POLJOPRIVREDNI FAKULTET UNIVERZITET U NOVOM SADU
PFNS
DEPARTMAN ZA RATARSTVO I POVRTARSTVO

UNIVERSITÀ DEGLI STUDI FIRENZE
DISPAA
DIPARTIMENTO DI SCIENZE DELLE PRODUZIONI AGROALIMENTARI E DELL'AMBIENTE

UNIVERSITAET FUER BODENKULTUR WIEN
BOKU
DEPARTMENT FÜR WASSER-ATMOSPHÄRE-UMWELT

EUROPEAN COMMISSION
Horizon 2020
EUROPEAN UNION FUNDING FOR RESEARCH & INNOVATION

AgMnet INTERNATIONAL SUMMER SCHOOL IN AGROMETEOROLOGY AND CROP MODELLING

27 June – 01 July 2016
Novi Sad, SERBIA

Serbia for Excell

H2020-TWINN-2015

Integration of AquaCrop Modelling & Numerical Weather Predictions

RESULTS

AQUACROP EXERCISE AND INTEGRATION WITH NWP

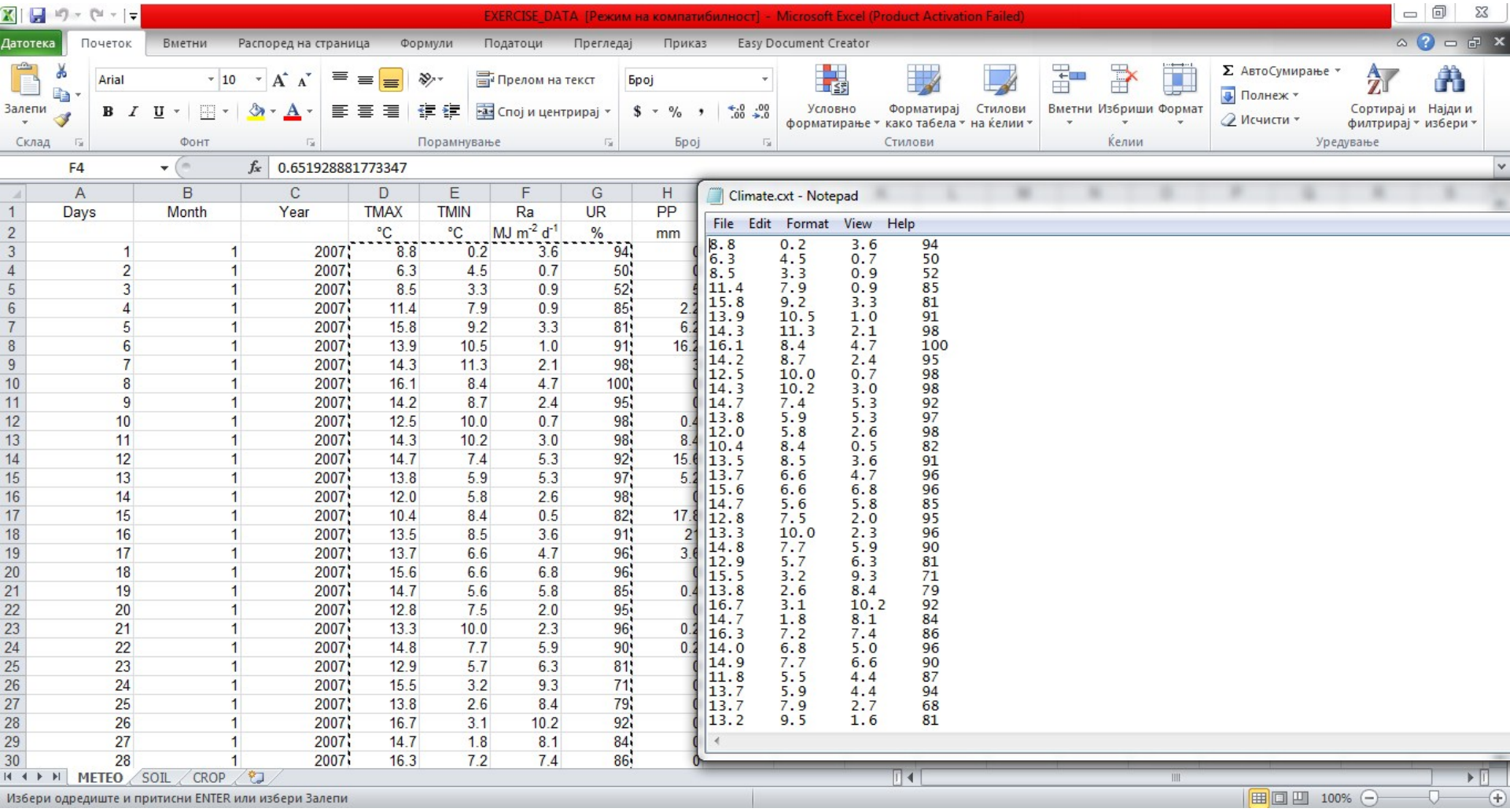
Task of students of modelling was to create input files and run the model for obtaining yield and water productivity of winter wheat in Novi Sad.

Task of students of NWP was to create a short time period (8 days) of weather data including average temperature, relative humidity, wind speed, sola radiation and precipitation for Novi Sad location

Further, the two groups integrated their activities as the predicted weather was used into AquaCrop and results were compared with a second simulation where the model was fed with real weather data for the same period.

The aim of the integrated exercise was to assess the impact of predicted weather data on the crop simulation

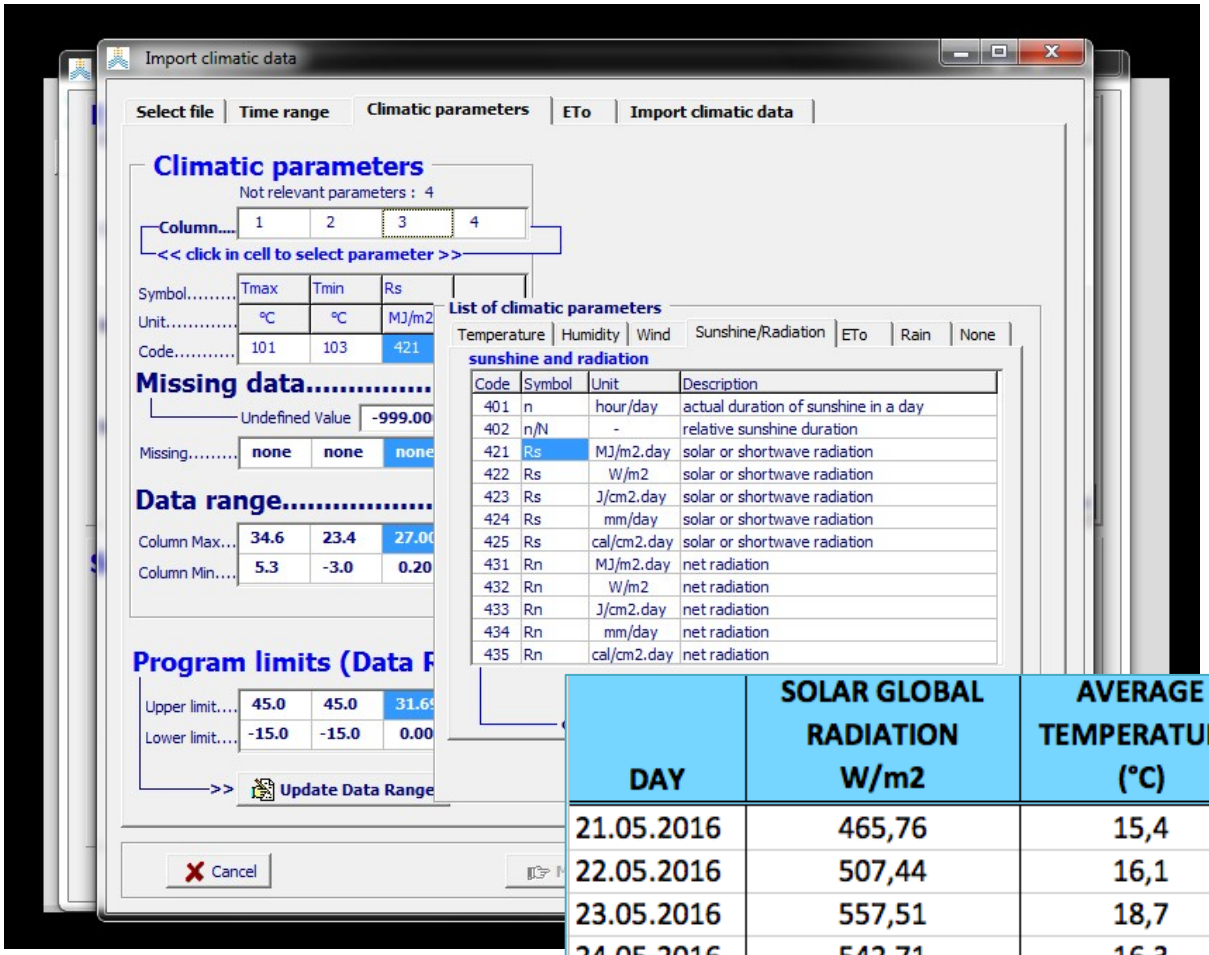
Input data preparation - meteorology



	A	B	C	D	E	F	G	H
1	Days	Month	Year	TMAX	TMIN	Ra	UR	PP
2				°C	°C	MJ m^{-2} d^{-1}	%	mm
3	1	1	2007	8.8	0.2	3.6	94	0
4	2	1	2007	6.3	4.5	0.7	50	0
5	3	1	2007	8.5	3.3	0.9	52	5
6	4	1	2007	11.4	7.9	0.9	85	2.2
7	5	1	2007	15.8	9.2	3.3	81	6.2
8	6	1	2007	13.9	10.5	1.0	91	16.2
9	7	1	2007	14.3	11.3	2.1	98	3
10	8	1	2007	16.1	8.4	4.7	100	0
11	9	1	2007	14.2	8.7	2.4	95	0
12	10	1	2007	12.5	10.0	0.7	98	0.4
13	11	1	2007	14.3	10.2	3.0	98	8.4
14	12	1	2007	14.7	7.4	5.3	92	15.6
15	13	1	2007	13.8	5.9	5.3	97	5.2
16	14	1	2007	12.0	5.8	2.6	98	0
17	15	1	2007	10.4	8.4	0.5	82	17.8
18	16	1	2007	13.5	8.5	3.6	91	2
19	17	1	2007	13.7	6.6	4.7	96	3.6
20	18	1	2007	15.6	6.6	6.8	96	0
21	19	1	2007	14.7	5.6	5.8	85	0.4
22	20	1	2007	12.8	7.5	2.0	95	0
23	21	1	2007	13.3	10.0	2.3	96	0.2
24	22	1	2007	14.8	7.7	5.9	90	0.2
25	23	1	2007	12.9	5.7	6.3	81	0
26	24	1	2007	15.5	3.2	9.3	71	0
27	25	1	2007	13.8	2.6	8.4	79	0
28	26	1	2007	16.7	3.1	10.2	92	0
29	27	1	2007	14.7	1.8	8.1	84	0
30	28	1	2007	16.3	7.2	7.4	86	0

```
8.8     0.2     3.6     94
6.3     4.5     0.7     50
8.5     3.3     0.9     52
11.4    7.9     0.9     85
15.8    9.2     3.3     81
13.9    10.5    1.0     91
14.3    11.3    2.1     98
16.1    8.4     4.7     100
14.2    8.7     2.4     95
12.5    10.0    0.7     98
14.3    10.2    3.0     98
14.7    7.4     5.3     92
13.8    5.9     5.3     97
12.0    5.8     2.6     98
10.4    8.4     0.5     82
13.5    8.5     3.6     91
13.7    6.6     4.7     96
15.6    6.6     6.8     96
14.7    5.6     5.8     85
12.8    7.5     2.0     95
13.3    10.0    2.3     96
14.8    7.7     5.9     90
12.9    5.7     6.3     81
15.5    3.2     9.3     71
13.8    2.6     8.4     79
16.7    3.1     10.2    92
14.7    1.8     8.1     84
16.3    7.2     7.4     86
14.0    6.8     5.0     96
14.9    7.7     6.6     90
11.8    5.5     4.4     87
13.7    5.9     4.4     94
13.7    7.9     2.7     68
13.2    9.5     1.6     81
```

Importing climatic data

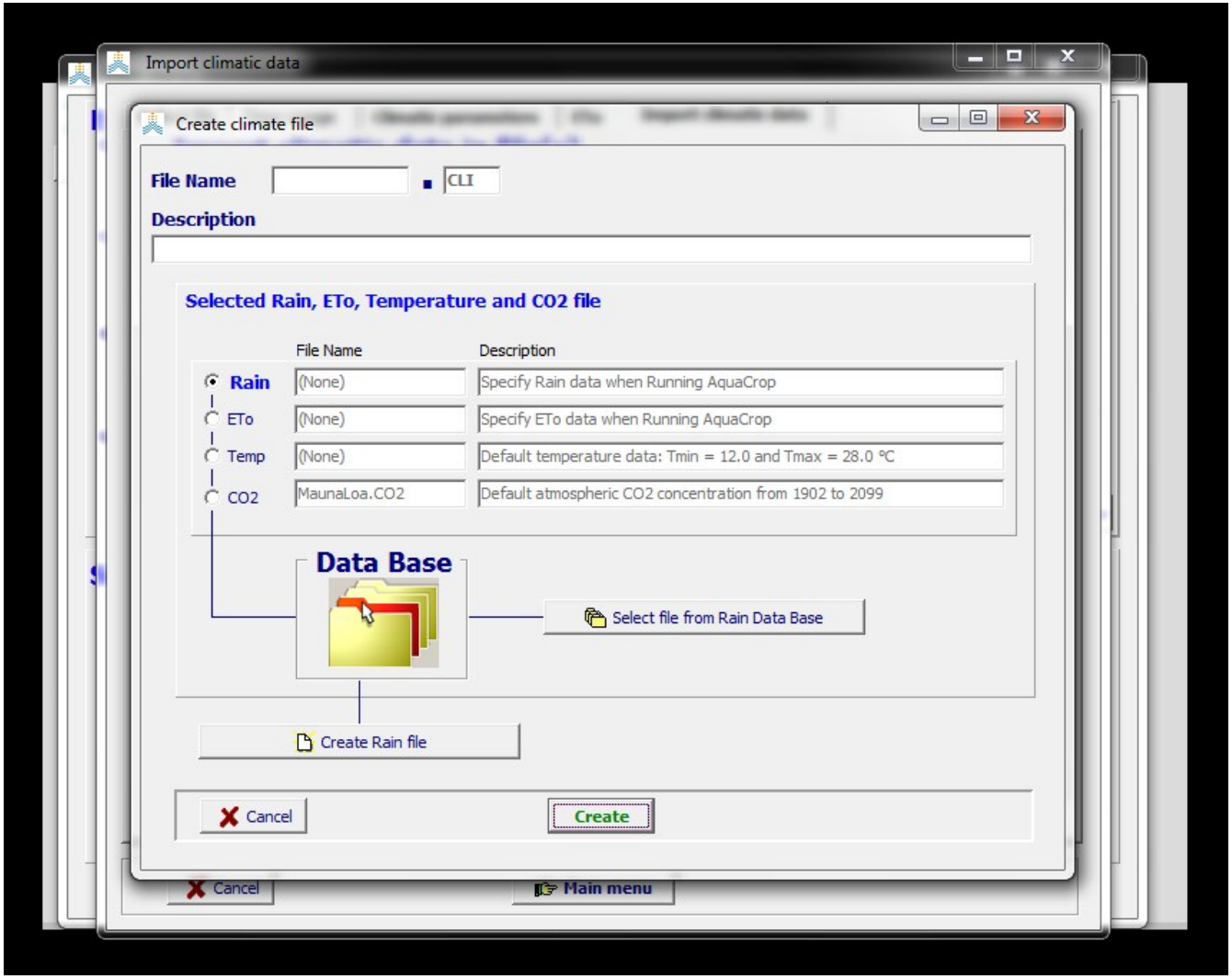


REAL WEATHER DATA

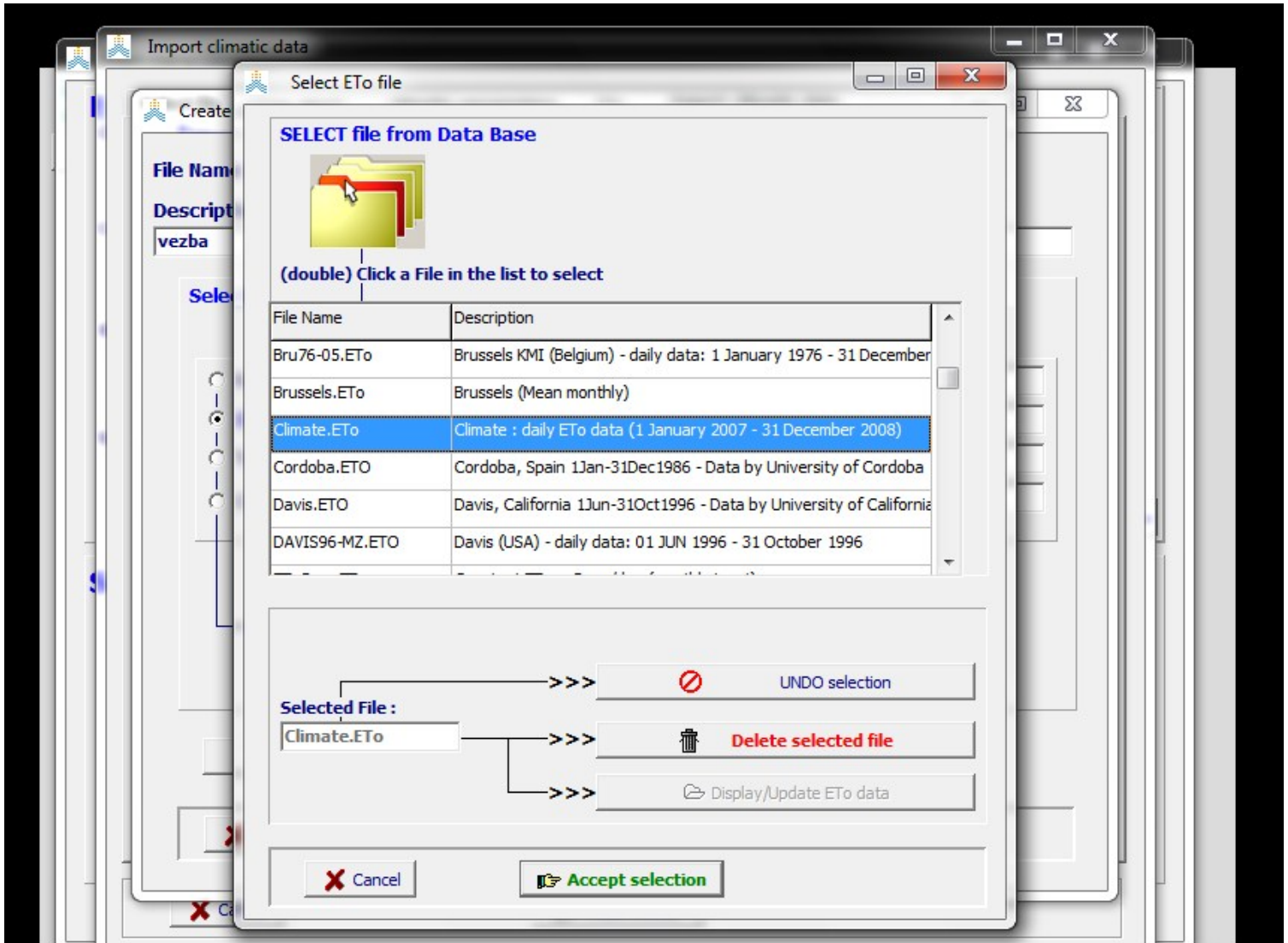
PREDICTED WEATHER DATA

DAY	SOLAR GLOBAL RADIATION W/m2	AVERAGE TEMPERATURE (°C)	RELATIVE HUMIDITY (%)	PRECIPITATION (mm)	WIND SPEED (m/s)
21.05.2016	465,76	15,4	51	0	3
22.05.2016	507,44	16,1	62	0	0,8
23.05.2016	557,51	18,7	61	0	1,9
24.05.2016	542,71	16,3	67	1,2	4,4
25.05.2016	452,82	17,0	74	10	4,9
26.05.2016	441,21	17,4	68	6	1,9
27.05.2016	555,23	19,0	65	0	1,4
28.05.2016	563,32	20,0	64	0	2,5

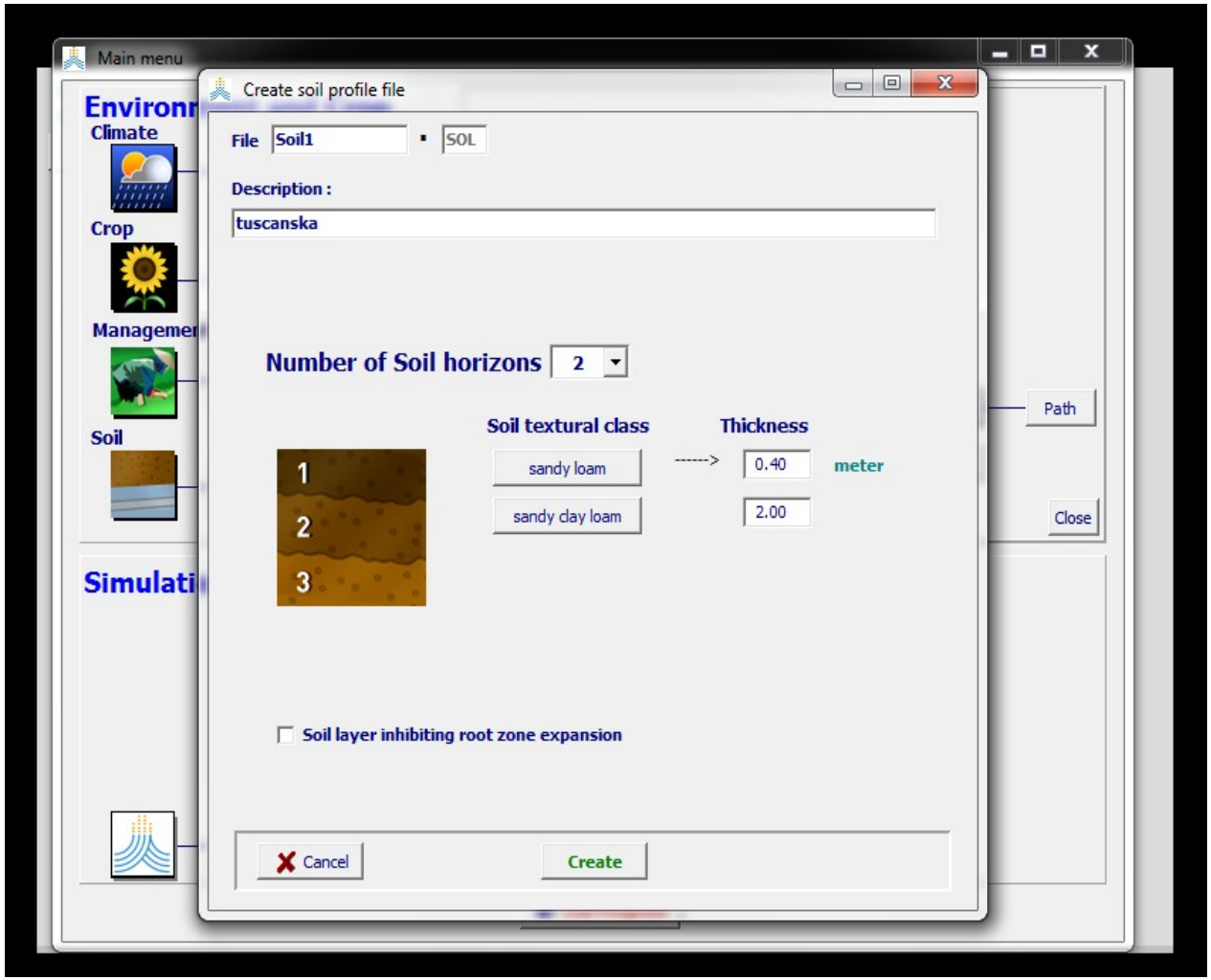
Create climate fileS



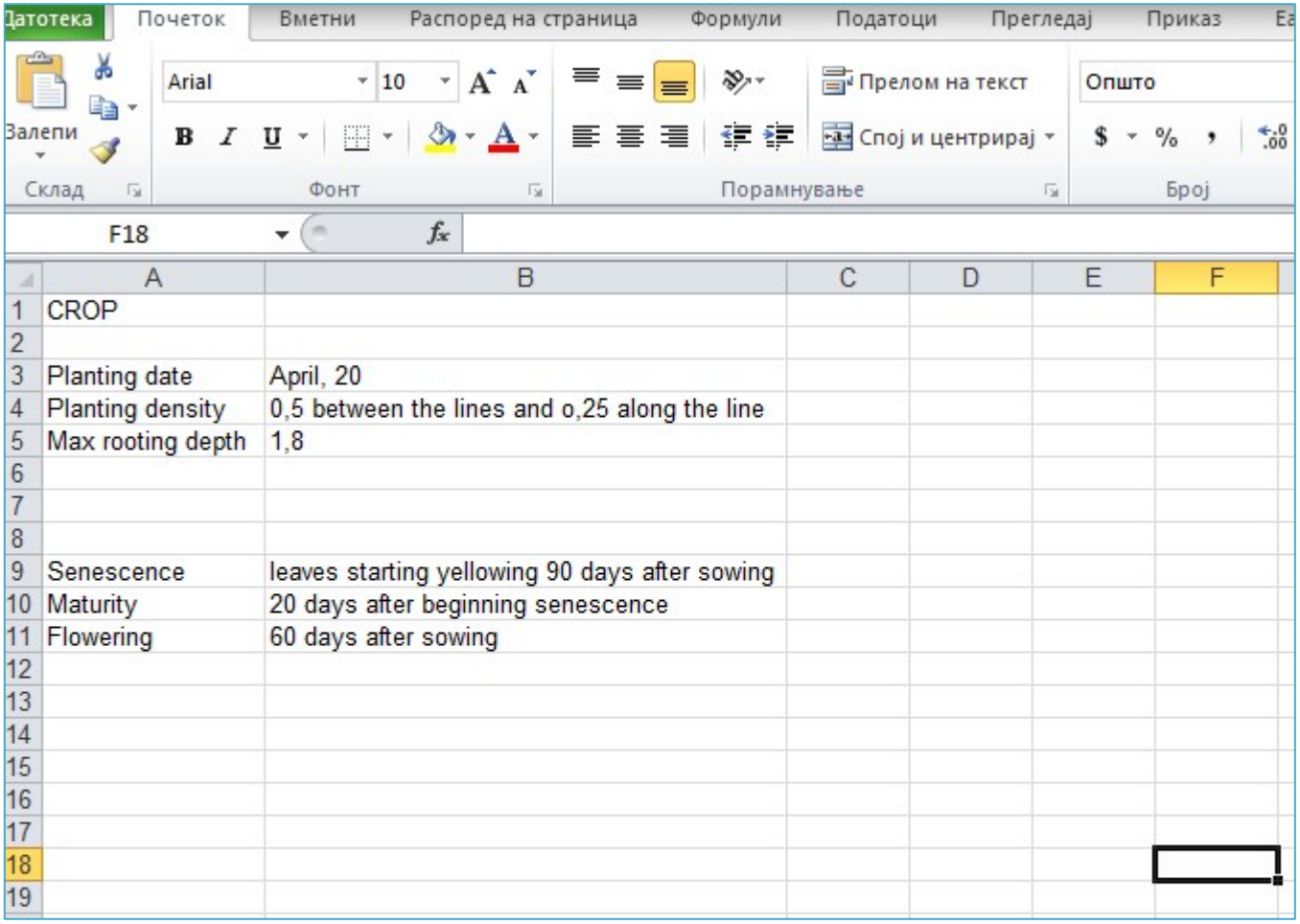
Select climate fileS



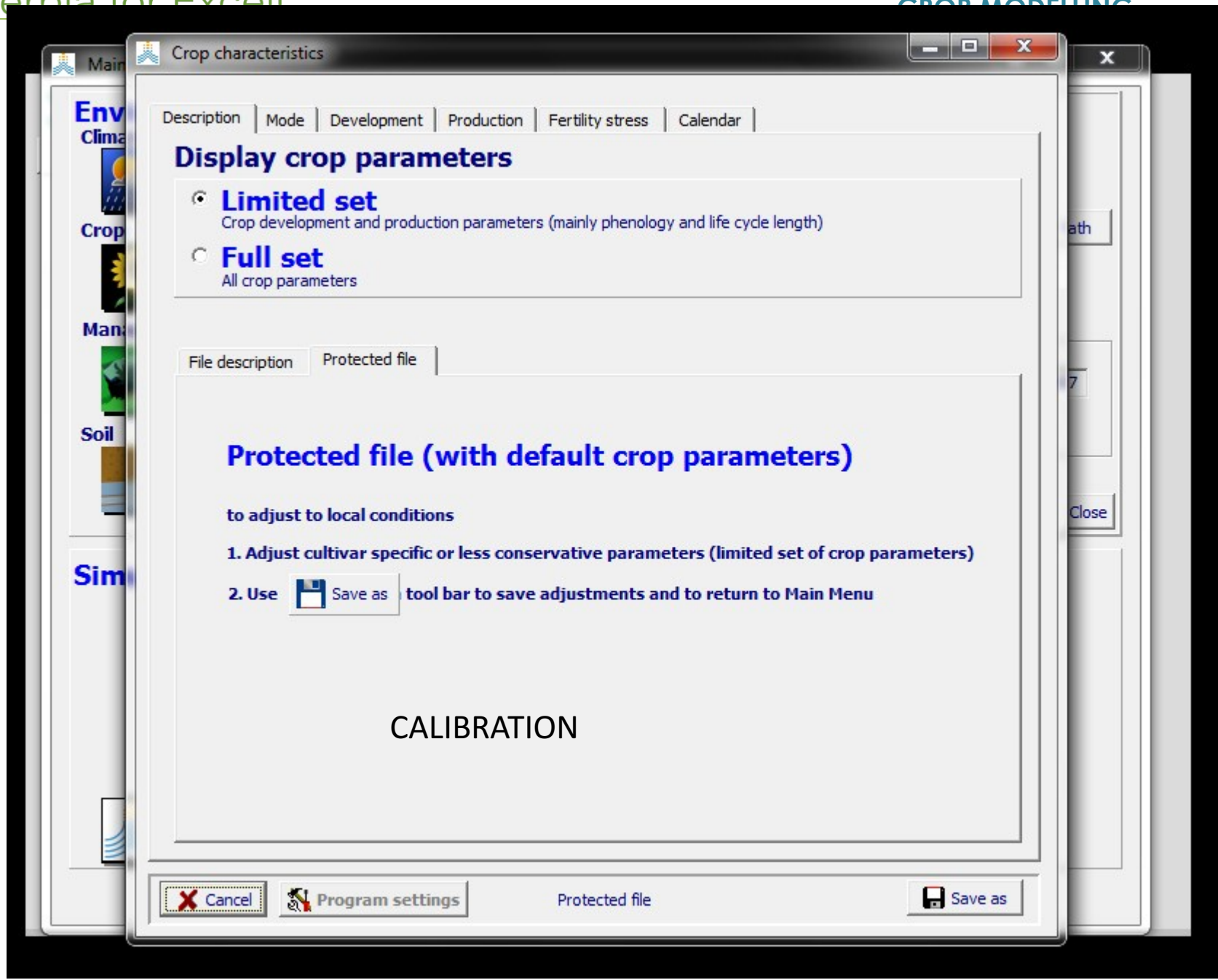
Soil data

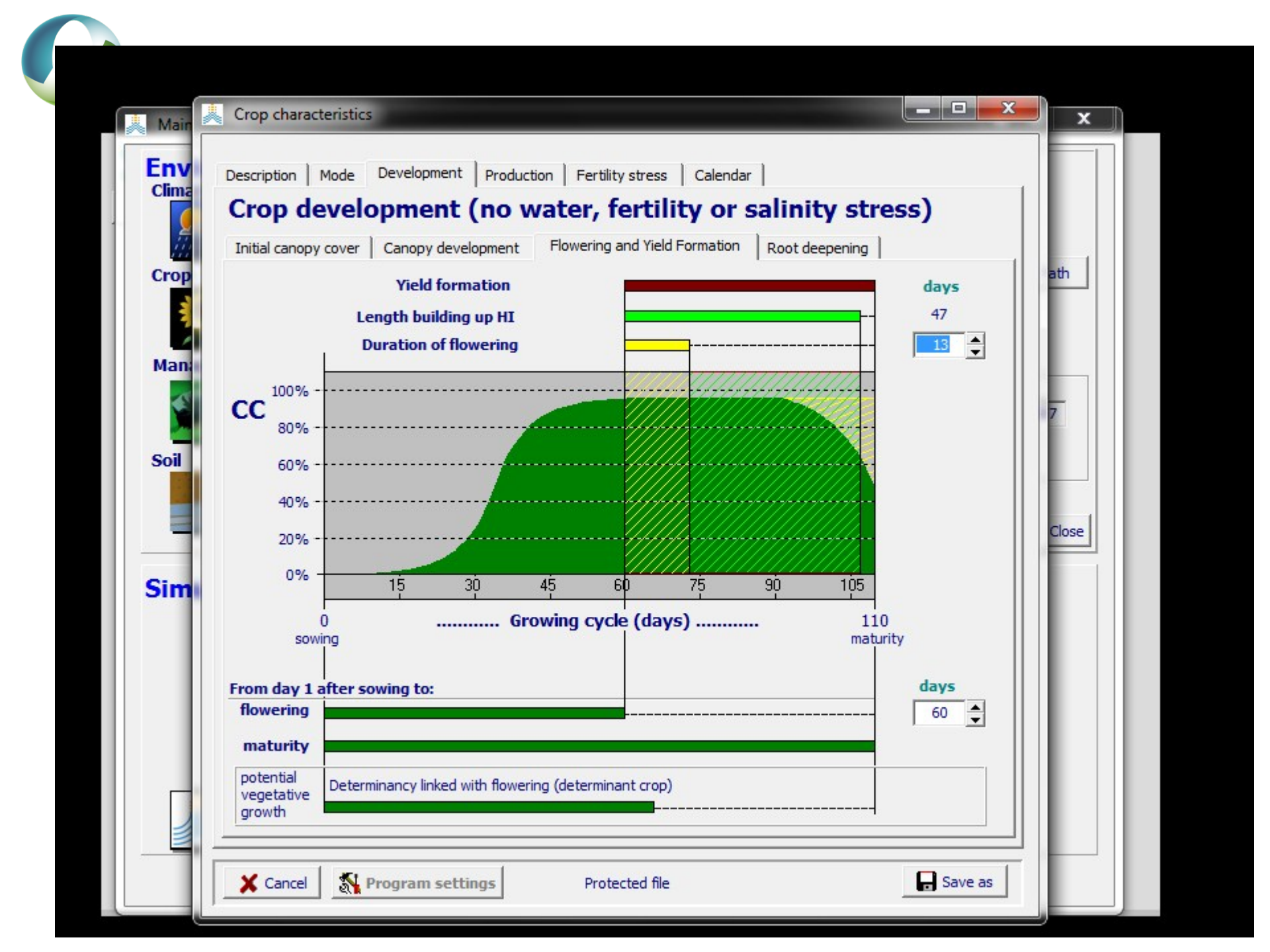

Main menu
Environ
Climate
Crop
Managemer
Soil
Simulati
Path
Close
Create soil profile file
File
Soil1
SOL
Description :
tuscanska
Number of Soil horizons
2
Soil textural class
Thickness
1
2
3
sandy loam
sandy clay loam
0.40
2.00
meter
Soil layer inhibiting root zone expansion
Cancel
Create

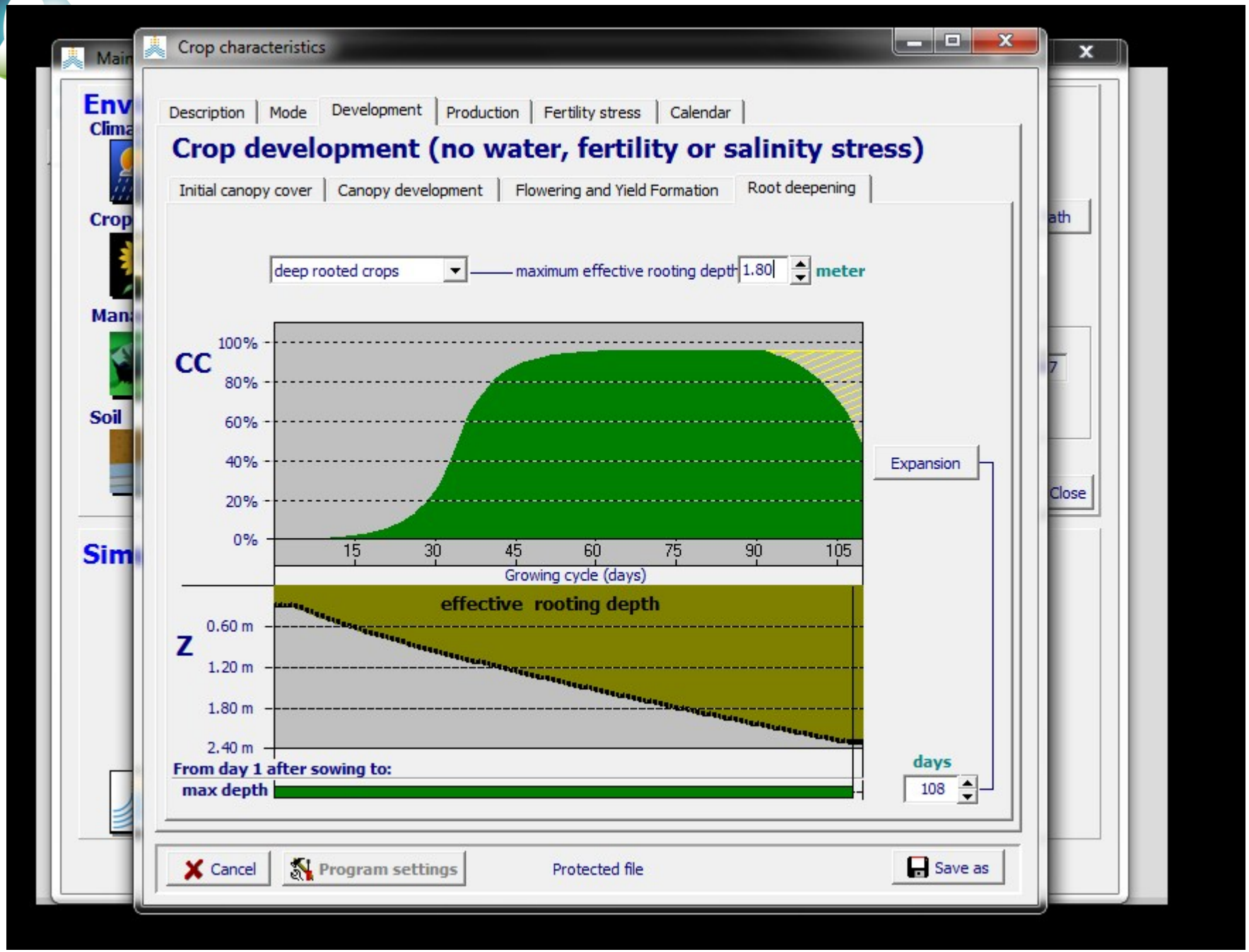
Input data preparation – crop data

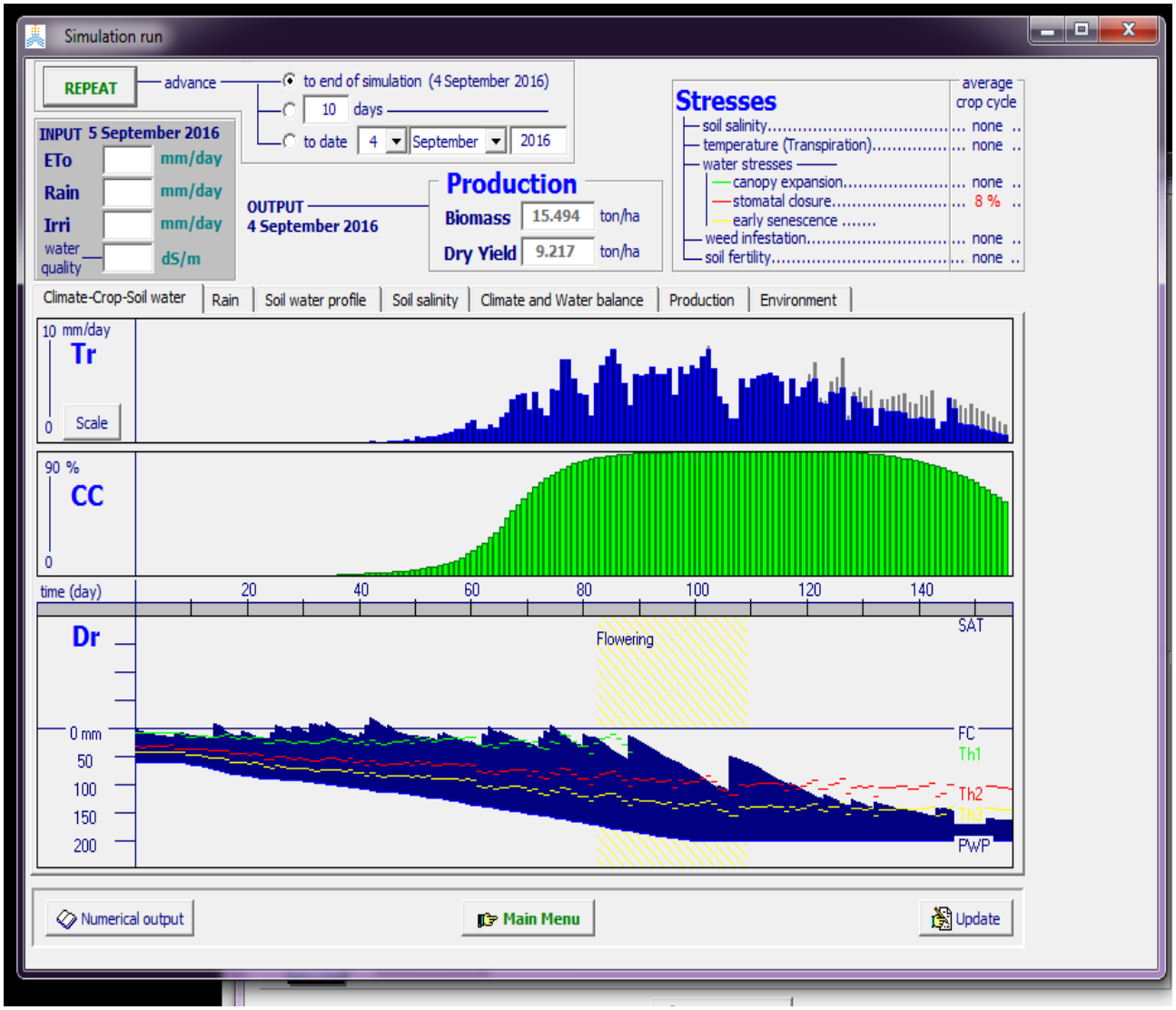


	A	B	C	D	E	F
1	CROP					
2						
3	Planting date	April, 20				
4	Planting density	0,5 between the lines and o,25 along the line				
5	Max rooting depth	1,8				
6						
7						
8						
9	Senescence	leaves starting yellowing 90 days after sowing				
10	Maturity	20 days after beginning senescence				
11	Flowering	60 days after sowing				
12						
13						
14						
15						
16						
17						
18						
19						


Crop characteristics
Description
Mode
Development
Production
Fertility stress
Calendar
Display crop parameters
Limited set
Crop development and production parameters (mainly phenology and life cycle length)
Full set
All crop parameters
File description
Protected file
Protected file (with default crop parameters)
to adjust to local conditions
1. Adjust cultivar specific or less conservative parameters (limited set of crop parameters)
2. Use Save as tool bar to save adjustments and to return to Main Menu
CALIBRATION
Cancel
Program settings
Protected file
Save as

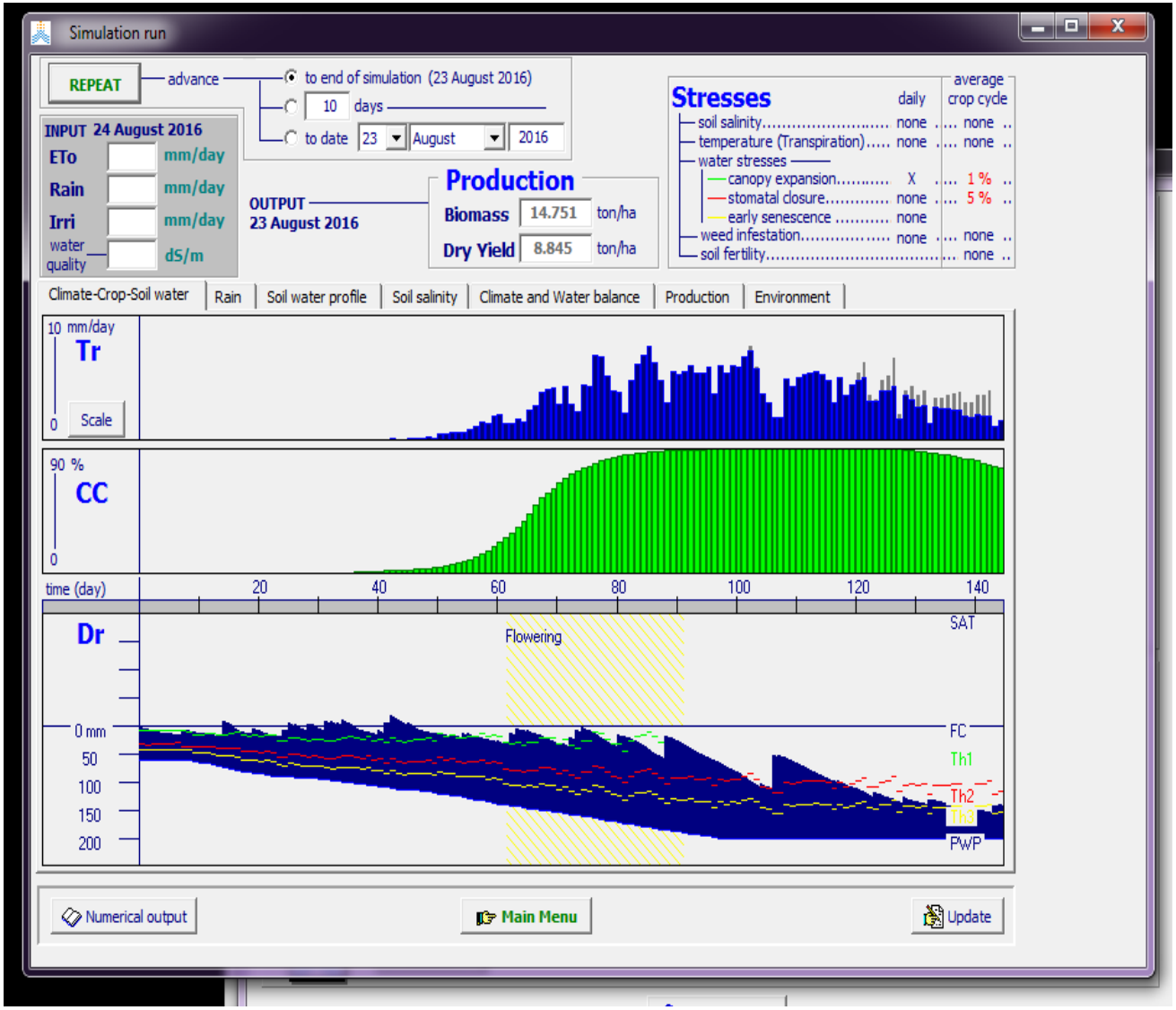

Crop characteristics
Description
Mode
Development
Production
Fertility stress
Calendar
Crop development (no water, fertility or salinity stress)
Initial canopy cover
Canopy development
Flowering and Yield Formation
Root deepening
Yield formation
Length building up HI
Duration of flowering
days
47
13
CC
100%
80%
60%
40%
20%
0%
15
30
45
60
75
90
105
0
sowing
Growing cycle (days)
110
maturity
From day 1 after sowing to:
days
flowering
60
maturity
potential vegetative growth
Determinancy linked with flowering (determinant crop)
Cancel
Program settings
Protected file
Save as


Crop characteristics
Description
Mode
Development
Production
Fertility stress
Calendar
Crop development (no water, fertility or salinity stress)
Initial canopy cover
Canopy development
Flowering and Yield Formation
Root deepening
deep rooted crops
maximum effective rooting depth
1.80
meter
CC
100%
80%
60%
40%
20%
0%
15
30
45
60
75
90
105
Growing cycle (days)
Expansion
effective rooting depth
Z
0.60 m
1.20 m
1.80 m
2.40 m
From day 1 after sowing to:
max depth
days
108
Cancel
Program settings
Protected file
Save as



AquaCrop simulation:

Crop: Tomato
Year: 2016
Weather: observed



AquaCrop simulation:

Crop: Tomato
Year: 2016
Weather: NWP

9 September 2016			
	WP (kg/m3)	Biomass (t/ha)	Yield (t/ha)
Clim_OBS	19,5	15,496	9,213
Clim_NWP	19,5	15,494	9,217

End of season final production

Details within 8 days
Numbers represent the difference between values of run with observed climatic data and values of run with 8 days of NWP generated data

OBS-NWP			
	Transpiration (%)	WP (kg/m3)	Biomass (t/ha)
21 May	0,1	0	0,000
22 May	0,1	0	0,001
23 May	0,2	0	0,003
24 May	0,2	0	0,006
25 May	0	0	0,010
26 May	0,2	0	0,014
27 May	0,2	0	0,021
28 May	0,3	0	0,029

Conclusion

- The two run with AquaCrop led to a very similar final result in terms of water productivity, biomass and yield of tomato grown in 2016 in Novi Sad.

- Looking at crop transpiration, water productivity and biomass accumulated during the 8 days for which weather data were compared (observed vs NWP) we observe that a even a small difference (rainfall and temperature, especially) in data led to a difference in the simulated processes

- We can conclude that as AquaCrop is essentially a soil water balance model, it is very sensitive to weather data and longer period of time should be tested to assess the impact of NWP data on the final simulation