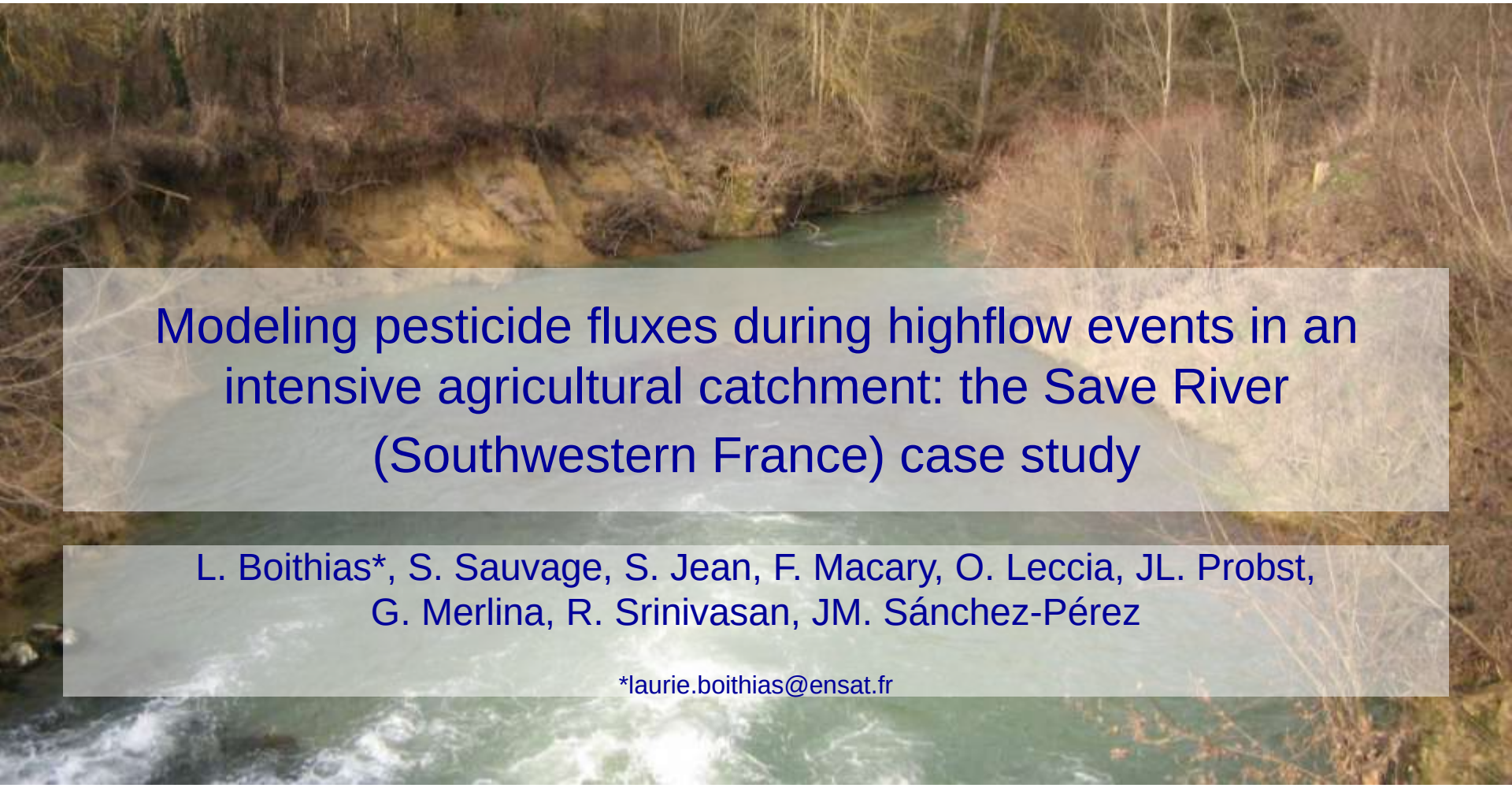

Modeling pesticide fluxes during highflow events in an intensive agricultural catchment: the Save River (Southwestern France) case study

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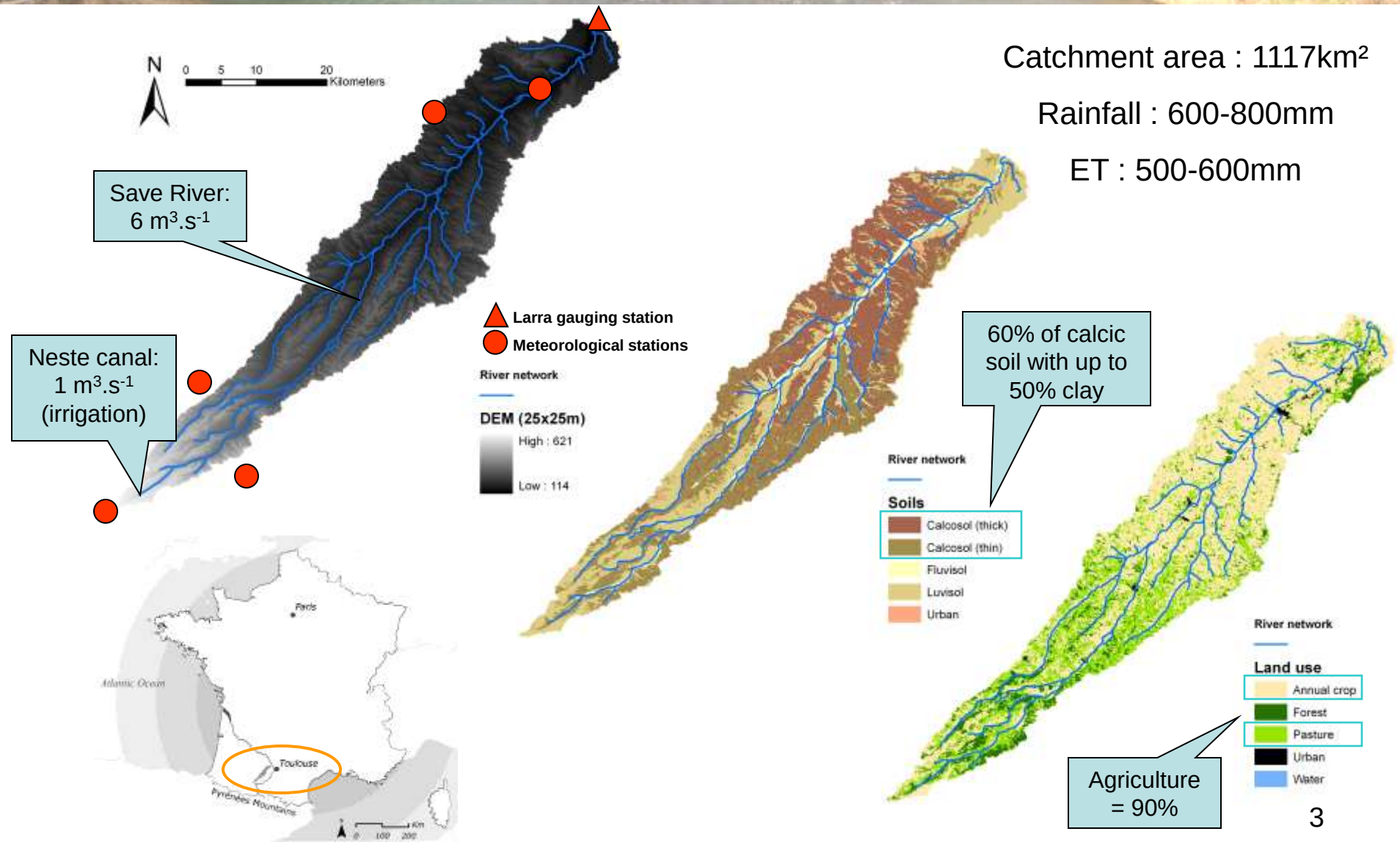
Introduction

- EU Directive of 1998 : threshold of 0.1µg.L^{-1} for single pesticide and 0.5µg.L^{-1} for all pesticides concentration
- In France, water agencies monitor water quality (including various pesticides) in rivers since 2000
- But… only total concentration and no cost-intensive continuous measurements
- AguaFlash EU project : suggest managers a tool
  - To predict pesticide contamination of rivers during floods
  - To promote and enforce water quality policies

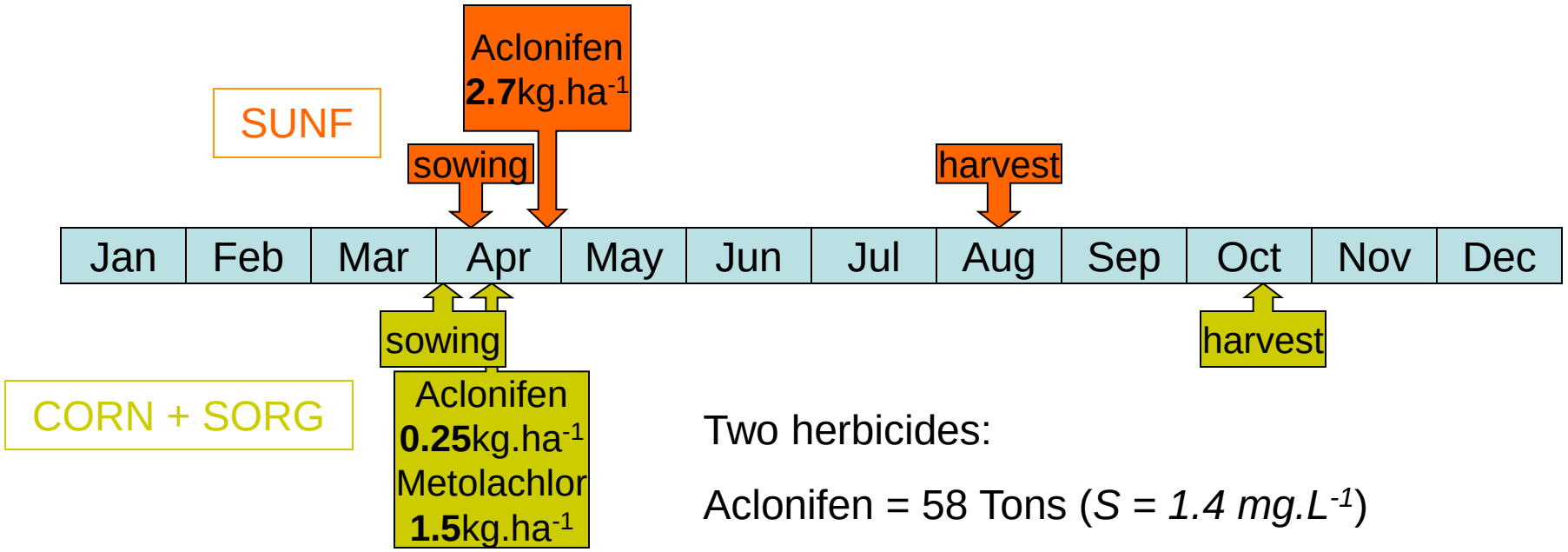
➢ Model pesticide transfer in both soluble and sorbed phases
➢ Indentify the factors controlling the transfer

Study Site – The Save catchment



Study site - Pesticides

- Corn + Sorghum + Sunflower = 23% of catchment area



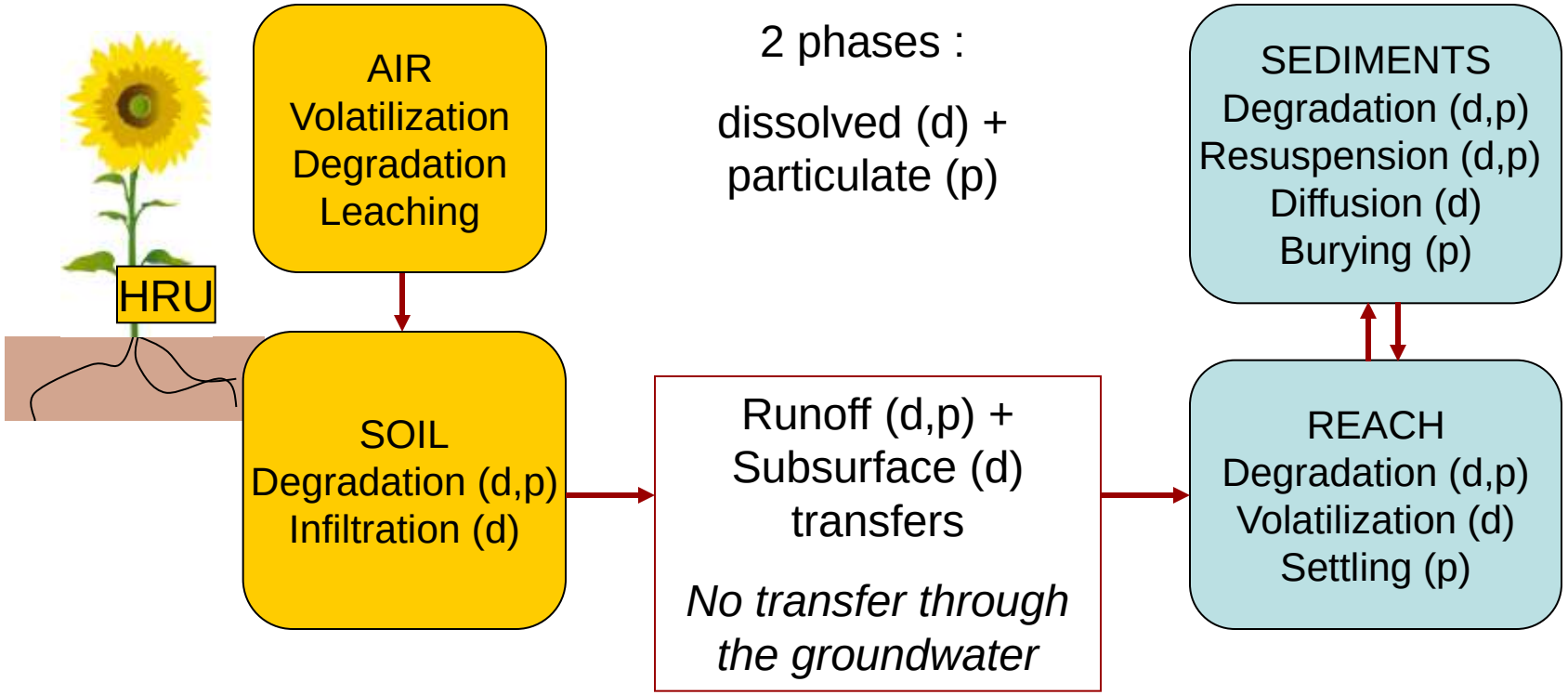
Two herbicides:

Aclonifen = 58 Tons (S = *1.4 mg.L^{-1}*)

Metolachlor = 30 Tons (S = *480 mg.L^{-1}*)

-> One year intensive pesticide monitoring data at outlet within the AguaFlash project

Pesticide modeling with SWAT



ArcSWAT 2009.93.3 : 73 sub-basins (min area = 500ha) -> 2985 HRUs

23 land use classes
6 soil classes
5 slope classes (%: 0-2, 2-5, 5-10, 10-15, >15)

Daily time step

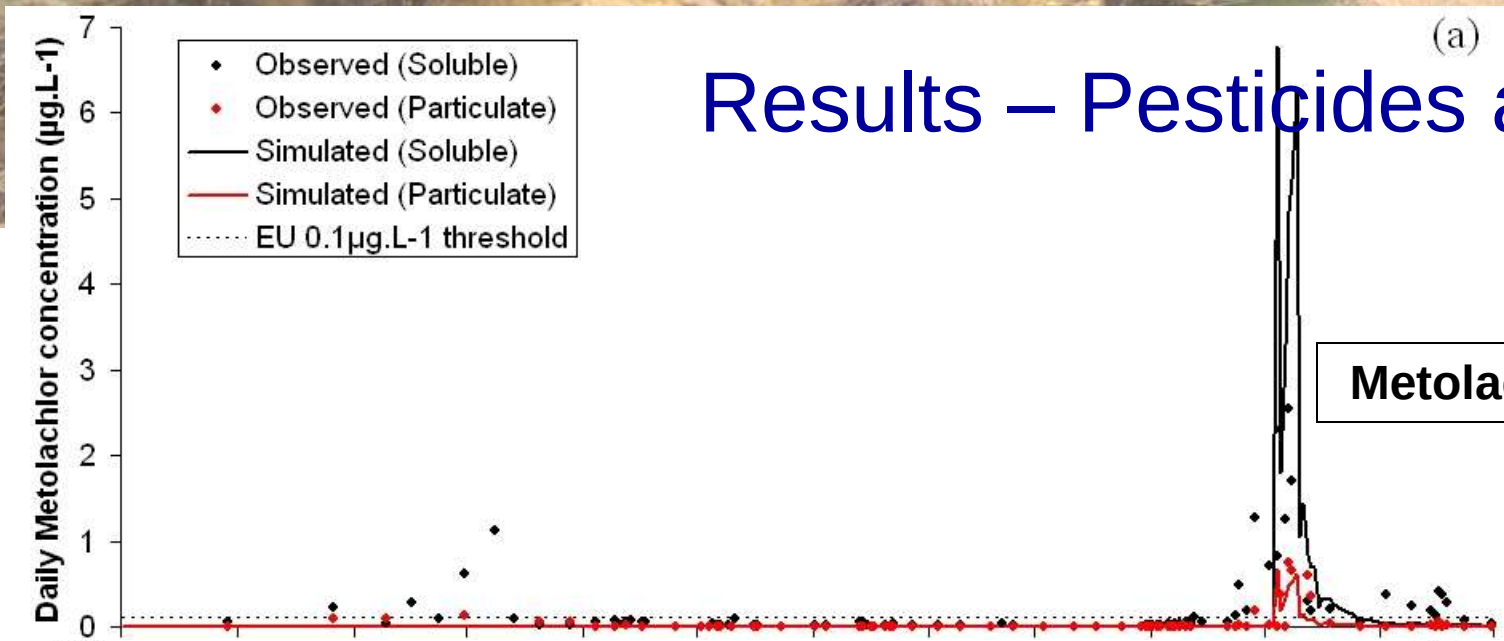
Sensitivity analysis on flow, NO_3, susp. sed. with ArcSWAT tool

Results – Discharge, NO_3, Susp. sediments

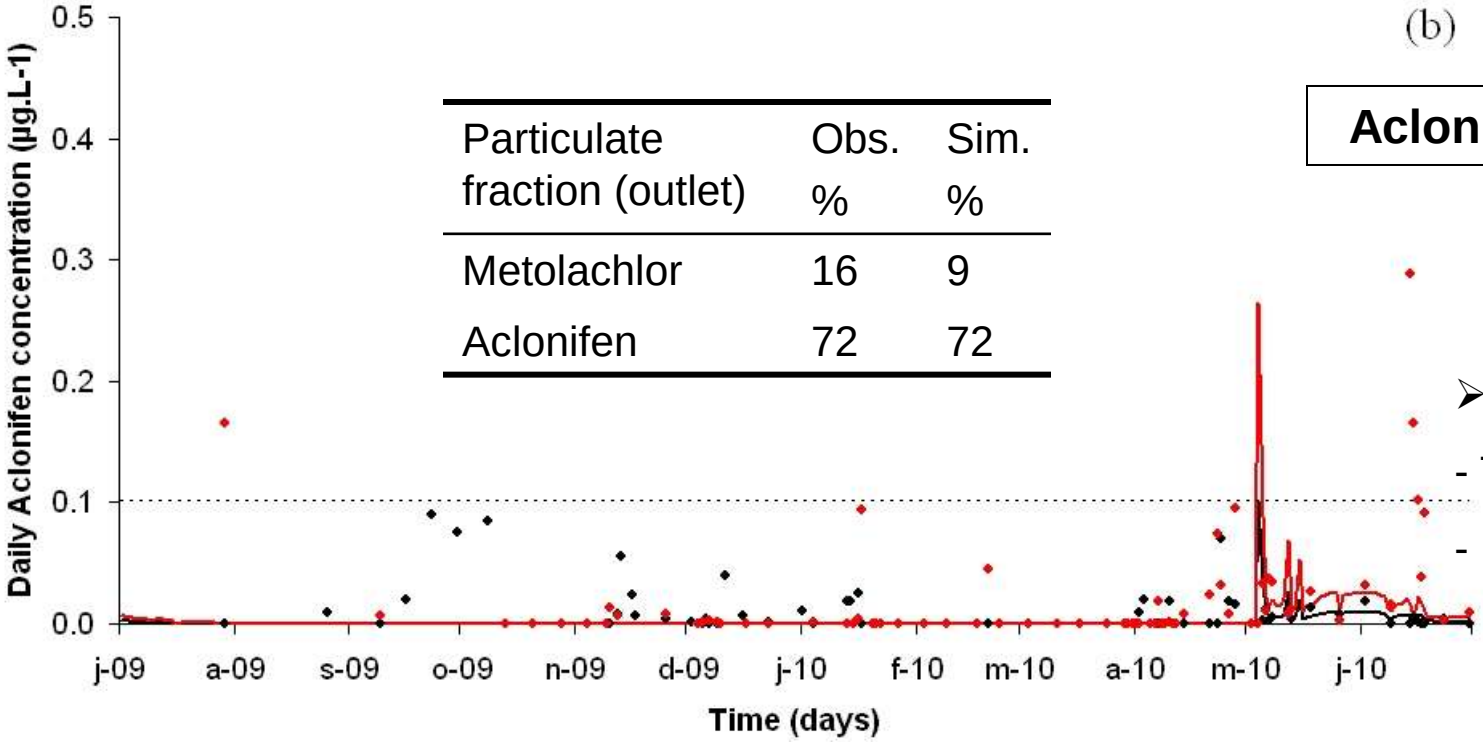
Discharge validation 2009 - 2010

Daily GOF	R^2	E_{NS}
Discharge	0.55	0.56
Nitrate	0.48	0.45
Susp. Sed.	0.21	0.18

Results – Pesticides at outlet



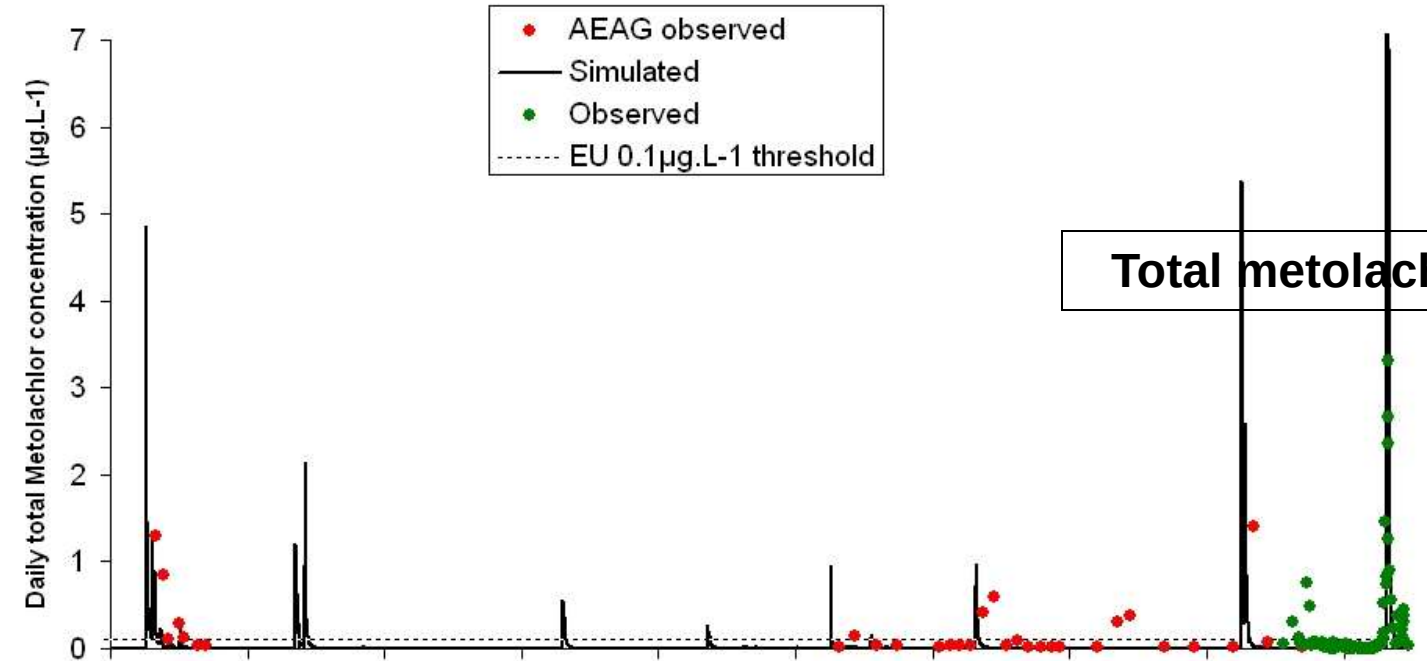
Metolachlor 2009-2010



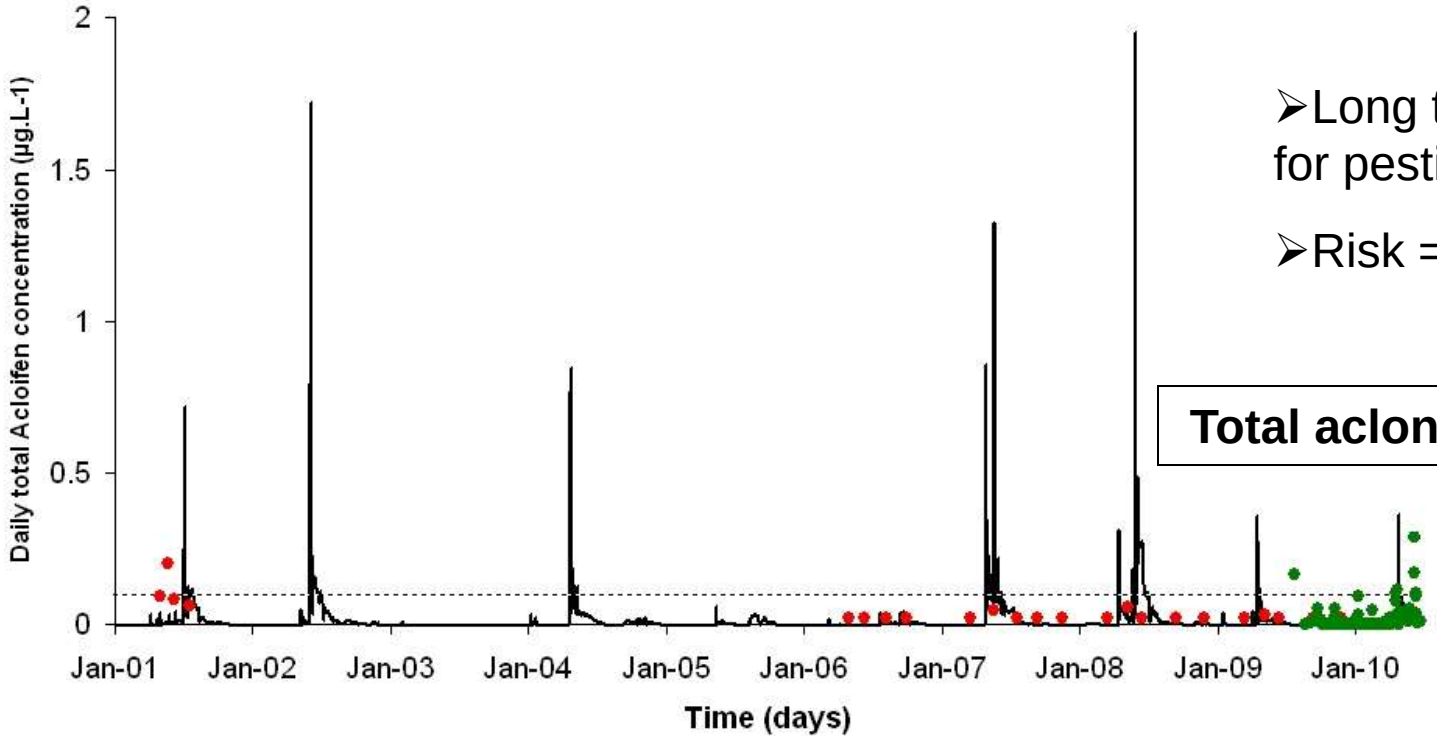
Aclonifen 2009-2010

Particulate fraction (outlet)	Obs. %	Sim. %
Metolachlor	16	9
Aclonifen	72	72

- Relevant with :
- Taghavi et al. (2011)
- Boithias et al. (subm.)



Total metolachlor 2001-2010

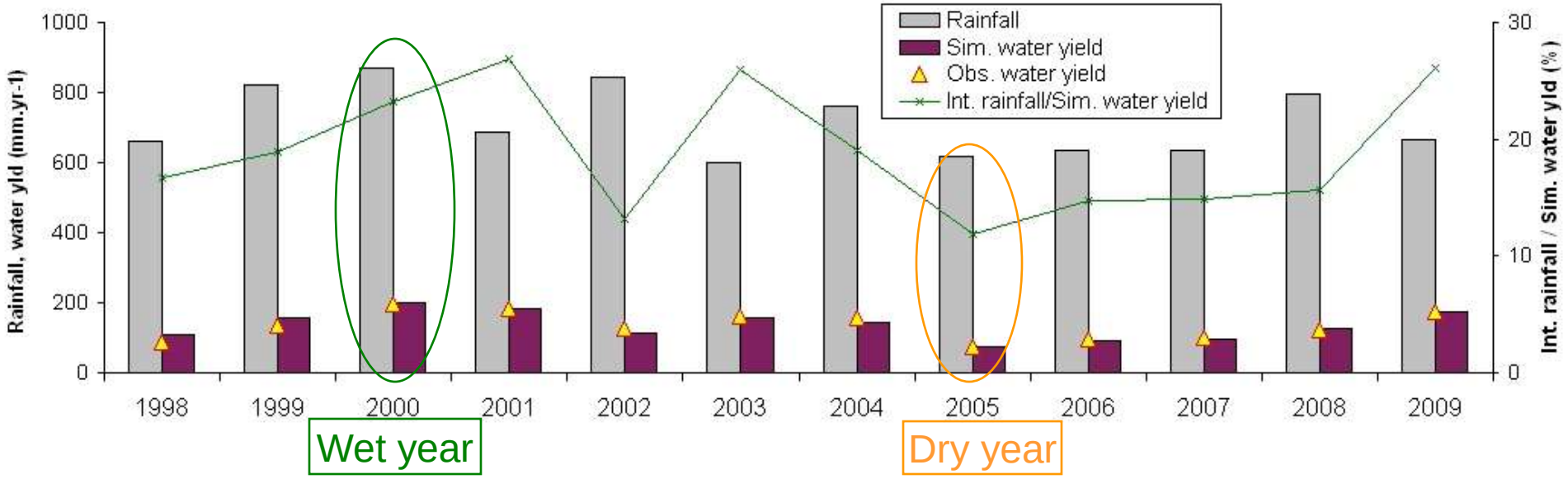


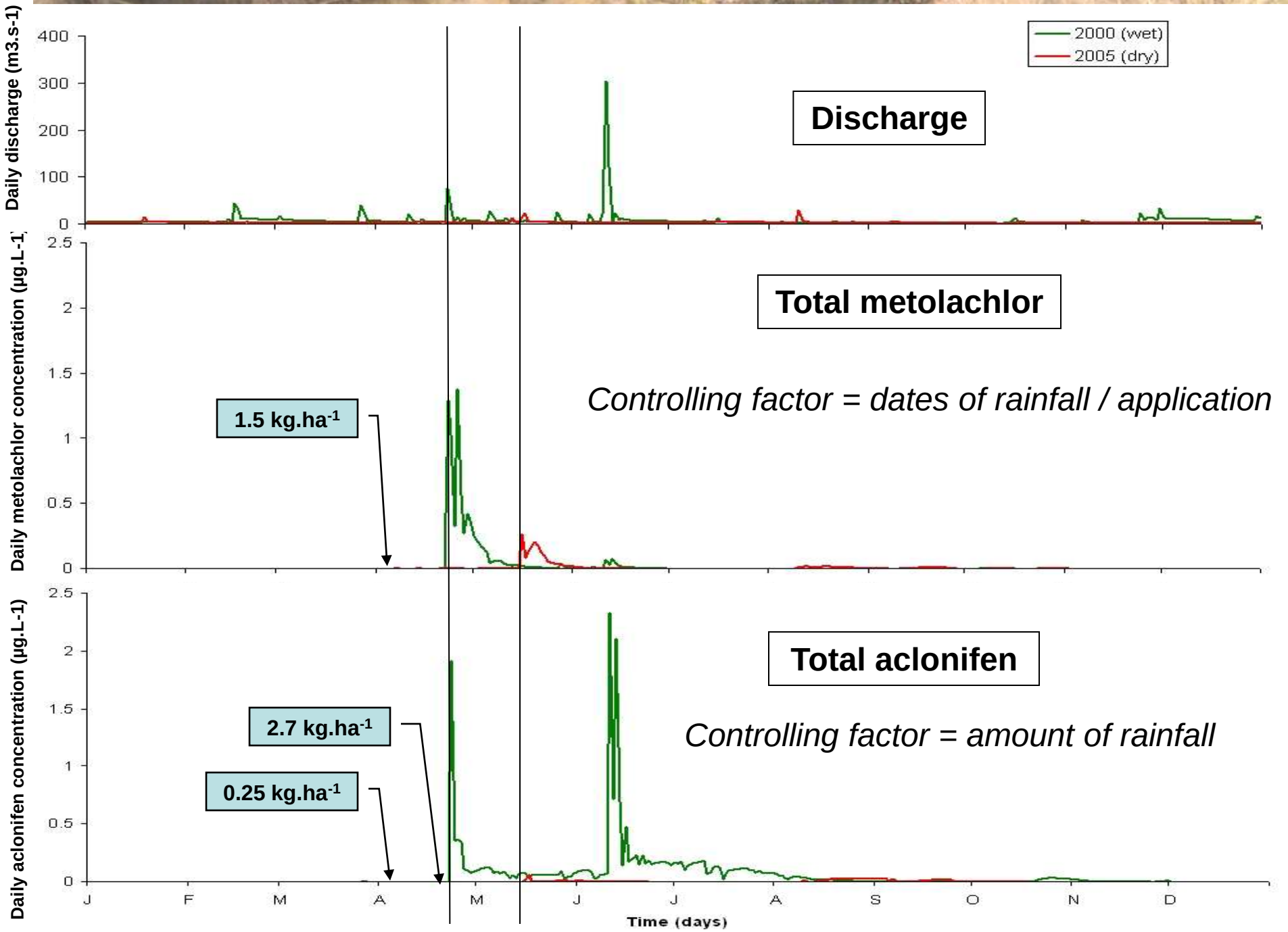
- Long term validation for pesticide simulation
- Risk = f(year)

Total aclonifen 2001-2010

Results – Controlling factors

- At catchment outlet:
  - Aclonifen/Rainfall $R^2 = 0.35$
  - Metolachlor/Water Yld $R^2=0.12$
- How does pesticide tranfer in extreme hydrological conditions ?




2000 (wet)
2005 (dry)
Discharge
Daily discharge (m3.s-1)
400
300
200
100
0
Total metolachlor
Daily metolachlor concentration (µg.L-1)
2.5
2
1.5
1
0.5
0
1.5 kg.ha-1
Controlling factor = dates of rainfall / application
Total aclonifen
Daily aclonifen concentration (µg.L-1)
2.7 kg.ha-1
0.25 kg.ha-1
Controlling factor = amount of rainfall
J
F
M
A
M
J
J
A
S
O
N
D
Time (days)

Results – Outlet exportation

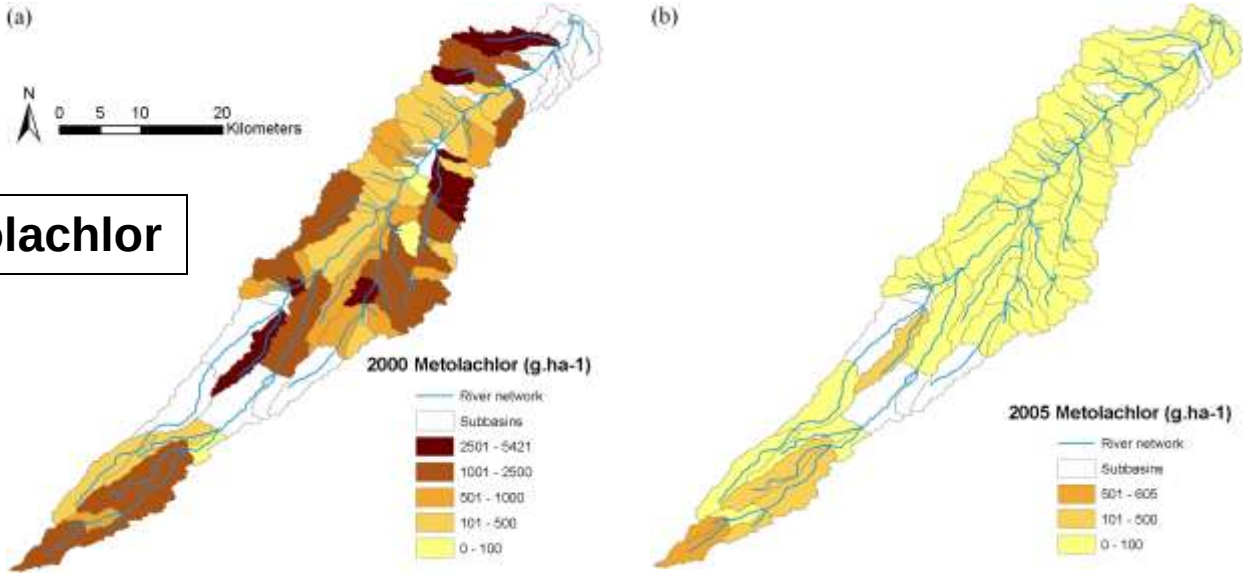
- Exportations

	Input (kg)	Output (kg)	Exportation rate (%)	Exportation during flood (%)	Annual flood duration (%)	Occurrence of threshold exceeding (%)
Metolachlor						
Wet (2000)	28060	21	0.073	47	22	4
Dry (2005)	32500	1	0.004	31	5	2
Aclonifen						
Wet (2000)	62000	90	0.145	82	22	14
Dry (2005)	54730	0.4	0.001	29	5	0

- Surface runoff was responsible for (long term):
  - 97% of total Aclonifen exportation
  - 65% of total Metolachlor exportation

Results – Contributing areas

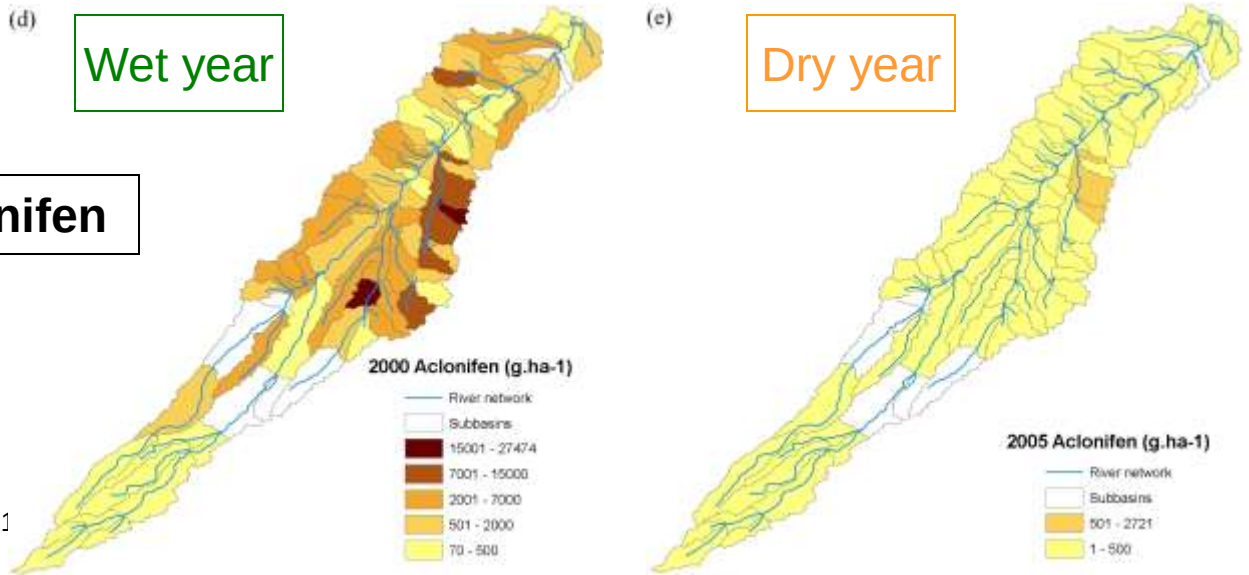
Total metolachlor



Wet year

Dry year

Total aclonifen



Boithias et al. – 201

Conclusion

- Better understanding of pesticide transfer controlling factors
  - Soluble molecule transfer depends on date of rainfall
  - Poorly soluble molecules transfer depends on amount of rainfall
  - Generalization ?
- Suggest and test improvements of the pesticide component in SWAT
- Water agencies :
  - No measurements during floods
  - A ‘when and what to monitor’ decision tool for risk assessment
  - Test scenarios of mitigation practice (e.g. amount and date of supply, depending on climate change, etc.)

Thanks for your attention !

For further questions :

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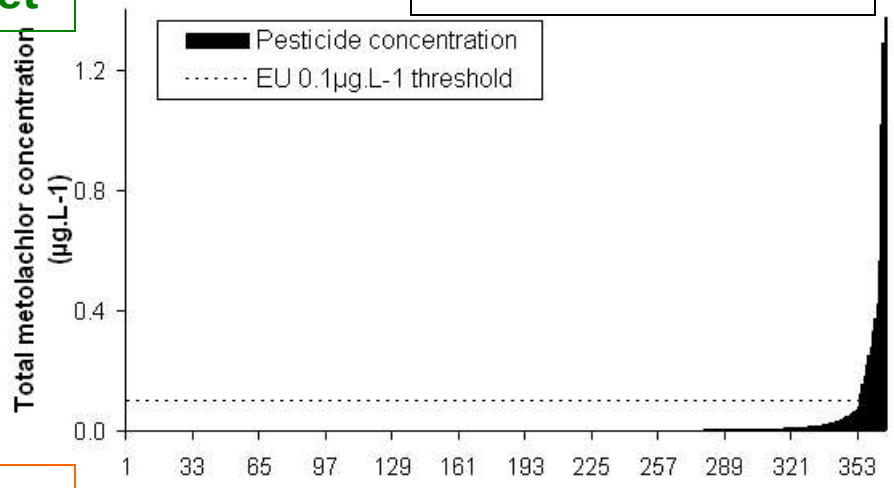
http://www.aguaflash-sudoe.eu/

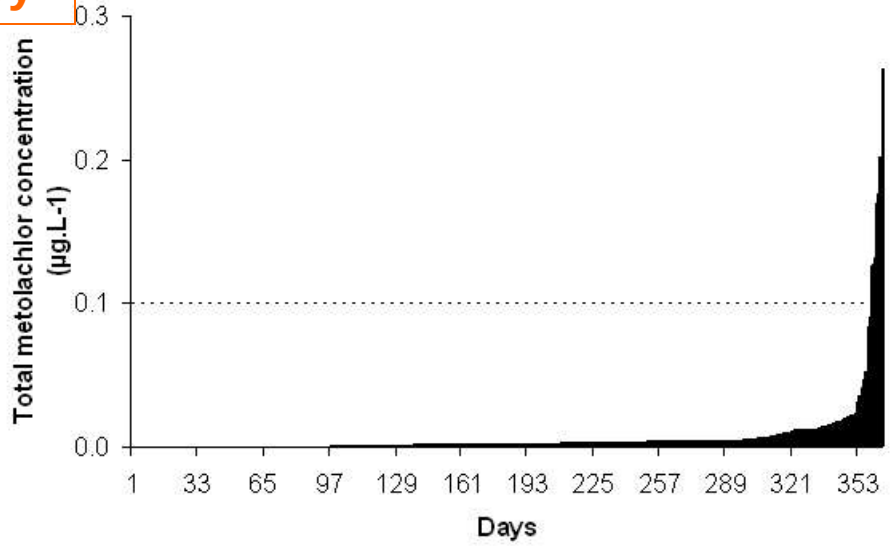
Occurrence of threshold exceeding

Wet

Dry

Total metolachlor





Total aclonifen