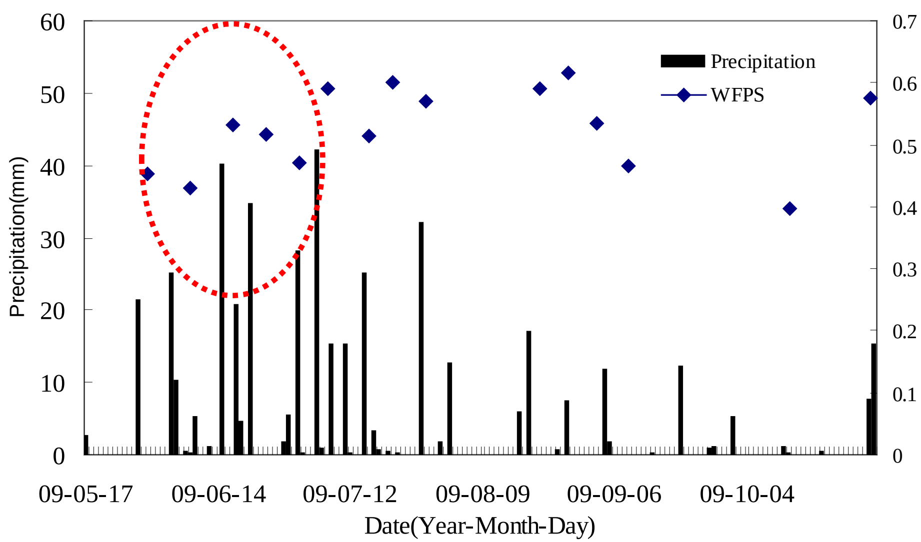
RESULTS: (1) N_2O fluxes

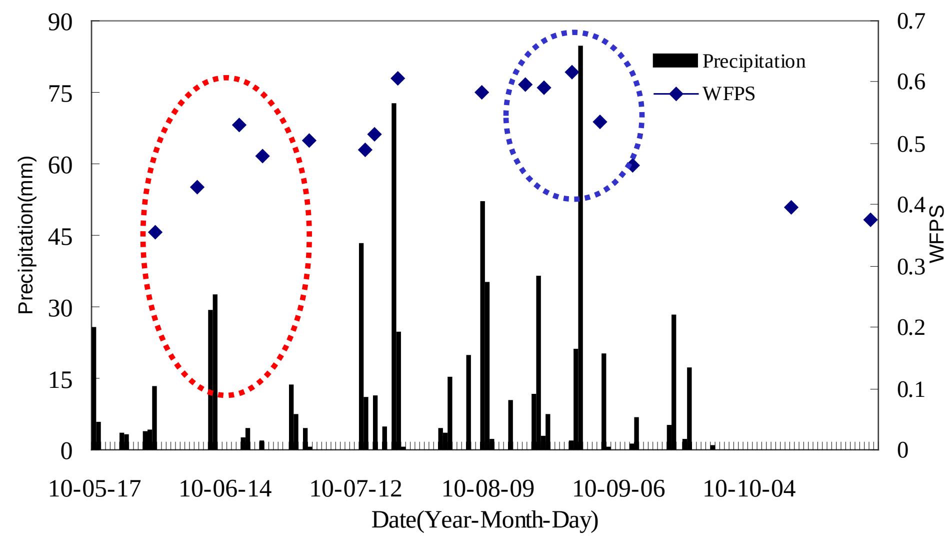
Fertilization



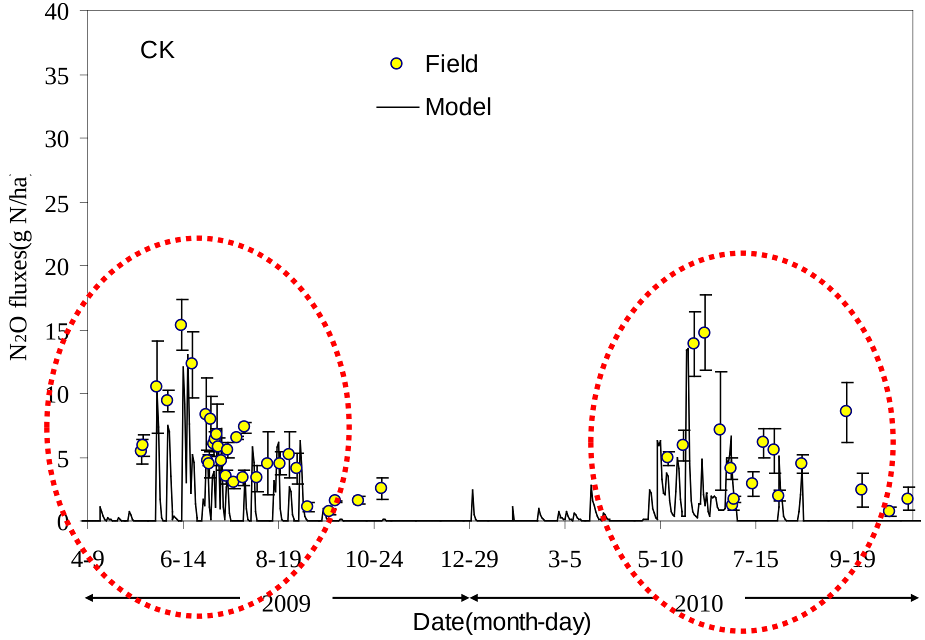
Fertilization



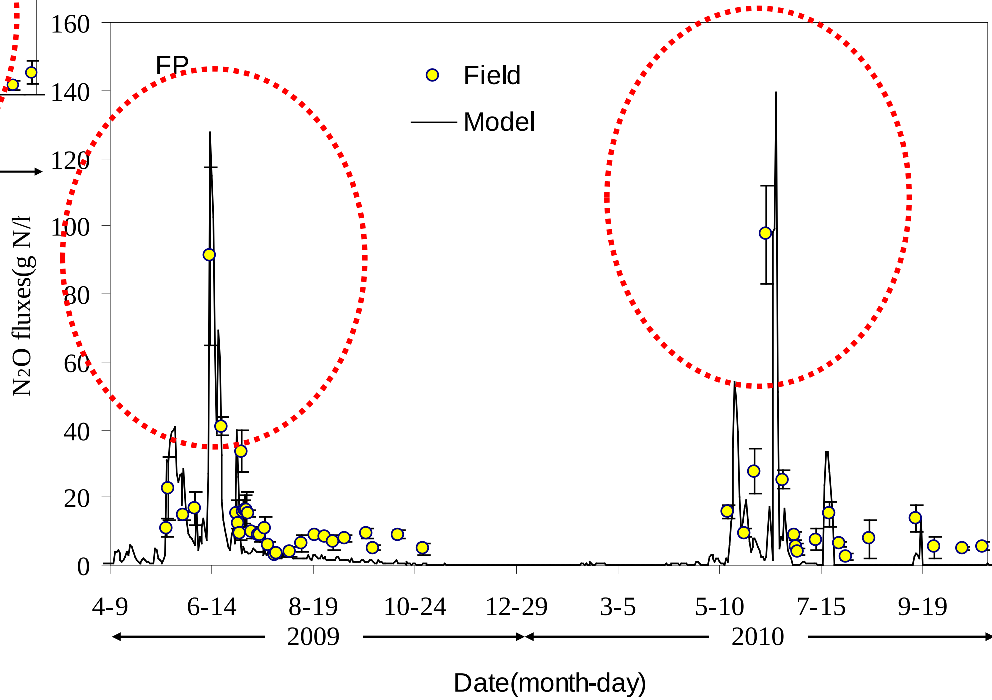




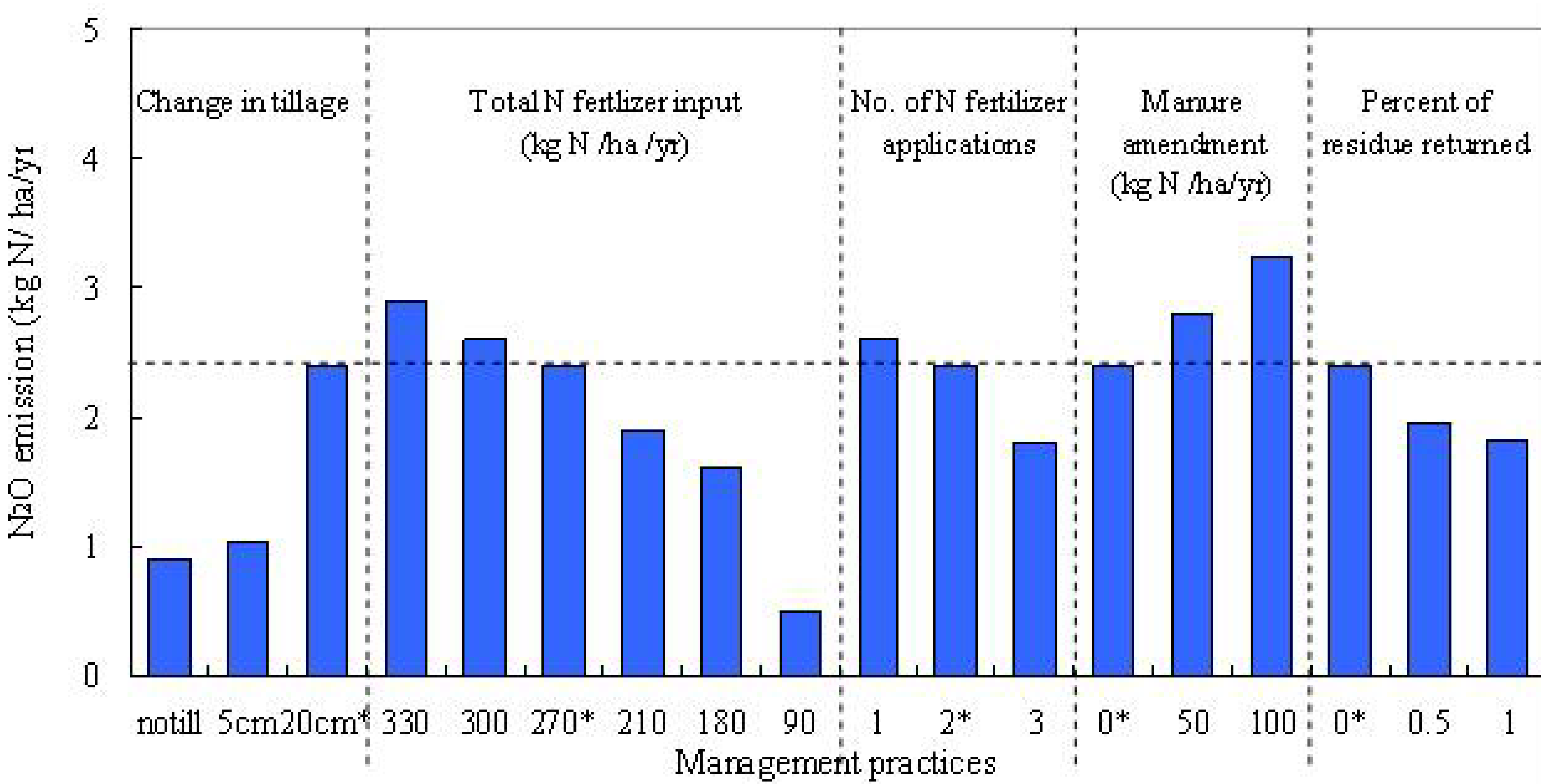
(2) DNDC validation



It captured the **pattern and magnitude** of high peaks of N_2O emissions measured at the site



（3）Mitigation measures

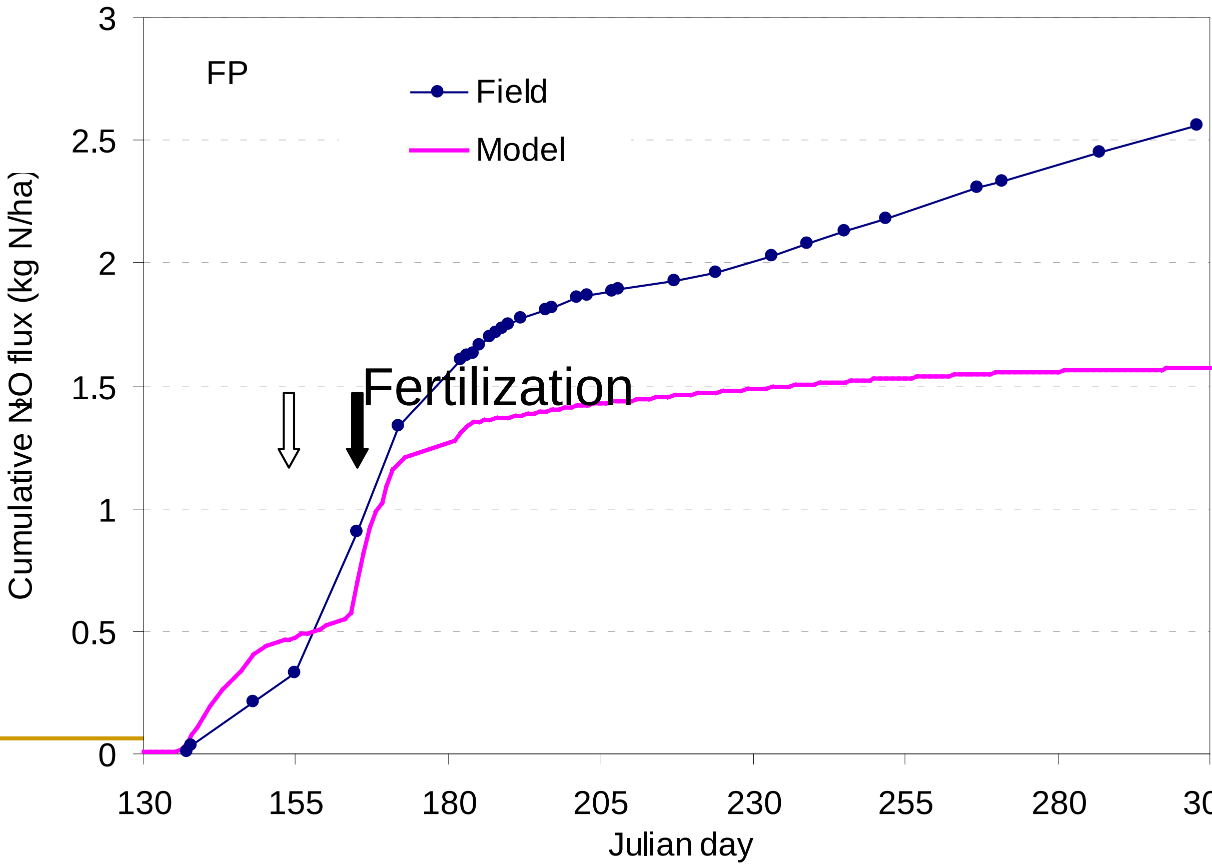


These results suggested that management options to reduce N_2O emissions should focus on optimizing the timing, amount and method of N fertilization

DISCUSSIONS:
(1) Uncertainties of N_2O estimates

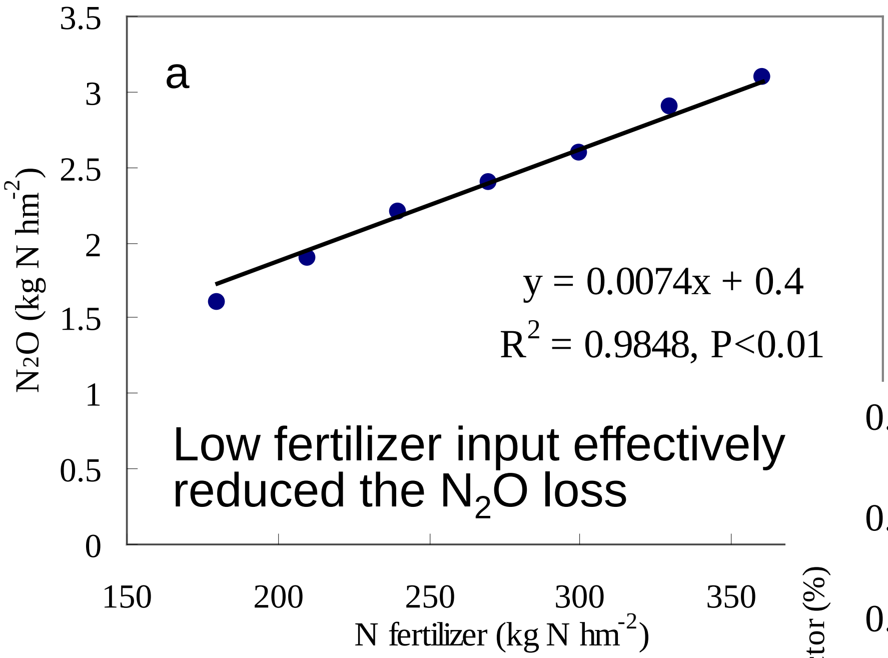
- The cumulative N_2O have high uncertainties due to the method of interpolation.
- It may be overestimated by filling the missing days with observed peak N_2O fluxes.

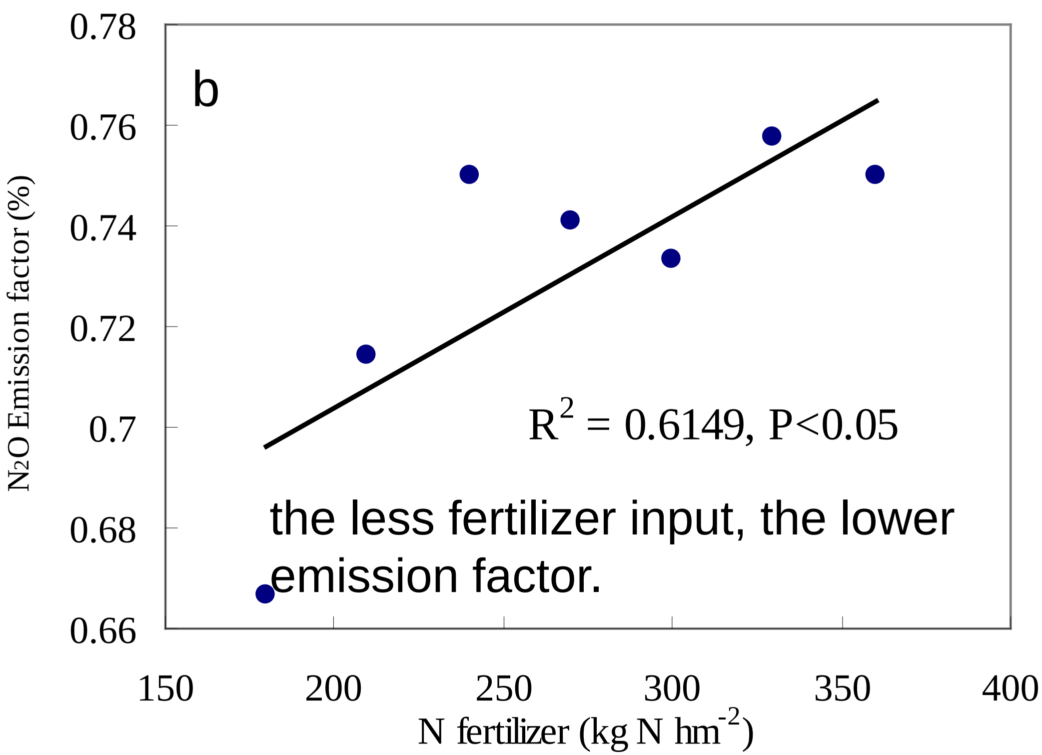
Fig. showed the comparison of model and observed cumulative N_2O emission rates in 2009



(2) N_2O EFs

- 0.62% in 2009
- 0.77% in 2010, respectively.

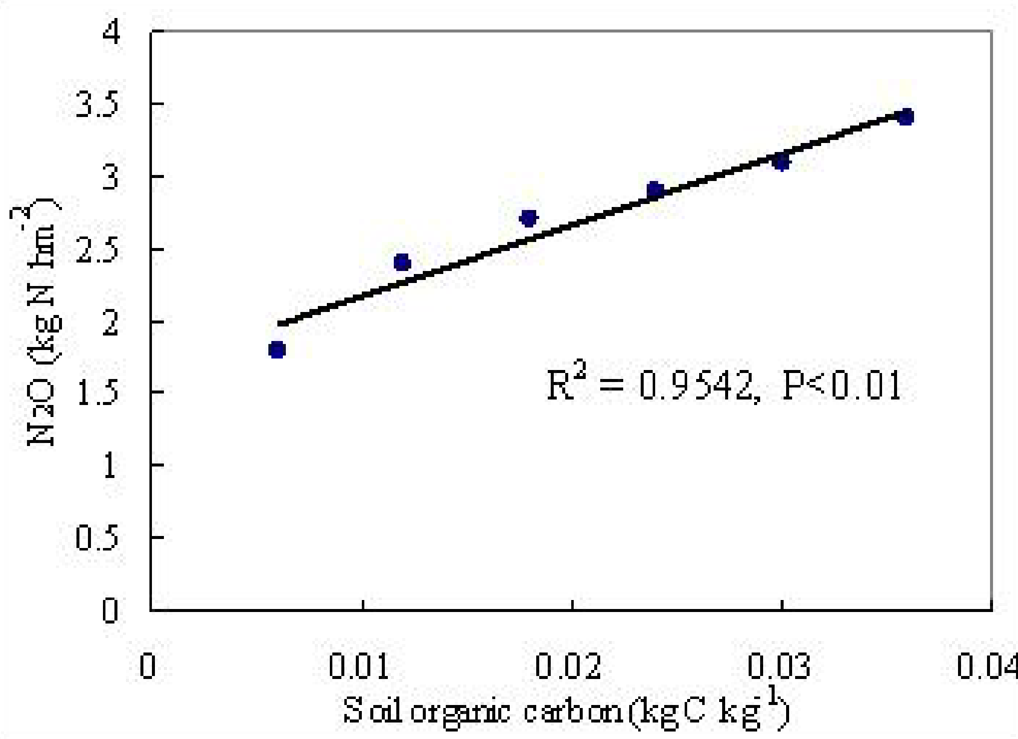




(3) Conflict between C and N_2O

- Practices should be developed to cope with the conflict among N_2O mitigation, crop production and C sequestration.
- Using models will turn this kind of complex tasks to be feasible.

- Fig. showed that the effect of SOC change on the N_2O emissions by DNDC model.



CONCLUSION:

- The fertilization were identified as the major environmental factors controlling N_2O emissions from the tested soil.
- The N_2O emission factors (0.62% and 0.77% for 2009 and 2010) derived from the present study were lower than that recommended by IPCC.
- The DNDC well captured the pattern and magnitude of N_2O fluxes measured at the experimental site.
- DNDC suggested that no N fertilizers be applied during periods of heavy rainfalls or split the fertilizer into more applications to reduce N_2O emissions from spring maize in northeast China.


Thank you!