



## 2.2 Crop Parameterisation




**FROGS (French Refinement Of Groundwater Scenarios)  
UIPP Training**

**Paris, 22 - 23 January 2015**

**UIPP Environmental Methodology Working Group**



### **Objective of realism: be as representative as possible of the actual environmental conditions in France**

-  Crop rotations instead of monoculture
-  Realistic emergence and harvest dates depending on geographical location
-  BBCH growth stages option for timing of the pesticides applications



## Be as representative as possible of the actual conditions of use of PPPs

### FOCUS:

- 🌱 Same crop grown every year on the plot where the PPP is applied

### FROGS approach:

- ✓ Include crop rotations within the GW risk assessment scheme
- ✓ Selection of relevant crop rotations based on agronomic expertise



- **For each « main crop » considered in FROGS, the most probable crop rotation within each relevant AU was determined**
  - Survey conducted with experts from Industry and Arvalis
  - 1 to 5 possible crop rotation types for each AU
  - 1-year to 4-year crop rotations, most of them being 3-year crop rotations
  
- **Reality check and selection of most representative rotation performed by comparing to most probable rotation based on 2001 regional Agreste data (Ministry of Agriculture)**
  - Data on crop grown the previous year
  - Data not available for potatoes and sunflower
  - 3 year-crop rotation probabilities of occurrence were calculated for each region for 12 possible crop rotation types
  
- **Final validation of the crop rotation type for each main crop in each AU was performed by field specialists within Industry**



**Table 7 Crop rotations implemented in FROGS for each AU and each primary crop**

AU code	AU Name	Primary crop	Crop rotation	Rotation length (years)
1	Collines molassiques - Lauragais	Winter Wheat	Winter Wheat-Sunflower	2
		Oilseed rape	Oilseed rape-Winter Wheat-Sunflower	3
		Maize fodder	Maize fodder	1
		Maize grain	Maize grain-Winter Wheat	2
		Barley	Barley-Winter Wheat-Sunflower	3
		Sunflower	Sunflower-Winter Wheat	2
2	Bretagne sud	Winter Wheat	Winter Wheat-Maize fodder-Barley	3
		Oilseed rape	Oilseed rape-Winter Wheat-Maize fodder	3
		Maize fodder	Maize fodder-Winter Wheat-Barley	3
		Maize grain	Maize grain-Winter Wheat	2
		Barley	Barley-Maize fodder-Winter Wheat	3
		Sunflower	Sunflower-Winter Wheat	2
3	Limagnes - Plaine du Forez	Sugar beet	Sugar beet-Winter Wheat-Winter Wheat	3
		Winter Wheat	Winter Wheat-Maize fodder	2
		Oilseed rape	Oilseed rape-Winter Wheat-Barley	3
		Maize fodder	Maize fodder-Winter Wheat	2
		Maize grain	Maize grain-Barley-Winter Wheat	3
		Barley	Barley-Winter Wheat-Sugar beet	3
4	Bordure Nord - Picardie - Normandie	Sunflower	Sunflower-Winter Wheat	2
		Sugar beet	Sugar beet-Winter Wheat-Winter Wheat	3
		Winter Wheat	Winter Wheat-Barley-Maize fodder	3
		Oilseed rape	Oilseed rape-Winter Wheat-Barley	3
		Maize fodder	Maize fodder-Winter Wheat-Barley	3
		Maize grain	Maize grain-Winter Wheat	2
		Barley	Barley-Winter Wheat-Sugar beet	3
Potato	Potato-Winter Wheat-Barley	3		



### **Assignment of main crop events in the different AUs**

- Emergence and harvest dates
- Data collected from expert knowledge and Agreste data
- When not available, default FOCUS values were selected (Chateaudun for Northern France and Piacenza for Southern France)
- Due to some limitations of PEARL, a shift in the emergence/harvest dates had to be performed for a small number of situations.

### **4-year crop rotations included in FROGS 3.3.3.3**

- Former versions of PEARL had a limitation and could not simulate more than 70 modelling years → workaround in former FROGS versions was removed and 86 year simulation periods were included



## FOCUS: applications on fixed dates

- Same dates of application repeated over the whole period of simulation
- Absolute or relative application dates (emergence or harvest)

FROGS: Application dates vary depending on weather conditions for each AU and each individual year of simulation

- ✓ More realistic approach
- ✓ Absolute or relative application dates (emergence or harvest) or **depending on the growth stage of the crop considered**

### Standard phenological sub-models based on temperature sums

- ✓ Same algorithms as in PEARL (FOCUS excluded) and the EU model WOFOST used by JRC for the CGMS (European Crop Growth Monitoring System)
- ✓ Phenological parameters from [Boons-Prins et al. \(1993\)\[1\]](#) for cereals, maize, sugar beet, potatoes and sunflower (dependent only on temperature sums)
- ✓ Sub-model and parameters from [Habekotté \(1997\)\[2\]](#) for oil seed rape (more complex, dependent on both temperature sums and degree of vernalization)

[\[1\]](#) Boons-Prins, E.R., G.H.J. de Koning, C.A. van Diepen and F.W.T. Penning de Vries, 1993. Crop specific simulation parameters for yield forecasting across the European Community. Simulation Rep. 32, CABO-DLO and SC-DLO, Wageningen, The Netherlands.

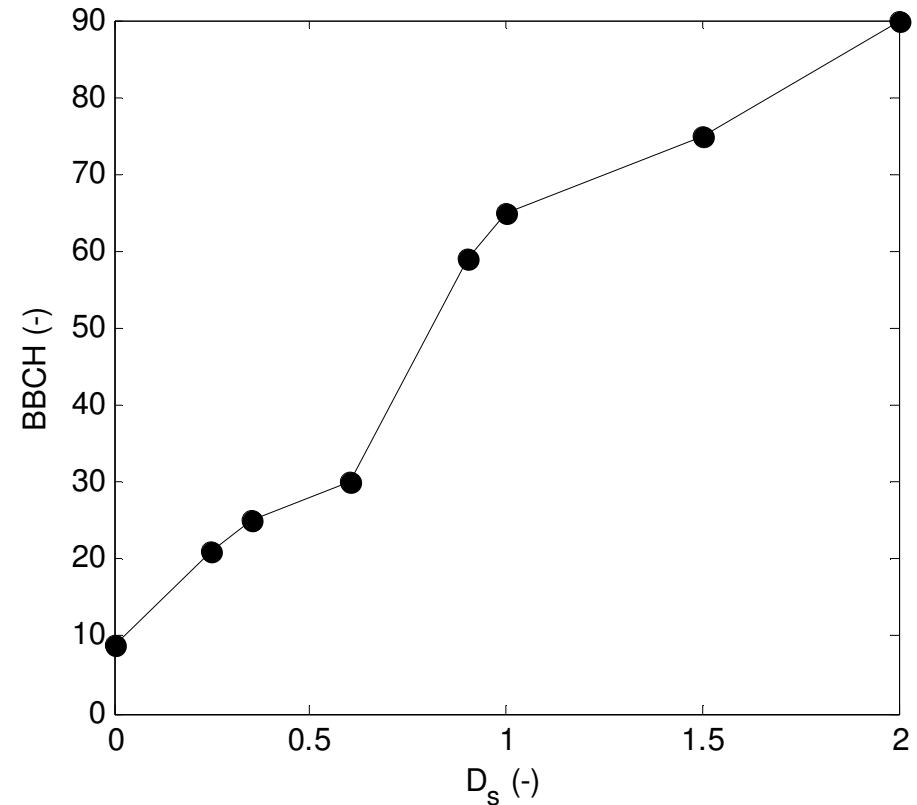
[\[2\]](#) Habekotté, B. 1997. A model of the phenological development of winter oilseed rape (*Brassica napus* L.). *Field Crops Research* 54: 127-136.



Correspondence between development stage and BBCH code  
(base JRC [<http://agsys.cra-cin.it/tools/cropml/help/>])



	$D_s$	BBCH
Emergence:	0	9
Beginning of tillering:	0.25	21
Mid tillering:	0.35	25
Panicle initiation:	0.6	30
Full Heading:	0.9	59
Full Flowering:	1	65
Full Grain filling:	1.5	75
Physiological maturity:	2	90

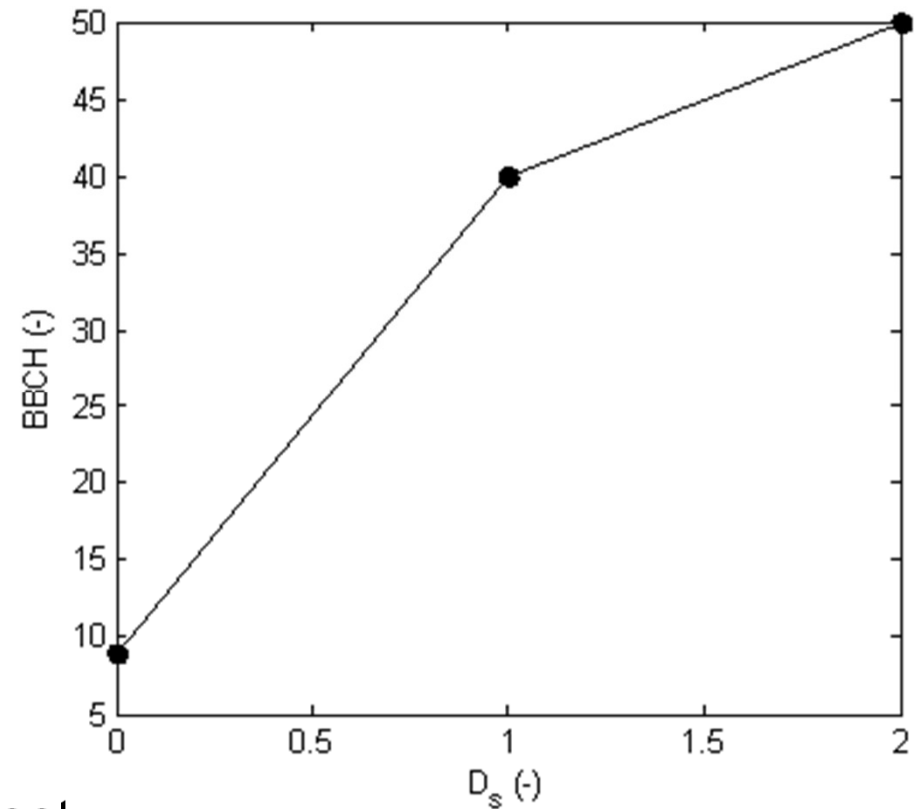


All crops except sugar beet  
(biannual crop)

Correspondence between development stage and BBCH code  
 (base JRC [<http://agsys.cra-cin.it/tools/cropml/help/>])



	$D_s$	BBCH
Emergence:	0	9
Full ground cover (LAI = 2.5):	1	40
Harvest:	2	50



Sugar beet



Compilation of growth stage information gathered during biological trials of the industry on a 20-year period (non published data under Access format):  
>150000 entries covering most crops and AUs

Correspondence with the 31 AUs based on postal codes and canton information

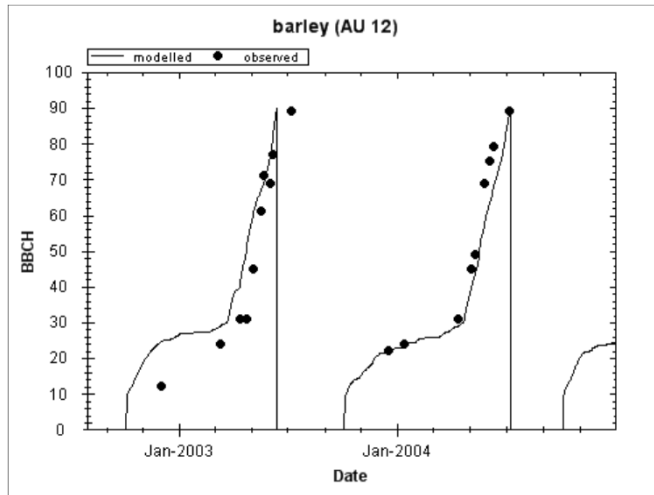
Comparison made with the simulated BBCH events for the same years using MARS weather data selected for each individual AU

**Conclusion: Phenological models are in excellent equivalence with the observed data**

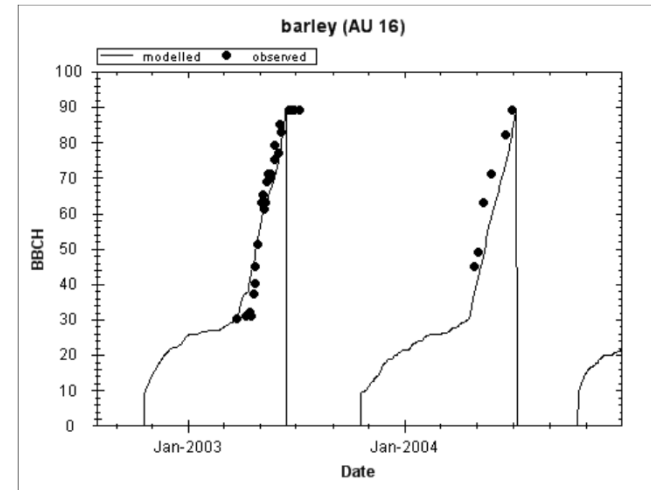


Winter Barley

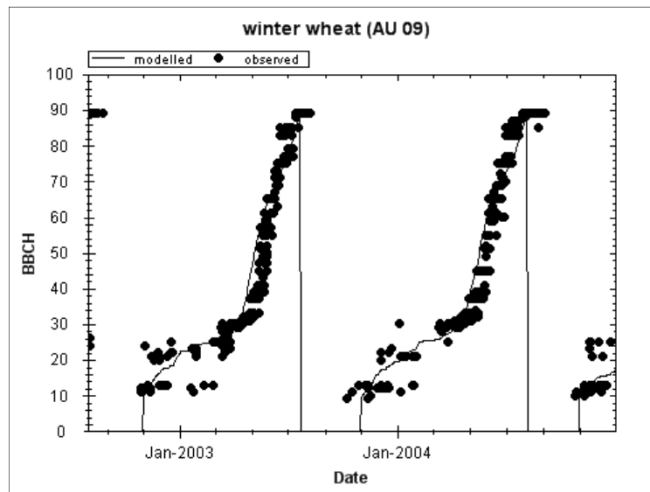
Barrois – Plateaux bourguignons



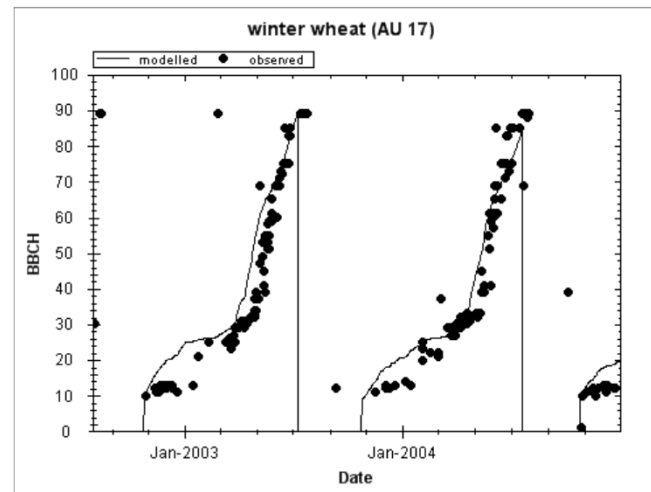
Champagne crayeuse



Picardie-Nord-Pas de Calais



Beauce – Drouais - Gâtinais

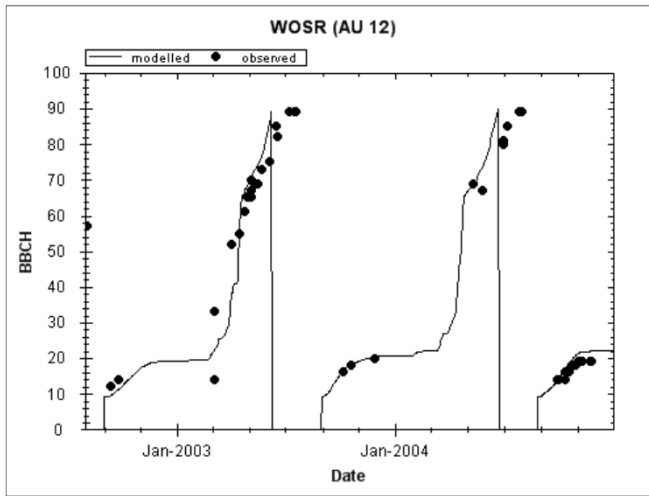


Winter wheat

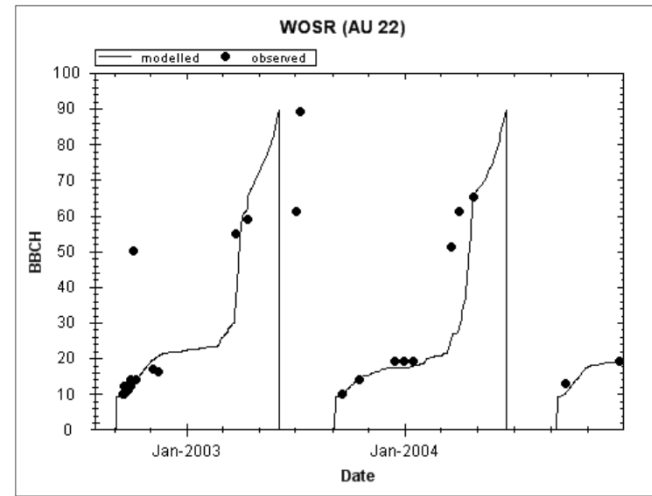


**Winter**  
**Oil Seed**  
**Rape**

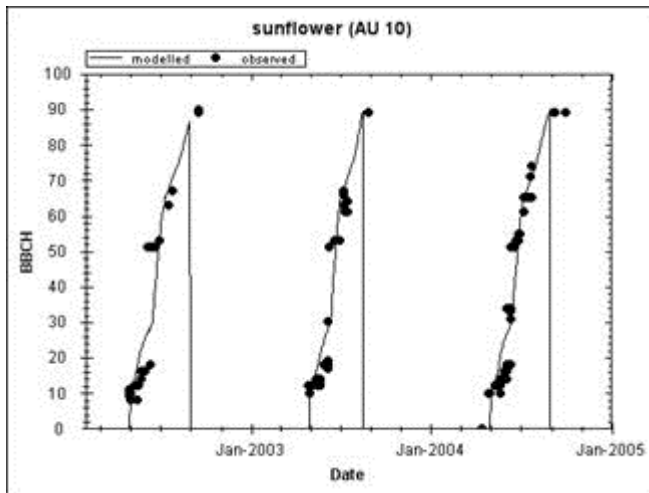
**Barrois – Plateaux bourguignons**



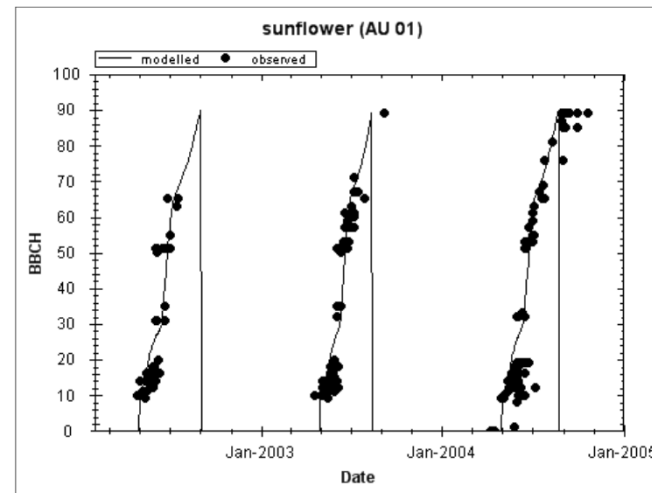
**Champagne berrichonne - Boischault**



**Charentes**



**Collines molassiques - Lauragais**

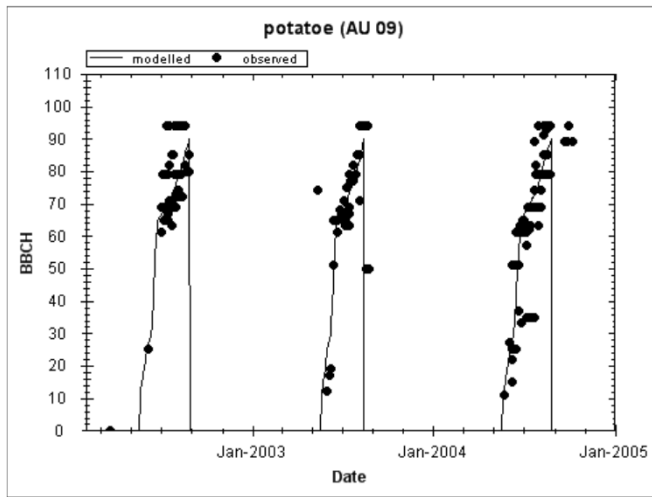


**Sunflower**

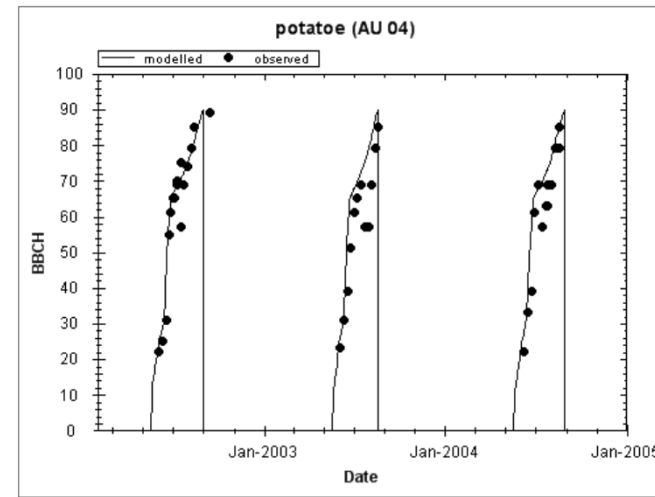


Potato

Picardie – Nord – Pas de Calais

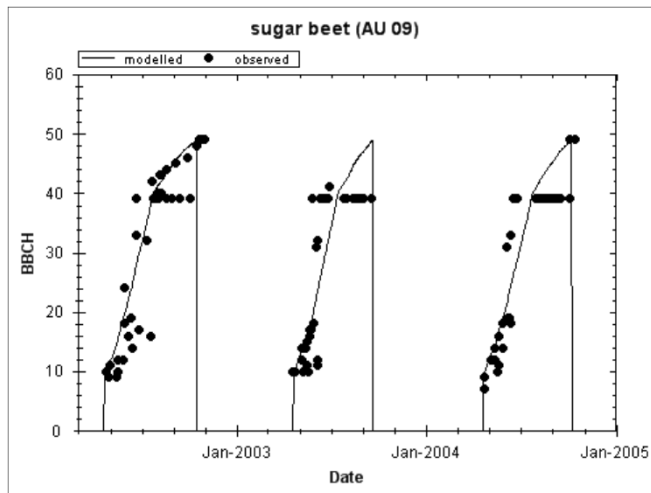


Bordure maritime Nord – Picardie - Normandie

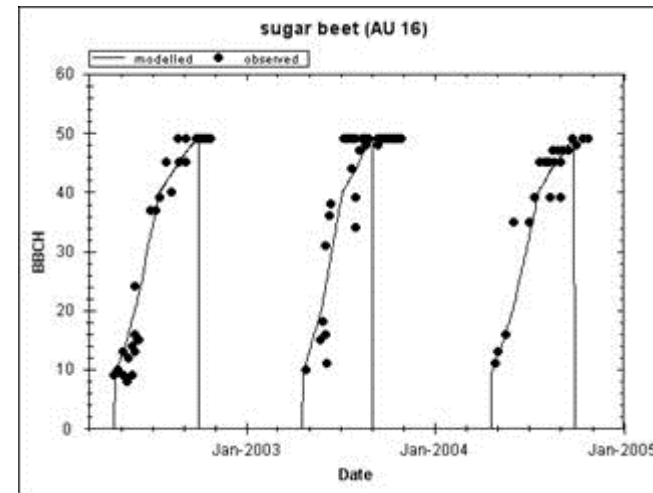


Sugar Beet

Picardie – Nord – Pas de Calais



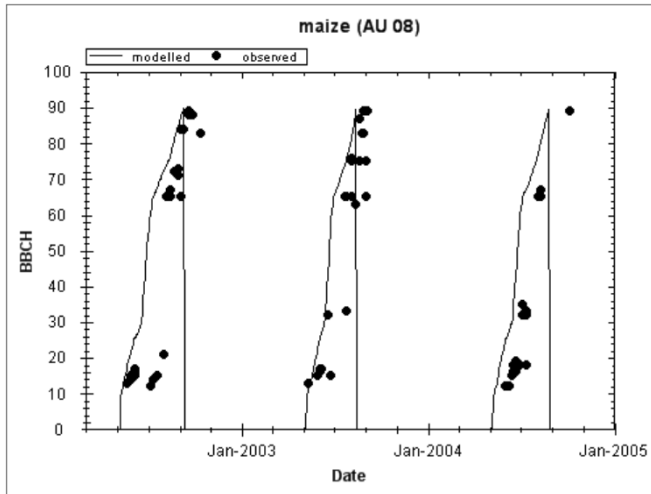
Champagne crayeuse





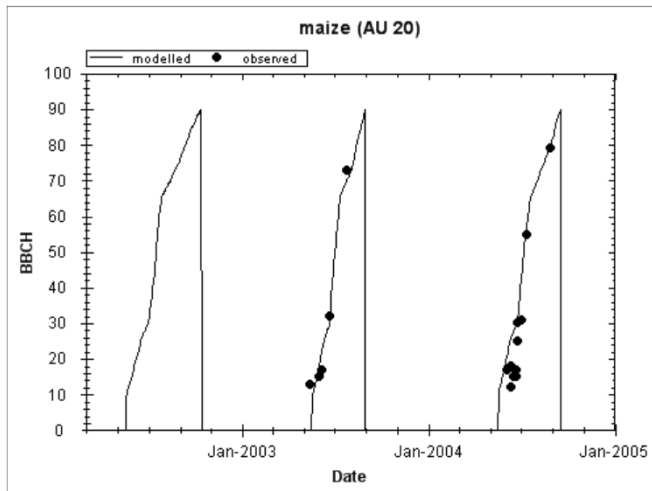
Grain  
Maize

Collines molassiques - Lauragais



Fodder  
maize

Bocages de l'Ouest





### **A number of crop-specific parameters are required for the modeling of water and pesticide fluxes**

- Leaf Area Index (LAI)
- Rooting depth

### **Because of the lack of available data, default FOCUS values were selected for these parameters**

- Values from Châteaudun or Piacenza
- Room for improvement in future versions of FROGS





Thank you very much for your kind attention.