modextreme

agriculture facing extreme climatic events

European Project n° 613817

2nd Annual Meeting

Modelling solutions in China（WP4 partner）

Huang qing （CAAS）






WP Objectives

Task T4.1 Model testing against historical data(M6-M18)

Our Task：

Model evaluation will be performed against experimental data， using site-specific data from detailed field experiments and observational sites

The most part of field data resources will be provided for model evaluation from crop experiments in Northern and Southern People‘s Republic of China (CAAS）






Objectives attained during the first 2 years

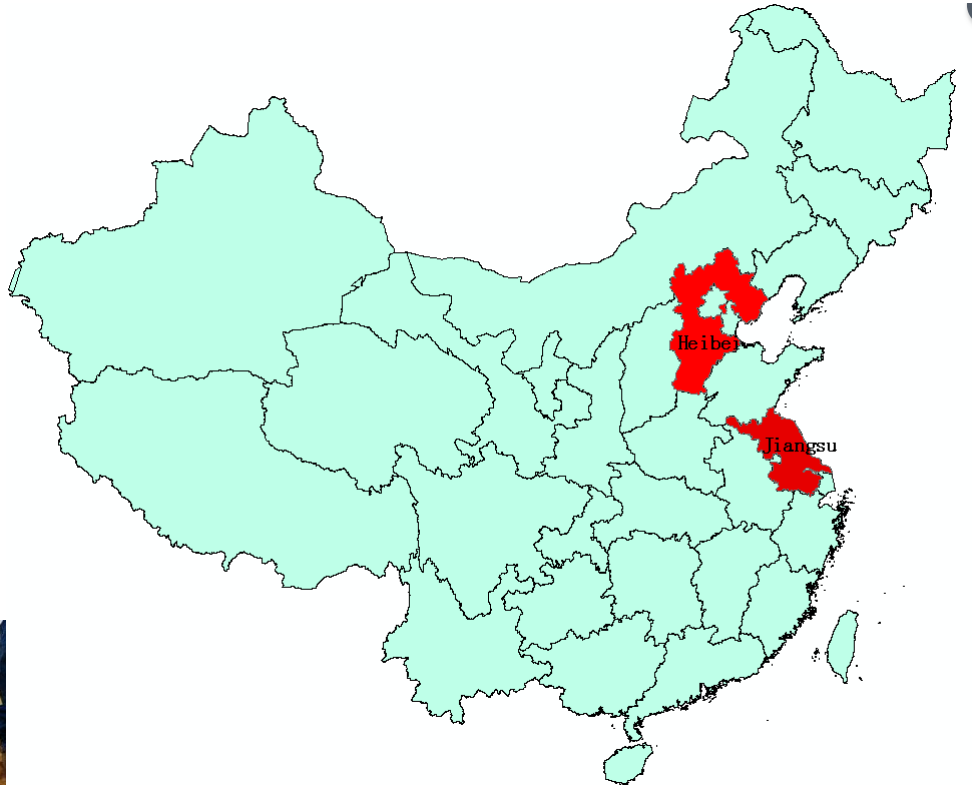
BioMASite case in China

Modelling solutions:

- WARM (rice simulations)
- CropSyst (generic crop simulation)

Crop:

- Rice in Jiangsu province in South China
- Winter wheat in Hebei province in North China



WARM case (rice simulation)

- **1、Data collected, processed…**
  - 1）Rice sampling point basic information (location, soil, varieties, Crop phenology, fertilization…)；
  - 2）Observed value(height, density, LAI, AGB,Yield）
  - 3) Weather data
  - 4) Crop/soil parameters acquired from
  - local experiments or reference documentation

- **2、WARM modelling application, parameters calibration...**

- **3、Some preliminary results**






Basic information in 2013.xlsx

Basic information in 2012.xlsx

Basic information in 2012.xlsx

Basic information in 2012.xlsx

growth period (day/month)

	Sowing date	Emergence date	Transplanting date	Booting date	Heading date	Flowering date	Physiological maturity date

Basic information in 2013.xlsx

Basal fertilizer

	Fertilization date	Fertilizer type	Fertilizer amount ($kg.ha^{-1}$)
SD1	20-Jun	Compound fertilizer (N-P2O5-K2O, 15-15-15)	375
SD2	5-Jul	Compound fertilizer (N-P2O5-K2O, 15-15-15)	375
SD3	8-Jun	Compound fertilizer (N-P2O5-K2O, 15-15-15)	375
SD4	10-Jun	Compound fertilizer (N-P2O5-K2O, 15-15-15)	525
SD5	8-Jun	Compound fertilizer (N-P2O5-K2O, 15-15-15)	375
SD6	14-Jun	Compound fertilizer (N-P2O5-K2O, 15-15-15)	375
SD7	12-Jun	Compound fertilizer (N-P2O5-K2O, 15-15-15)	525
SD8	12-Jun	Compound fertilizer (N-P2O5-K2O, 15-15-15)	300
		Ammonium bicarbonate (N, 17%)	375
SD9	20-Jun	Compound fertilizer (N-P2O5-K2O, 15-15-15)	375

soil | varieties | growth period | fertilization





Collection of results.xlsx

Plant height of *Japonica* rice in different growth periods

Collection of results.xlsx

Collection of results.xlsx

Collection of results.xlsx

Aboveground biomass changes of *Japonica* rice in different growth periods

Collection of results.xlsx

Yield structures of different rice varieties

Japonica	SI
	S
Indica	SI
	SD

height

Meteorological data of Jiangsu in 2012.xlsx

Meteorological data for SD9

Year	Month	Day	Maximum daily temperature(℃)	Minimum daily temperature(℃)	Rainfall(mm)	Sunshine duration(hour)	Global solar ra
2012	5	1	21.7	15.1	12.1	4.1	
	5	2	26	14.1	0	11.1	
	5	3	28.4	16.7	0	9.4	
	5	4	30.1	17.5	0	11.3	
	5	5	30.2	17.9	0	10.8	
	5	6	30.6	20.2	0	11.2	
	5	7	31.3	19.9	0.4	8	
	5	8	27.6	19.5	3.2	3.3	
	5	9	23.1	18.8	0	0	
	5	10	26.5	17.7	0	8.5	
	5	11	25.5	14.3	0	8.8	
	5	12	22.3	17.7	0	0	
	5	13	21.8	17.2	0	0	
	5	14	21.6	17.2	0.6	0	
	5	15	27.2	16.7	0	10.3	
	5	16	30.4	16.9	0	11.3	
	5	17	29.7	14.6	0	11.9	
	5	18	31.3	16.6	0	9.5	
	5	19	26.1	18.2	0	1.1	
	5	20	25.2	13.4	0	11.7	
	5	21	25.2	13.8	0	11.8	
	5	22	25.9	14.6	0	8.3	
	5	23	27	17.5	0	10.7	
	5	24	25.9	18.2	0	5.6	
	5	25	25.6	17.8	0	4.3	
	5	26	28.9	18.8	0	10.3	

Hanjiang | Jiangdu | Xinghua | Baoying | Jinhu | Hongze

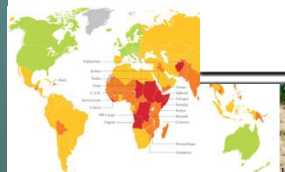
height | density | SPAD | LAI | biomass | yield

Some crop parameters from reference documentation

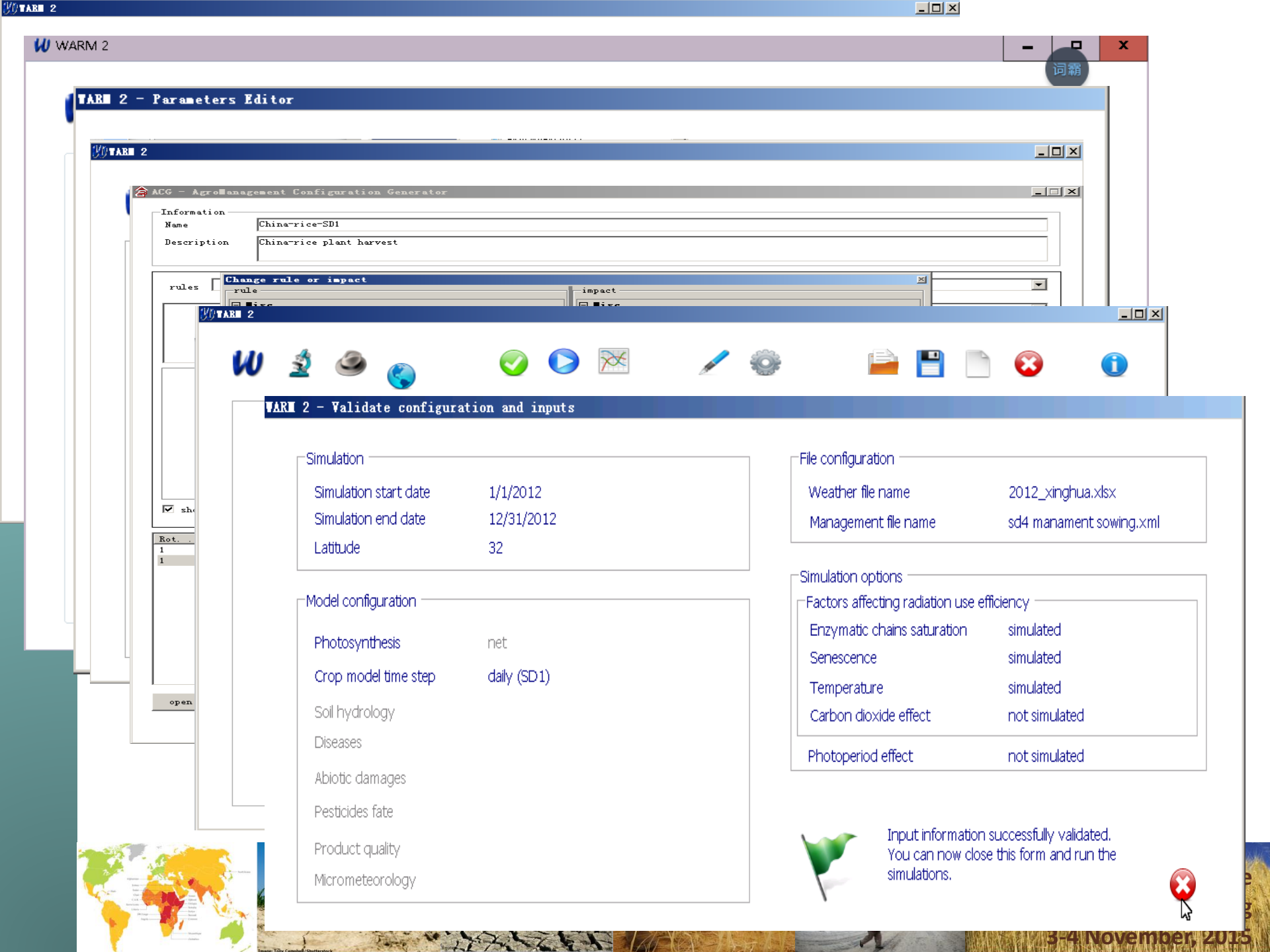
CropSyst 模型中部分参数

Table 3 Some parameters for calibration of CropSyst model

数据来源	模型参数	小麦	玉米
试验观测数据	最大收获指数	0.48	0.43
	无胁迫的最大叶面积指数	5.00	5.00
相关文献	植物生长最适宜温度/℃	20.00	25.00
	植物生长最低温度/℃	2.00	6.00
	最大根深/m	1.70	2.00
	植物生长速率降低的最高温度/℃	30.00	30.00
通过观测数据计算得到	播种到出苗的有效积温/℃·d^{-1}	60	80
	播种到开花的有效积温 /℃·d^{-1}	740	960
	播种到灌浆的有效积温/℃·d^{-1}	850	1270
	播种到生理成熟的有效积温/℃·d^{-1}	1340	1750
校准参数	光能转换系数/g·MJ^{-1}	3.00	4.00
	比叶面积/m^2·kg^{-1}	24.00	22.00
	作物蒸腾系数	1.05	1.10
	生物量/呼吸系数	5.00	10.00






WARM 2
WARM 2 - Parameters Editor
ACG - AgroManagement Configuration Generator
Information
Name
China-rice-SD1
Description
China-rice plant harvest
rules
Change rule or impact
rule
impact
open
WARM 2 - Validate configuration and inputs
Simulation
Simulation start date
1/1/2012
Simulation end date
12/31/2012
Latitude
32
Model configuration
Photosynthesis
net
Crop model time step
daily (SD1)
Soil hydrology
Diseases
Abiotic damages
Pesticides fate
Product quality
Micrometeorology
File configuration
Weather file name
2012_xinghua.xlsx
Management file name
sd4 manament sowing.xml
Simulation options
Factors affecting radiation use efficiency
Enzymatic chains saturation
simulated
Senescence
simulated
Temperature
simulated
Carbon dioxide effect
not simulated
Photoperiod effect
not simulated
Input information successfully validated.
You can now close this form and run the simulations.

CropIL calibrator

CropIL calibrator

CropIL calibrator

CropIL calibrator

CropIL calibrator

CropIL calibrator

CropIL calibrator

Optimization method

CropIL calibrator

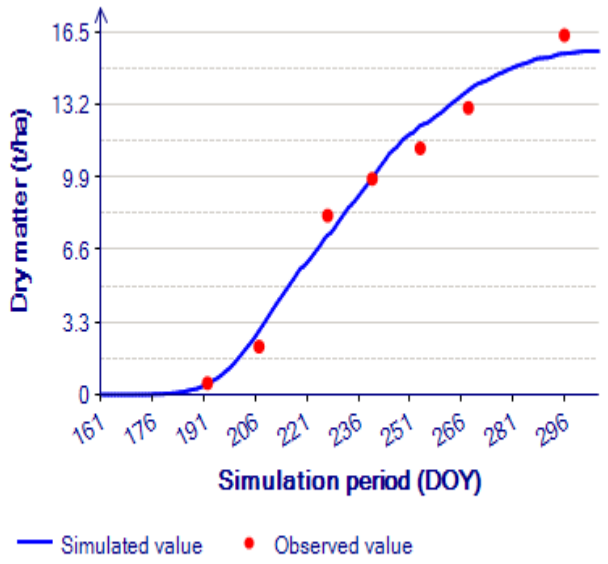
Results

Fitting indices

RRMSE 7.8982

Parameters values

Parameter	Optimized value
SpecificLeafAreaAtEmerg...	25.86
PartitioningToLeavesAtE...	0.9
MaximumRadiationUseEf...	2.68



Select parameters

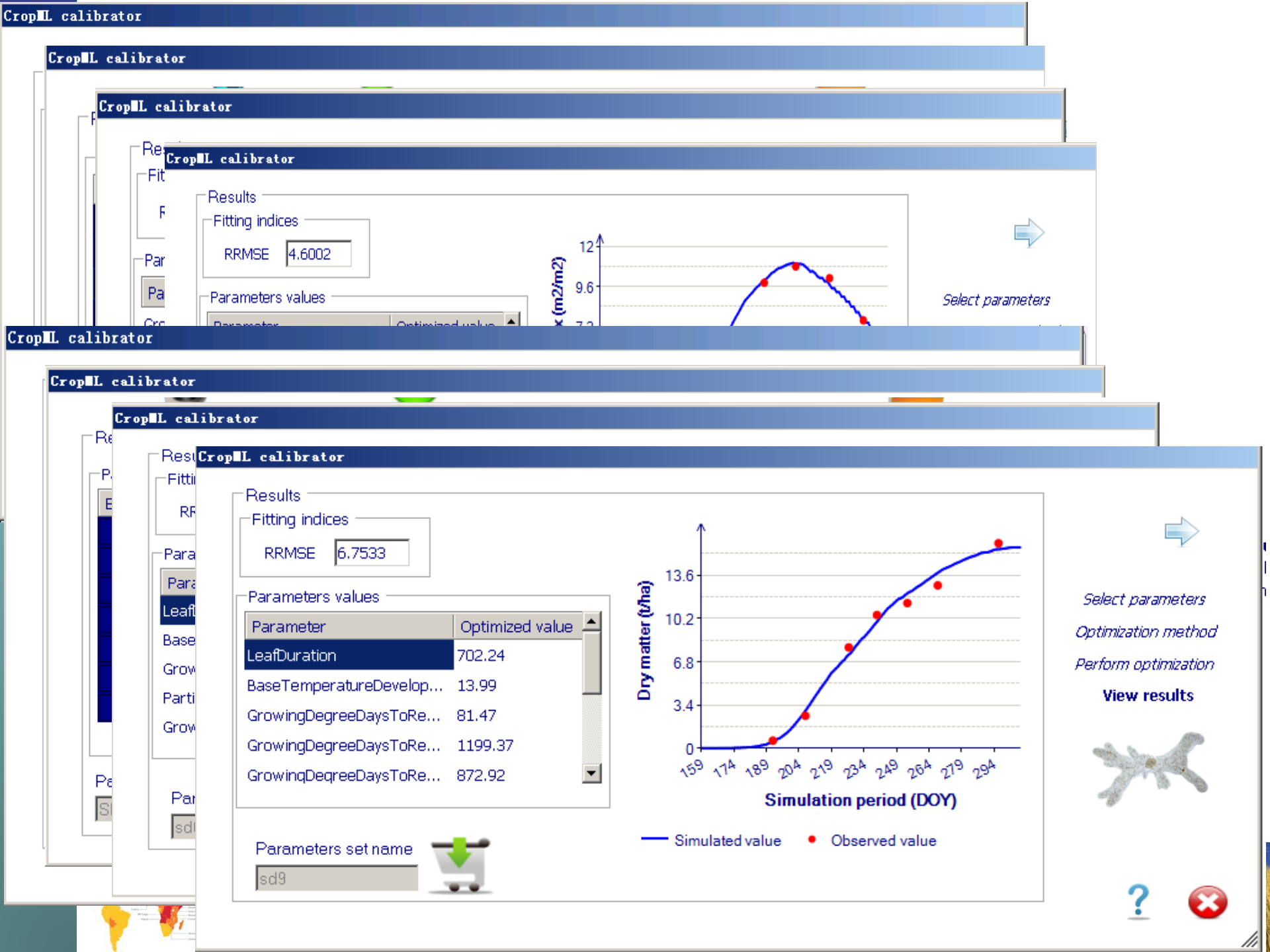
Optimization method

Perform optimization

View results

Parameters set name

SD1


CropIL calibrator
Results
Fitting indices
RRMSE
6.7533
Parameters values
Parameter
Optimized value
LeafDuration
702.24
BaseTemperatureDevelop...
13.99
GrowingDegreeDaysToRe...
81.47
GrowingDegreeDaysToRe...
1199.37
GrowingDegreeDaysToRe...
872.92
Parameters set name
sd9
Dry matter (t/ha)
13.6
10.2
6.8
3.4
0
159
174
189
204
219
234
249
264
279
294
Simulation period (DOY)
Simulated value
Observed value
Select parameters
Optimization method
Perform optimization
View results

Cropsys case (wheat simulation)

- **1、Data collected, processed…**
  - **1) winter wheat sampling point basic information (location, Crop phenology, management…);**
  - **2) crop spatial distribution data**
  - **3) Observed value(LAI, AGB, Yield）**
  - **4) Weather data**
  - **5) Crop/soil parameters acquired from local experiments or reference documentation**

- **2、Biomasite application…**





E	F	G	H	I	J	K	L	M
LATITUDE	LONGITUDE	ALTITUDE	HAS_LAND	ASIA_08	Cell_ID	Year	Surface	NUTS
36.25	114.25	156	1	1	271	1997	10925	Hebei
36.25	114.5	82	1	1	272	1997	32575	Hebei
36.25	114.75	53	1	1	273	1997	31362.5	Hebei
36.25	115	56	1	1	274	1997	31356.25	Hebei
36.25	115.25	45	1	1	275	1997	26918.75	Hebei
36.5	113.75	696	1	1	250	1997	2450	Hebei
36.5	114	445	1	1	251	1997	368.75	Hebei
36.5	114.25					1997	11456.25	Hebei
36.5	114.5					1997	21856.25	Hebei
36.5	114.75					1997	22593.75	Hebei
36.5	115					1997	25275	Hebei
36.5	115.25					1997	23650	Hebei
36.75	113.5					1997	1418.75	Hebei
36.75	113.75					1997	418.75	Hebei
36.75	114					1997	681.25	Hebei
36.75	114.25	245	1	1	233	1997	8268.75	Hebei
36.75	114.5	83	1	1	234	1997	21243.75	Hebei
36.75	114.75	47	1	1	235	1997	22556.25	Hebei
36.75	115	38	1	1	236	1997	13931.25	Hebei
36.75	115.25	38	1	1	237	1997	14006.25	Hebei

Crop location data

A	B	C	D	E	F	G	H
code	county	height	longitude	latitude	DATE	Yield（公斤/公顷）	AGB（kg/ha）
1	[illegible]		[illegible]	[illegible]	2014/6/8	8401.50	19446.75
2					2014/6/8	6922.05	13992.00
3					2014/6/9	7500.00	10944.00
4					2014/6/13	7661.25	17598.75
5					2014/6/13	8491.50	13485.00
6	武强县	18	115.902778	38.0808333	2014/6/7	7252.50	18888.75
7	饶阳县		115.75315	38.2383	2014/6/5	5745.00	10920.00
8	安平县	31	115.474167	38.2359333	2014/6/7	8250.00	22463.70
9	故城县	32	115.967833	37.3928333	2014/6/9	7776.00	17955.00
10	景县		116.207933	37.6818333	2014/6/9	6969.00	15930.00
11	阜城县	15	116.223611	37.8830556	2014/6/9	8525.70	28008.75

Yield data

纬度		出苗期	分蘖期	返青期	起身期	拔节期
115.6062	37.7407	0.048	1.04	0.99	2.21	7.49
115.7327	37.7371	0.041	1.01	0.99	2.36	6.5
115.6145	37.5795	0.02	0.67	1.1	2.1	4.9
115.5179	37.4940	0.02	0.49	0.97	2	5.5
115.7569	37.5282	0.04	1.23	1	2.29	4.14
115.7159	37.4415	0.03	1.84	1.5	3.28	6.68
					39	4.35
						4.79
					29	4.22
						3.7
						3.9
					1.87	4.38
115.9900	38.0333	0.016	0.71	0.62	1.49	3.39
115.8193	38.0306	0.0172	0.93	0.81	2.86	4
115.6742	38.1222				1.5	2.5
115.6893	38.2226				2.2	3.9
115.4354	38.2021	0.07	1.11	0.7	3.1	4.36
115.9686	37.3992	0.03	1.44	1.83	2.77	3.2

LAI data

B	C	D	E	F	G	H	I	J
YEAR	MONTH	DAY	Precipit	atmospheric p	average te	sunshine	min tempretu	max tempret
2014	1	1	0	855.1	-6.4	7.8	-11.4	-0.1
2014	1	2	0	857.6	-6.3	7.2	-12.9	1.7
2014	1	3	0	860.9	-9.5	7.5	-14.2	-2.3
2014	1	4	0	857.7	-8.1	7.2	-12.9	-2.4
2014	1	5	0	860.2	-10.9	7.6	-16.5	-2.6
2014	1	6	0	858.6	-6	6.5	-12.7	0.7
2014	1	7	0	864.1	-11.9	5.4	-14.5	-2.9
2014						7.5	-21.3	-13.4
2014						7.6	-22.5	-9.8
2014								
2014								
2014								
2014								
2014	1	14						
2014	1	15						
2014	1	16						
2014	1	17						
2014	1	18						
2014	1	19						
2014	1	20						
2014	1	21						
2014	1	22						

Weather data

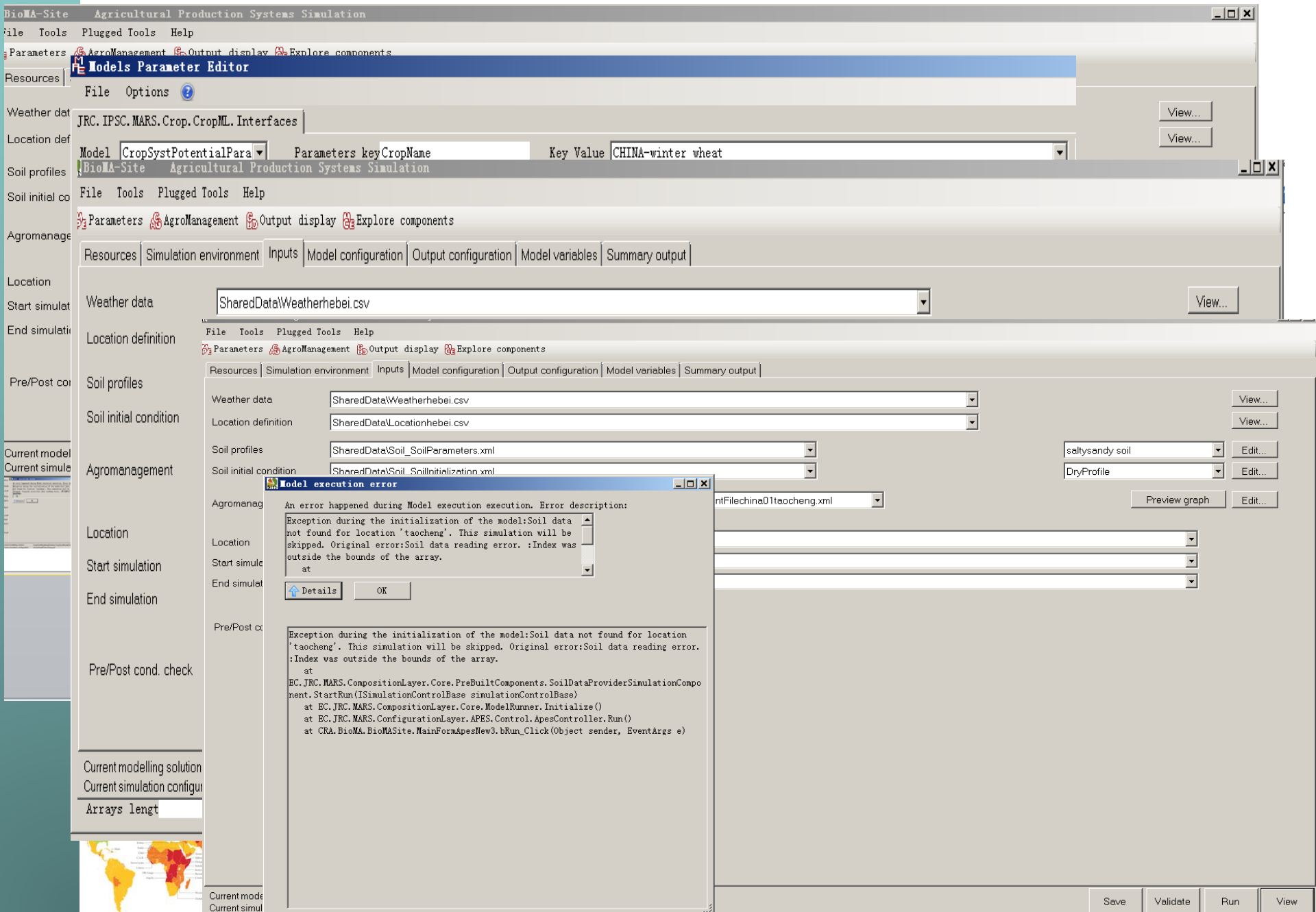
表 2　冬小麦主要参数值[9, 31]

Table 2　Main parameter values of winter wheat

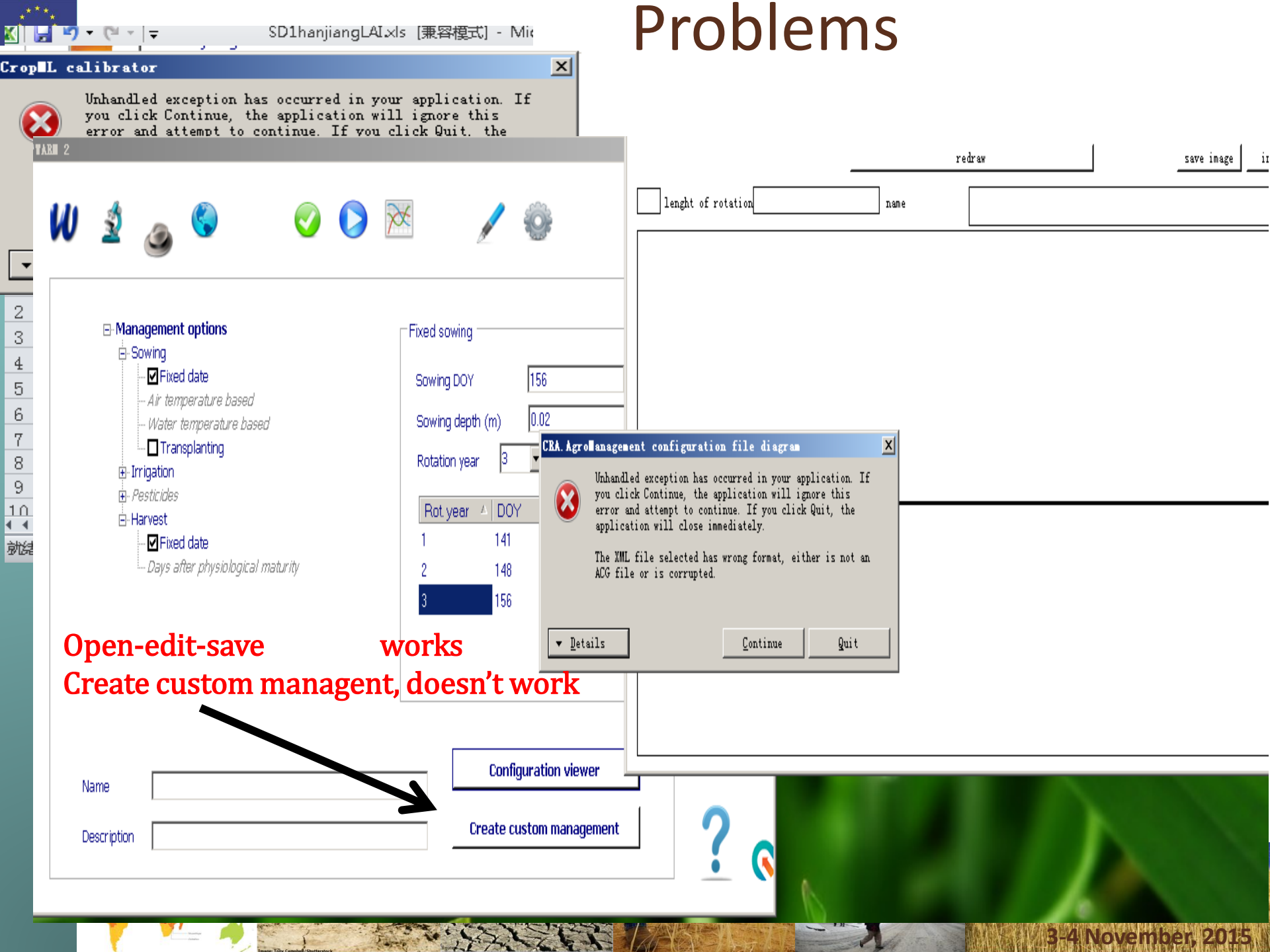
	位	含义		取值
TBASEM	℃	基点温度		0
TEFFMX		最高温度		30
TSUM1		返青到开花的积温		600
TSUM2		开花到成熟的积温		750
SPAN	d	叶片在 35℃时的生命期		28
AMAXTB	kg CO_2 /hm^2 · h			35.83
Q10	kg/hm^2			2.0
RGRLAI	hm^2 /hm^2 · d			0.008 17
PERDL	kg/kg · d	由		0.030
CVL	kg/kg	同化物转化成干物质重的效率		0.685
CVO				0.709
CVR			根	0.694
CVS			茎	0.662
RML	kg CH_2O/kg · d	同化物维持呼吸消耗	叶	0.03
RMO			籽粒	0.01
RMR			根	0.015
RMS			茎	0.015

Some crop parameters from reference documentation

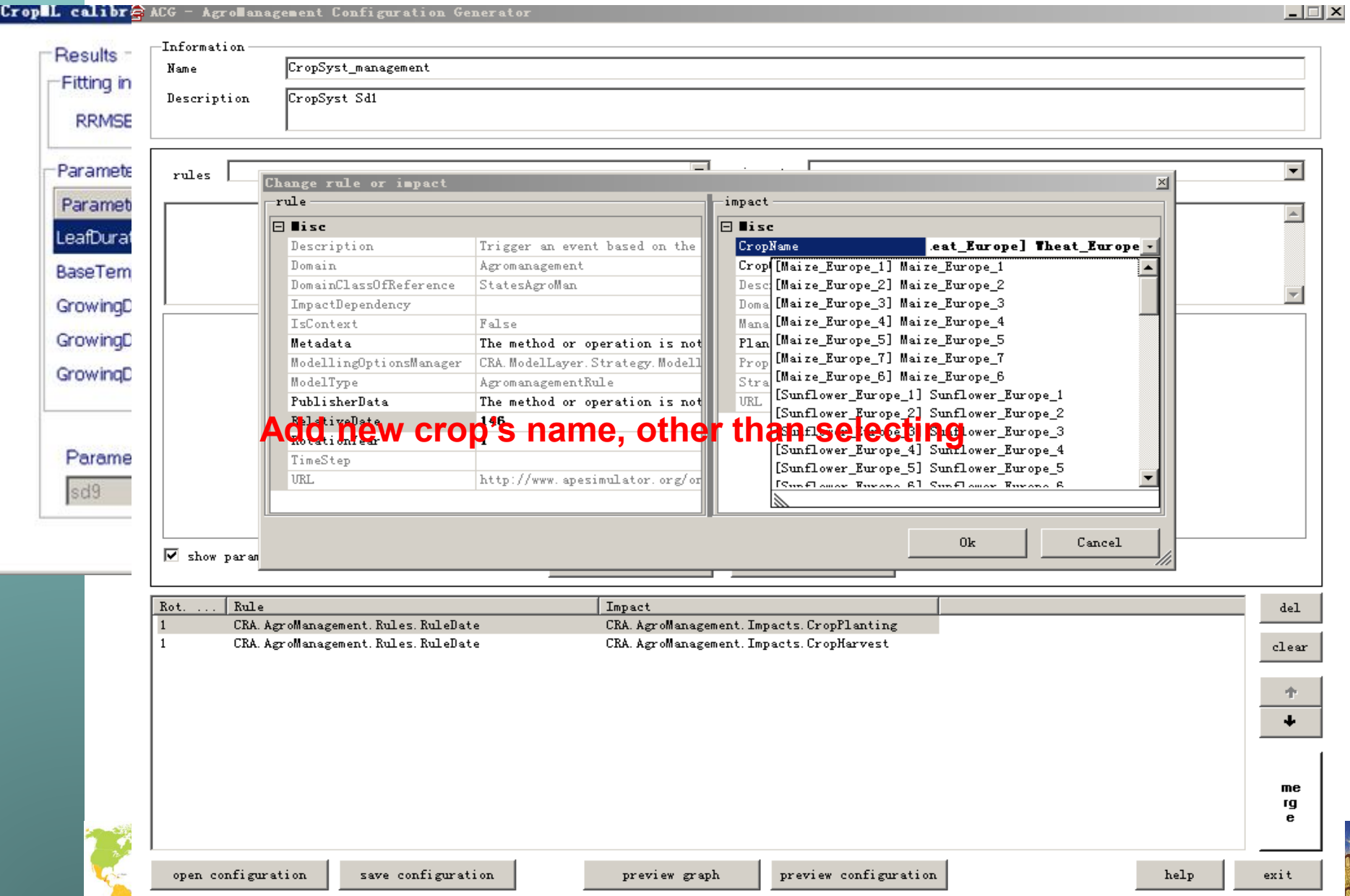
BioMAsite software application



Problems


SD1hanjiangLAI.xls [兼容模式] - Mi
Crop■L calibrator
Unhandled exception has occurred in your application. If you click Continue, the application will ignore this error and attempt to continue. If you click Quit, the
redraw
save image
lenght of rotation
name
Management options
Sowing
Fixed date
Air temperature based
Water temperature based
Transplanting
Irrigation
Pesticides
Harvest
Fixed date
Days after physiological maturity
Fixed sowing
Sowing DOY
156
Sowing depth (m)
0.02
Rotation year
3
Rot. year
DOY
1
141
2
148
3
156
CRA. Agro■anagement configuration file diagram
Unhandled exception has occurred in your application. If you click Continue, the application will ignore this error and attempt to continue. If you click Quit, the application will close immediately.
The XML file selected has wrong format, either is not an ACG file or is corrupted.
Details
Continue
Quit
Open-edit-save works
Create custom managent, doesn't work
Name
Description
Configuration viewer
Create custom management

Problems


ACG - AgroManagement Configuration Generator
Information
Name
CropSyst_management
Description
CropSyst Sd1
rules
Change rule or impact
rule
impact
Description
Trigger an event based on the
Domain
Agromanagement
DomainClassOfReference
StatesAgroMan
ImpactDependency
IsContext
False
Metadata
The method or operation is not
ModellingOptionsManager
CRA.ModelLayer.Strategy.Modell
ModelType
AgromanagementRule
PublisherData
The method or operation is not
TimeStep
URL
http://www.apesimulator.org/or
CropName
[Maize_Europe_1] Maize_Europe_1
[Maize_Europe_2] Maize_Europe_2
[Maize_Europe_3] Maize_Europe_3
[Maize_Europe_4] Maize_Europe_4
[Maize_Europe_5] Maize_Europe_5
[Maize_Europe_7] Maize_Europe_7
[Maize_Europe_6] Maize_Europe_6
[Sunflower_Europe_1] Sunflower_Europe_1
[Sunflower_Europe_2] Sunflower_Europe_2
[Sunflower_Europe_4] Sunflower_Europe_4
[Sunflower_Europe_5] Sunflower_Europe_5
Ok
Cancel
Add new crop's name, other than selecting
show param
Rot. ...
Rule
Impact
1
CRA.AgroManagement.Rules.RuleDate
CRA.AgroManagement.Impacts.CropPlanting
1
CRA.AgroManagement.Rules.RuleDate
CRA.AgroManagement.Impacts.CropHarvest
del
clear
merge
open configuration
save configuration
preview graph
preview configuration
help
exit

Further work

- Finishing winter wheat sites simulation using cropsys model on the newest version of Bioma
- Spatial simulation
- Future climate-based simulation





Acknowledgement

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Thanks for your attention!