



Dynamic modelling of pesticide fluxes to surface waters using SWAT

K. Holvoet, A. van Griensven, P. Seuntjens and P.A. Vanrolleghem



Content

- problem statement
- case study
- modelling pesticide fluxes
- adjustments to SWAT
- modelling results
- conclusions



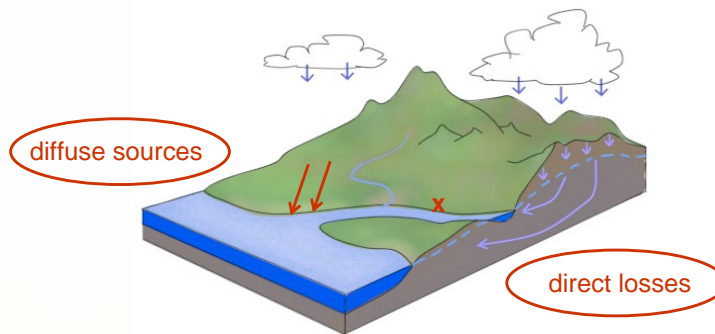
March 17, 2007

confidential – © 2005, VITO NV – all rights reserved

2



Problem statement



how important are direct losses



should we add them to SWAT?



March 17, 2007

confidential – © 2005, VITO NV – all rights reserved

3

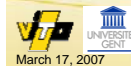


Case study

location



- small basin: 34 km², 16 km long, $t = 1$ day
- well documented
- studied in detail for pesticide application: 1998-2002



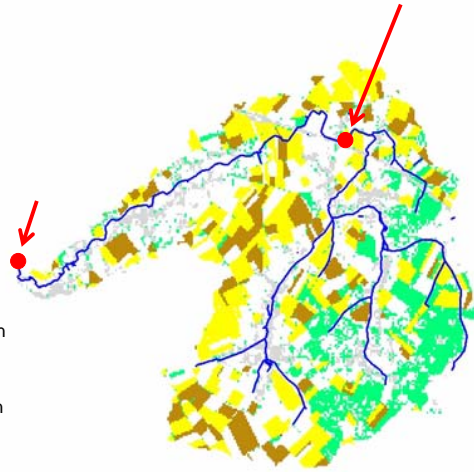
March 17, 2007

confidential – © 2005, VITO NV – all rights reserved

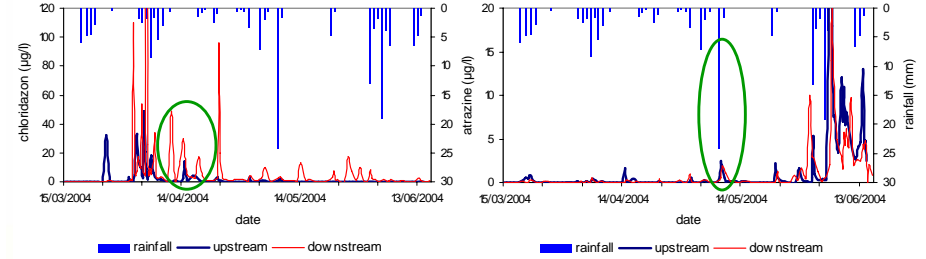
4



Case study



teelt	% opp.	pesticide
SGBT	10.34	→ chloridazon
CORN	15.09	→ atrazine
WATR	0.03	
WWHT	21.53	→ isoproturon



→ highly dynamic system with hourly variations
 → due to runoff but also to direct losses

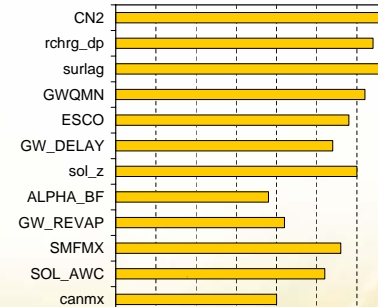


Modelling pesticide fluxes

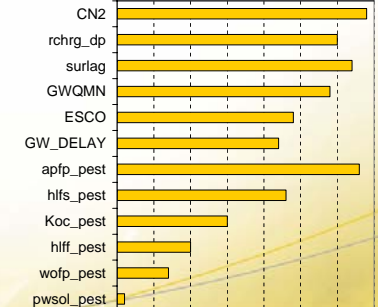


Sensitivity analysis:

hydrology



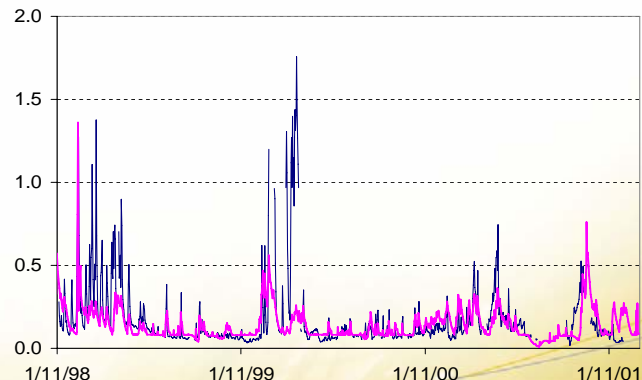
pesticide supply



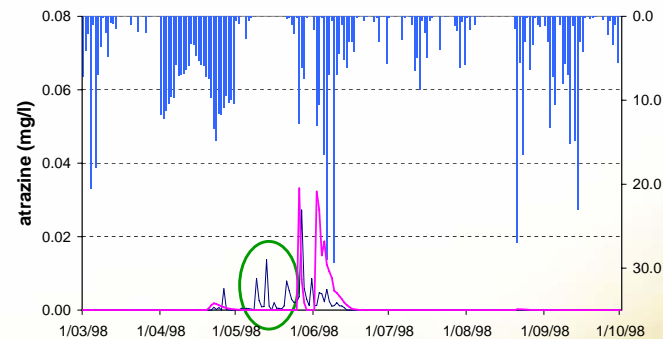


Modelling pesticide fluxes

hydrology



Modelling pesticide fluxes



→ acceptable agreement

→ direct losses are lacking



Adjustments to SWAT

Insertion in the apply.f-file:

```
if (k == irtpest) then
drift(jj)= drift(jj) + xx * (1-ap_ef(kk))* hru_km(j) * 100. * 1.e6
end if
```

```
xx = xx * ap_ef(kk)
```

with: xx : amount of pesticide applied to HRU
ap_ef : application efficiency
hru_km : area of HRU

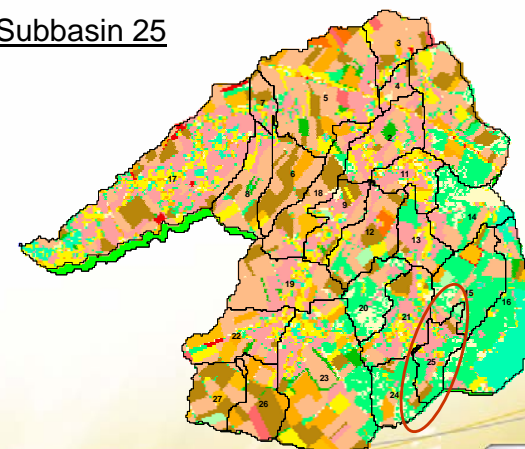
Insertion in the virtual.f-file:

```
varoute(11,ihout) = wsolp(sb) +drift(sb)
```



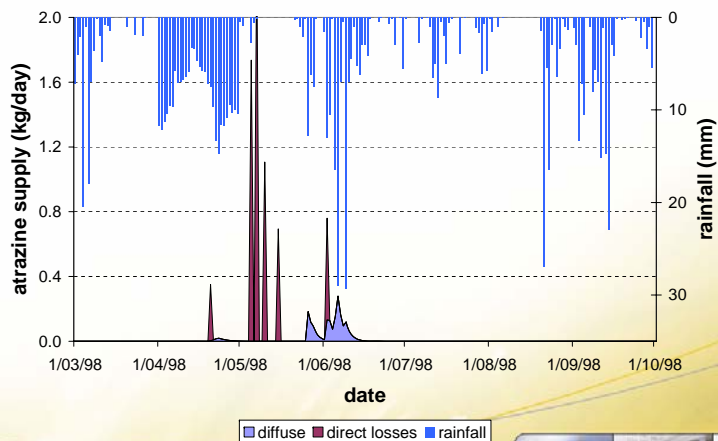
Modelling results: subbasin 25

Subbasin 25





Modelling results: subbasin 25



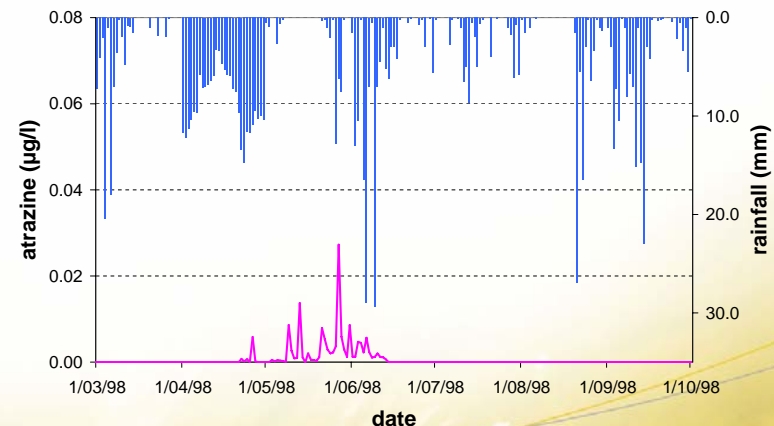
March 17, 2007

confidential – © 2005, VITO NV – all rights reserved

13



Modelling results: subbasin 25



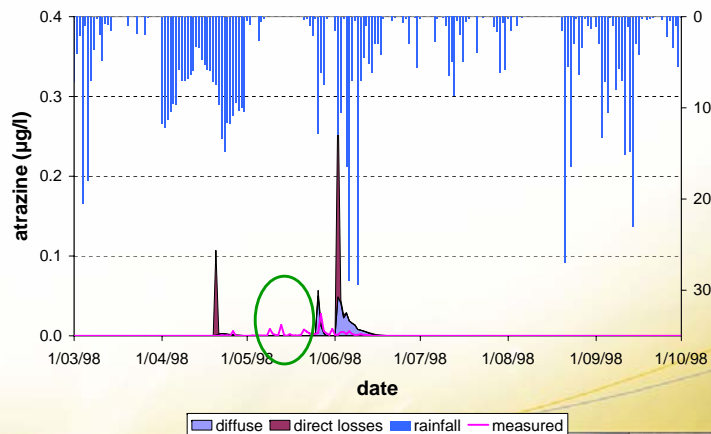
March 17, 2007

confidential – © 2005, VITO NV – all rights reserved

14



Modelling results: mouth of the river



March 17, 2007

confidential – © 2005, VITO NV – all rights reserved

15



Conclusions

- direct losses can contribute for 50 to 70% of pesticide load
- sensitivity analysis → sensitive parameters
- calibration of pesticide supply with SWAT2000 gives reliable predictions
- in dry periods: → extension of SWAT code
↓
better results
- what happens in routing towards the mouth?



March 17, 2007

confidential – © 2005, VITO NV – all rights reserved

16