

***Improvement of crop processes in ORCHIDEE***

***Xiuchen Wu, Nicolas Vuichard, Philippe Ciais, Nathalie de Noblet, Nicolas Viovy, etc.***

**We integrated some key processes from STICS into ORCHIDEE to improve both phenological, biophysical and biogeochemical processes. These processes include: Vegetative growth (phenology, growth stages); Carbon allocation and grain filling processes**

**Multi-sites comparison shows that our model has good ability to simulate the phenological, biophysical and biogeochemical processes for major crops even using a generic scheme.**

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# *Improvement of crop processes in ORCHIDEE*

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Nathalie de Noblet, Nicolas Viovy, etc.*

Acknowledgement:

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# WHY ?

## LETTERS

PUBLISHED ONLINE: 18 NOVEMBER 2012 | DOI:10.1038/NCLIMATE1585

nature  
climate change

### Adaptation of US maize to temperature

Ethan E. Butler\* and Peter Huybers

## LETTER

doi:10.1038

### Closing yield gaps through nutrient and water management

Nathaniel D. Mueller<sup>1</sup>, James S. Gerber<sup>1</sup>, Matt Johnston<sup>1</sup>, Deepak K. Ray<sup>1</sup>, Navin Ramankutty<sup>2</sup> & Jonathan A. Foley<sup>1</sup>

nature  
climate change

PUBLISHED ONLINE: 25 NOVEMBER 2012 | DOI:10.1038/NCLIMATE1585

## REVIEW ARTICLE

SOILS—THE FINAL FRONTIER  
VIEWPOINT

### Ground water and climate change

Richard G. Taylor *et al.*\*

### Soil Carbon Sequestration Impacts on Global Climate Change and Food Security

### Nonlinear temperature effects indicate severe damages to U.S. crop yields under climate change

Wolfram Schlenker<sup>a,1</sup> and Michael J. Roberts<sup>b</sup>

CLIMATE CHANGE

### Losing Arable Land, China Stark Choice: Adapt or Go

To ensure food security, China is racing to develop new cultivars that thrive in a warmer world

### The impacts of climate change on water resources and agriculture in China

REVIEWS

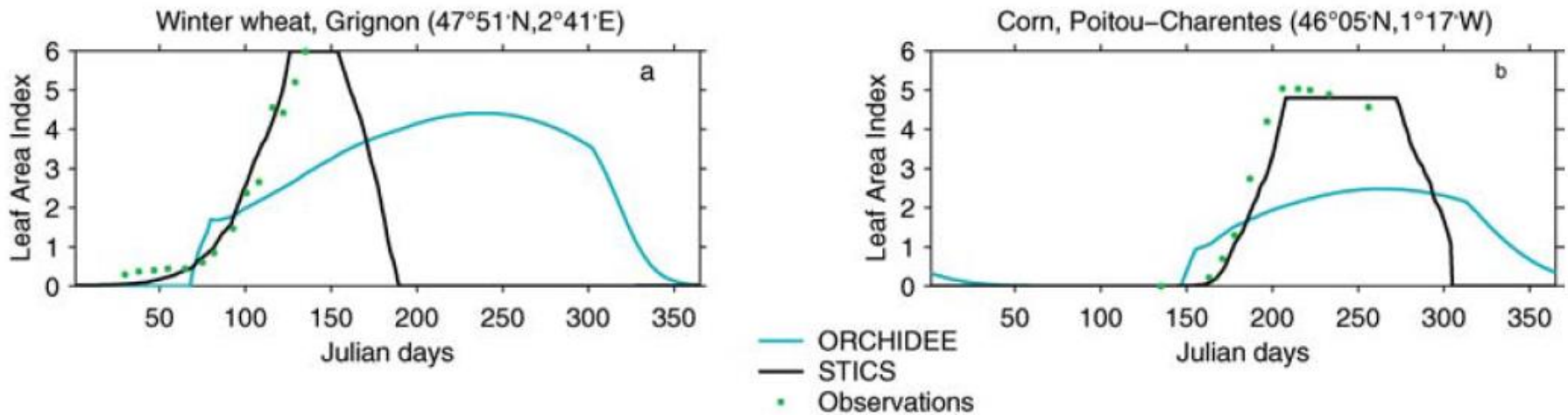


Paris Workshop

Shilong Piao<sup>1</sup>, Philippe Ciais<sup>2</sup>, Yao Huang<sup>3</sup>, Zehao Shen<sup>1</sup>, Shushi Peng<sup>1</sup>, Junsheng Li<sup>4</sup>, Liping Zhou<sup>1</sup>, Hongyan Liu<sup>1</sup>, Yuecun Ma<sup>1</sup>, Yihui Ding<sup>2</sup>, Pierre Friedlingstein<sup>2,6</sup>, Chunzhen Liu<sup>7</sup>, Kun Tan<sup>1</sup>, Yongqiang Yu<sup>3</sup>, Tianyi Zhang<sup>2</sup> & Jingyun Fang<sup>1</sup>  
Nov. 12-14 2013

SPECIAL SECT

# WHY?



**Sébastien Gervois, Nathalie de Noblet-Ducoudré,\* Nicolas Viovy, and Philippe Ciais**

(2004)

# HOW?

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- 1. We integrated major key processes from a general crop model STICS into ORCHIDEE to improve both phenological, biophysical and biogeochemical processes. These processes are including:**
  - ◆ **Vegetative growth (phenology, growth stages);**
  - ◆ **Carbon allocation processes (AGB/BGB);**
  - ◆ **Grain filling processes**
- 2. We do not consider the following processes:**
  - **Fertilization (A limiting factor for growth, soil nutrition processes, greenhouse gas emissions);**
  - **Irrigation (to my mind we can consider it in the SECHIBA);**
  - **Other crop managements (pruning, intercropping,etc, but it is not our concern in large-scale run)**

# WHAT?

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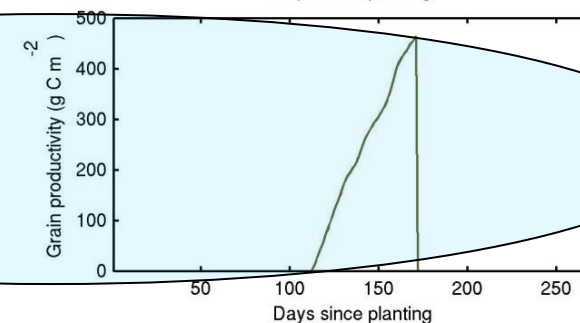
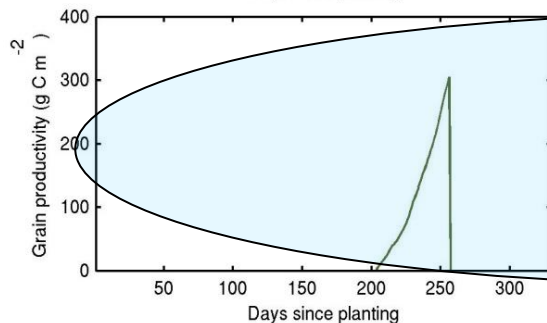
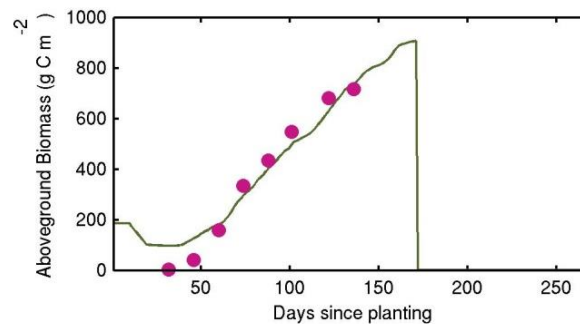
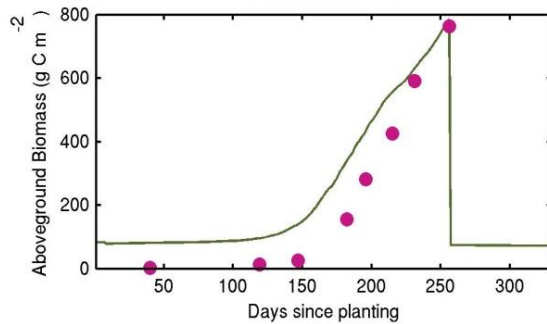
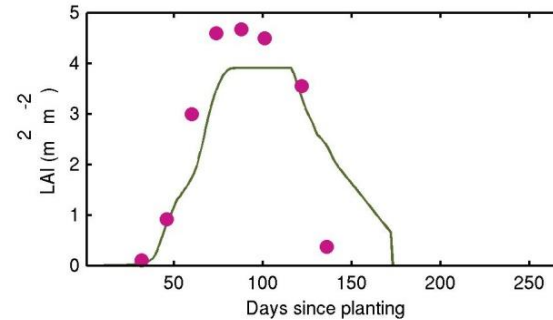
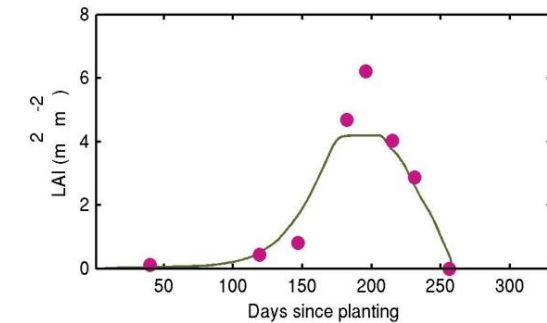
- To evaluate our model performance, we focus on some key biophysical and carbon-related variables: **GPP, NEE, LE, H, LAI, AGB and crop yield**.
- We test **winter wheat** as an example of C3 crop and **grain maize** as an example of C4 crop.
- We built the climate forcing file according to the observational climate data.
- Finally, we compared the model results and the observational results for those variables.

# Results

## CEIP sites validation

### FR-Gri Winter wheat

### Grain maize



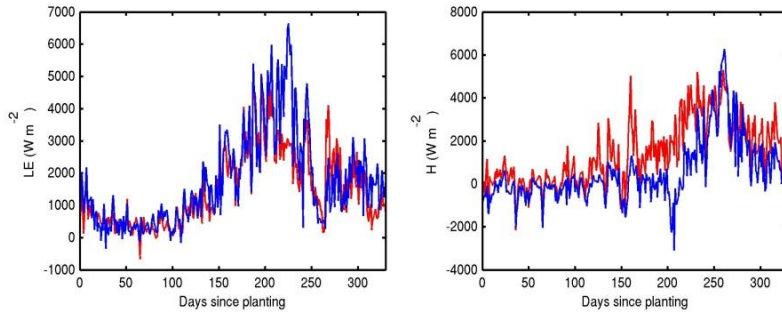
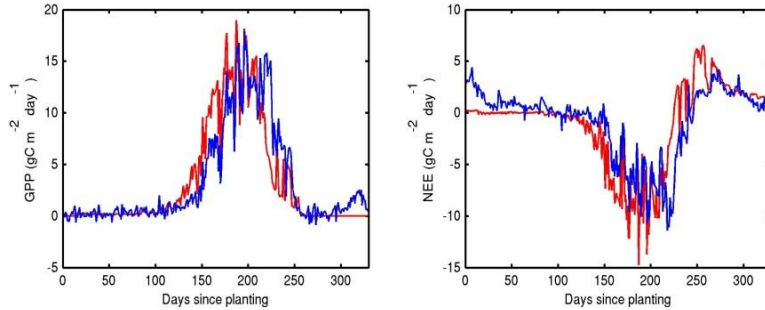
Results: our model can simulate the phenological processes, for both wheat and maize well.

Comparison between model and observation shows that OCST can capture the AGB well.

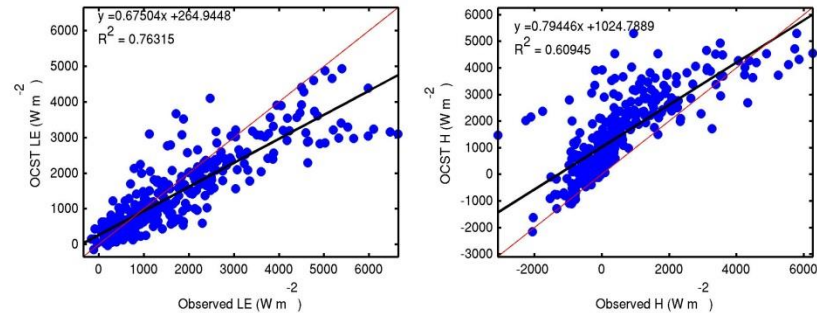
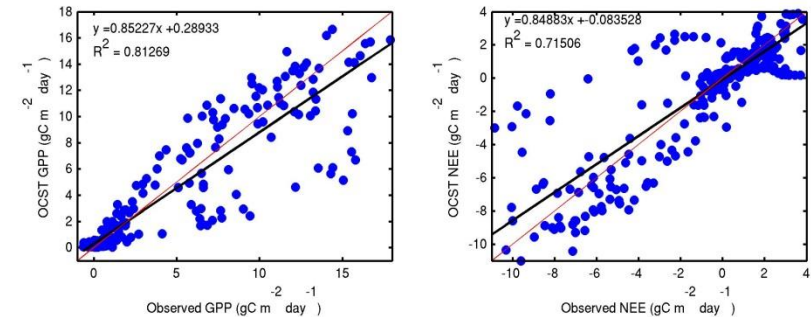


# For GPP, NEE, Biophysical variables

Both of the seasonal cycle and amplitudes are ok.  
Daily-scale comparison shows that our model has good ability to capture even the day-to-day variations ( $R^2 \sim 0.7-0.9$ ).



**GPP, NEE, HE, LE  
for wheat**

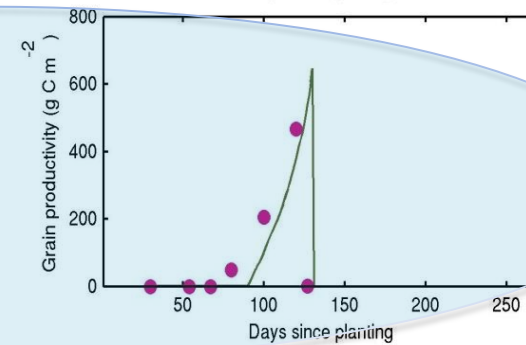
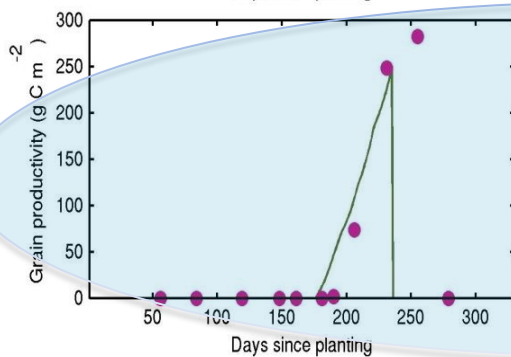
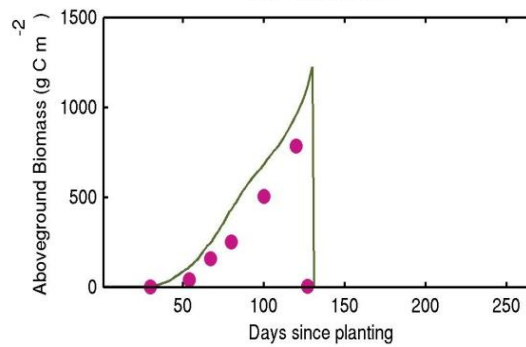
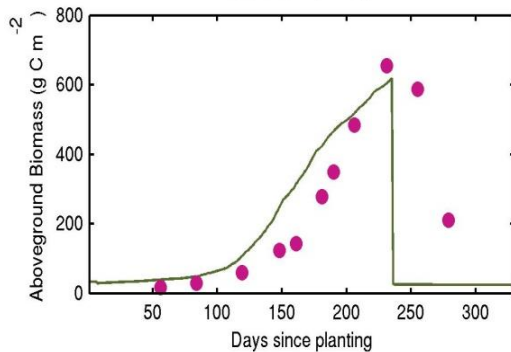
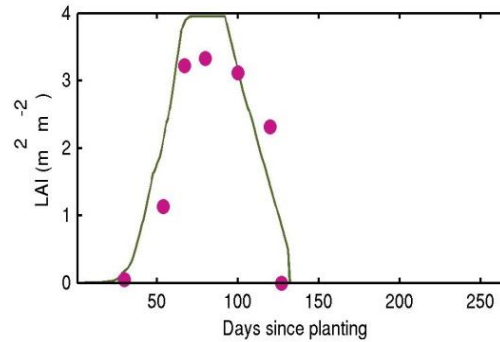
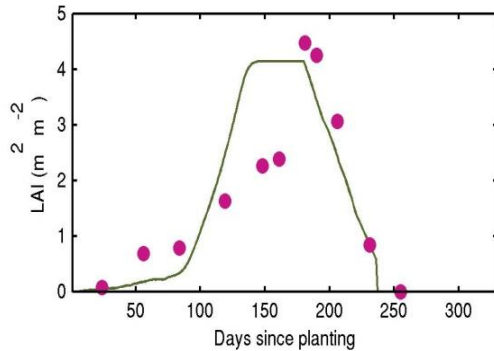




# FR-Lam Winter wheat

# FR-Lam maize

# CEIP sites validation



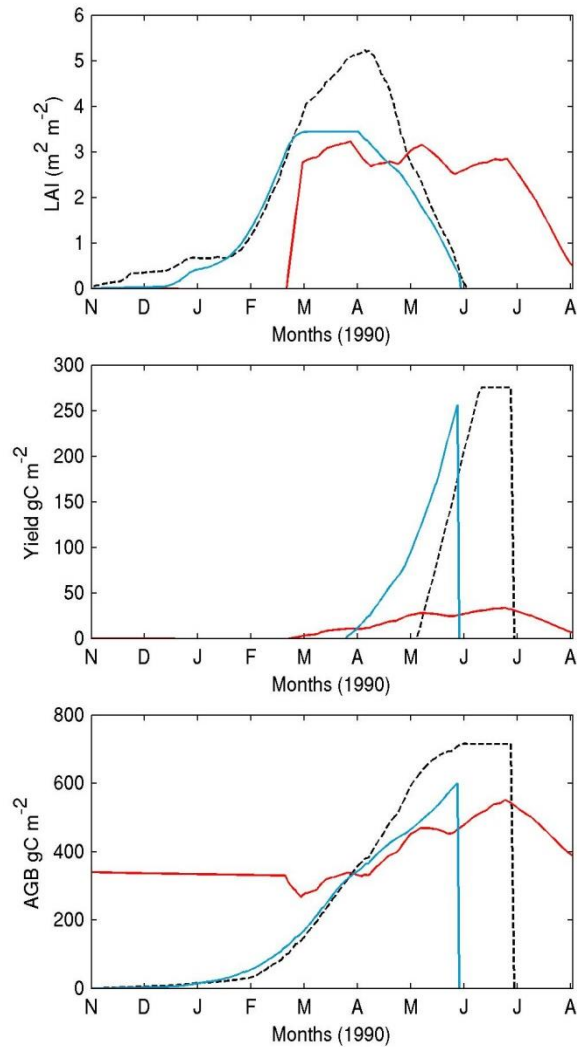
# CLIMATOR EVALUATION

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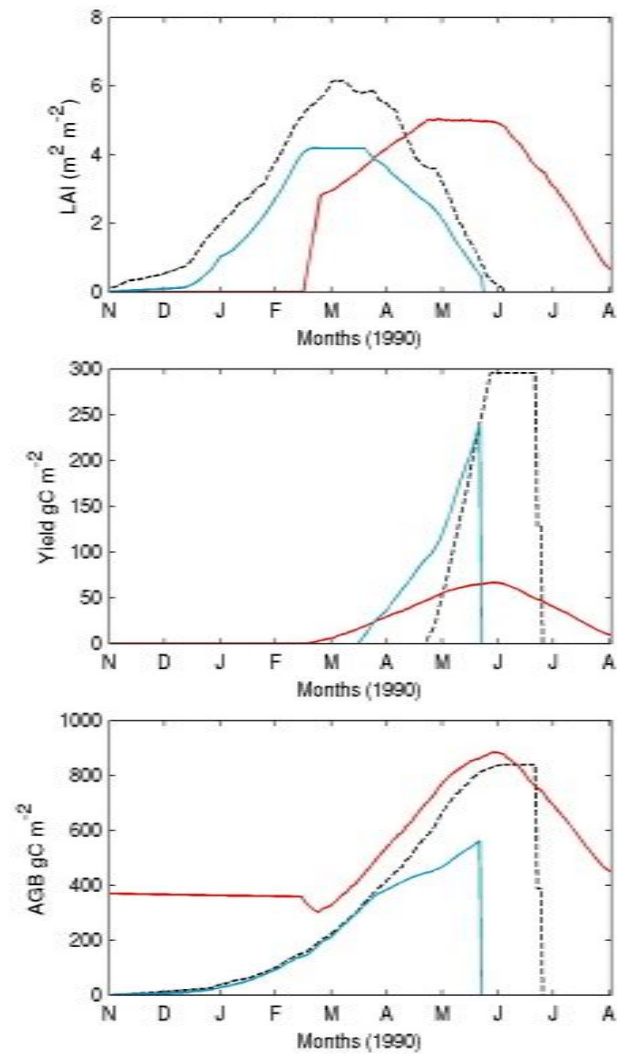
1. 12 sites in FRANCE
2. Three models: OCST, ORCHIDEE, STICS
3. Target variables: LAI, Aboveground Biomass, yield.
4. I do not have the observation for these sites. So, I do not compare the model outputs with observations.

# Winter wheat example

## FR-Gri winter wheat



## FR-Bor winter wheat



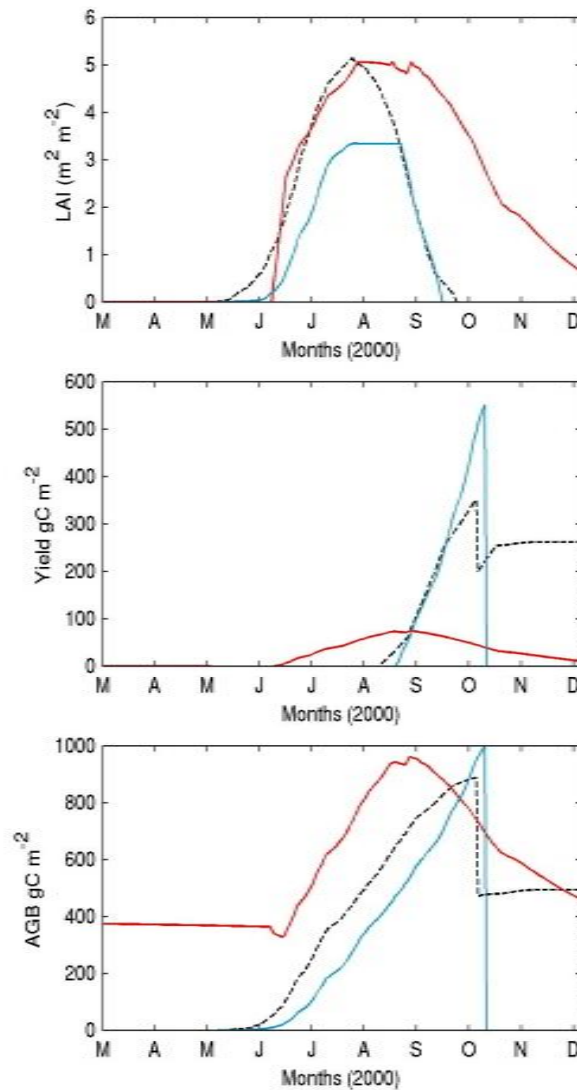
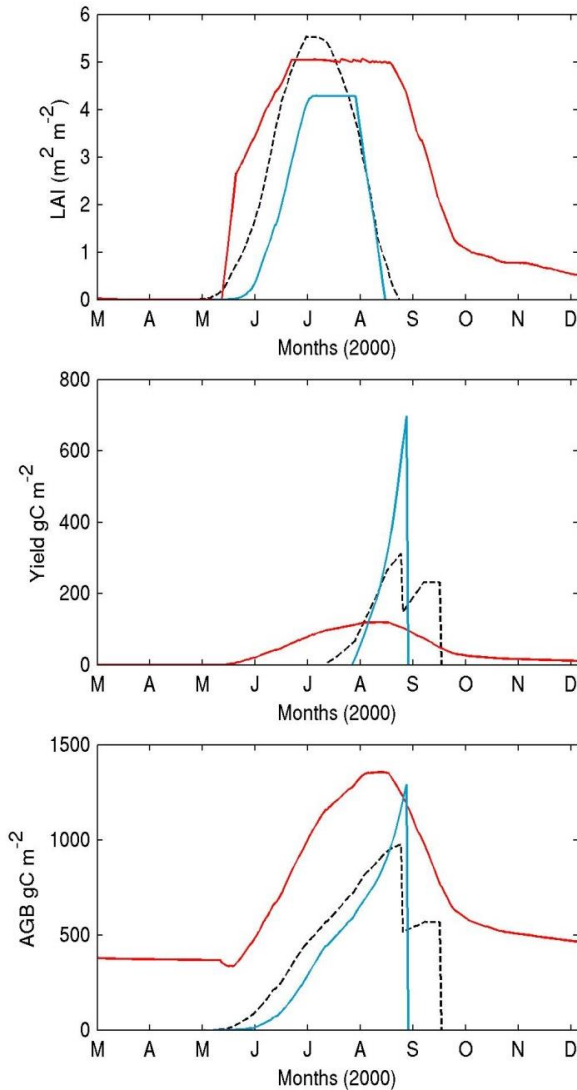
Sino-I

# Maize example

## FR-Gri maize

## FR-Dij maize

Similar results are observed on other sites. (data not shown here)



# Summary

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Multi-site comparison shows that our model has good ability to simulate the phenological, biophysical and biogeochemical processes for experiment crops even using a generic scheme.

Future priority for improving OCST includes the nitrogen processes and management module (mainly for irrigation, etc).

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- Thank you for your attention!