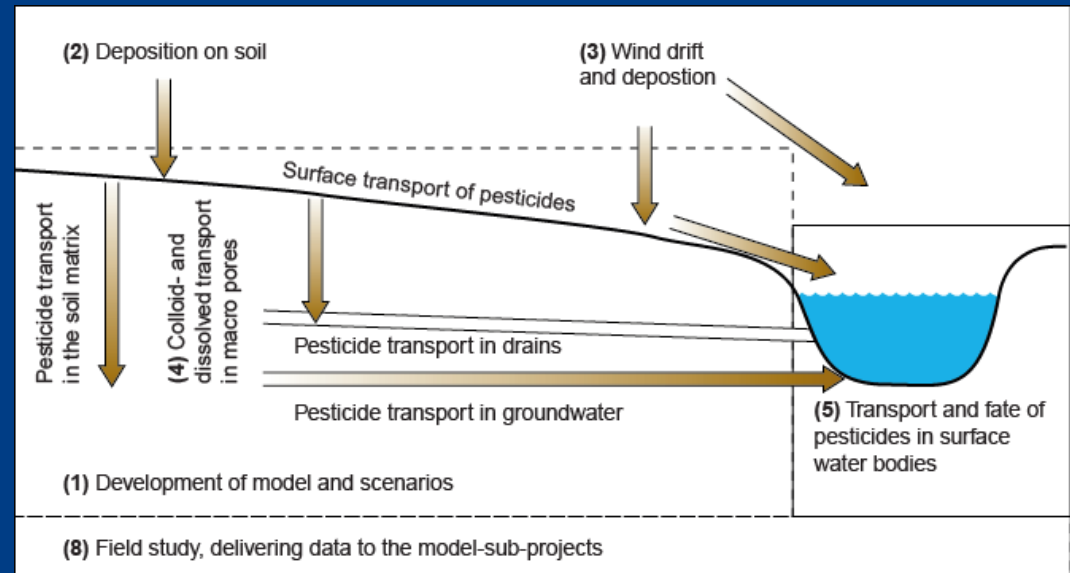




# Pesticide transport in tile-drained fields in the SWAT model

## New modules for pesticide transport to tile drains

Shenglan Lu  
Email: SL@BIOS.AU.DK  
Jes Russmusen  
Dennis Trolle  
Gitte Blicher-Mathiesen  
Hans Estrup Andersen





# WHY?

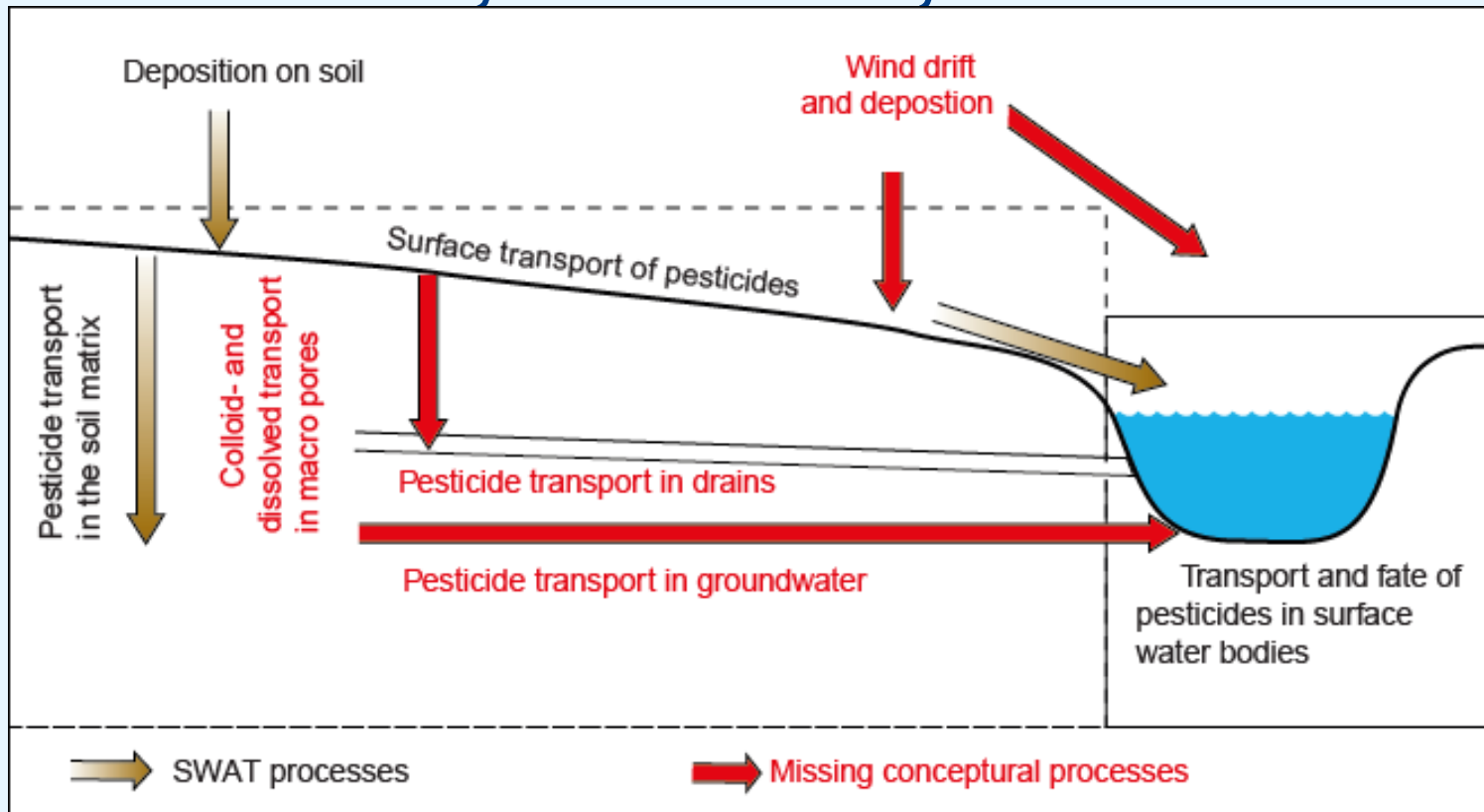
- › **Modelling (fully distributed) tools have been trailed and failed in Denmark**
- › **Alternative (and better) models are needed for risk assessment**



# Pesticide Transport Pathways

## SWAT vs Conceptual Denmark

### › Tile drains, Wind drift, Groundwater





# HOW?

- › **Based on “original” SWAT model, further developments were made to improve pesticide dynamics for tile drained areas:**
  - › **Leaching of pesticides to tile drains**
  - › **Macropore module for sediment and sediment-bound pesticide transport to tile drains**

# Pesticide monitoring: Lillebæk, Denmark

## Catchment:

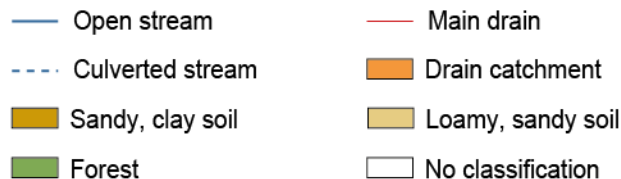
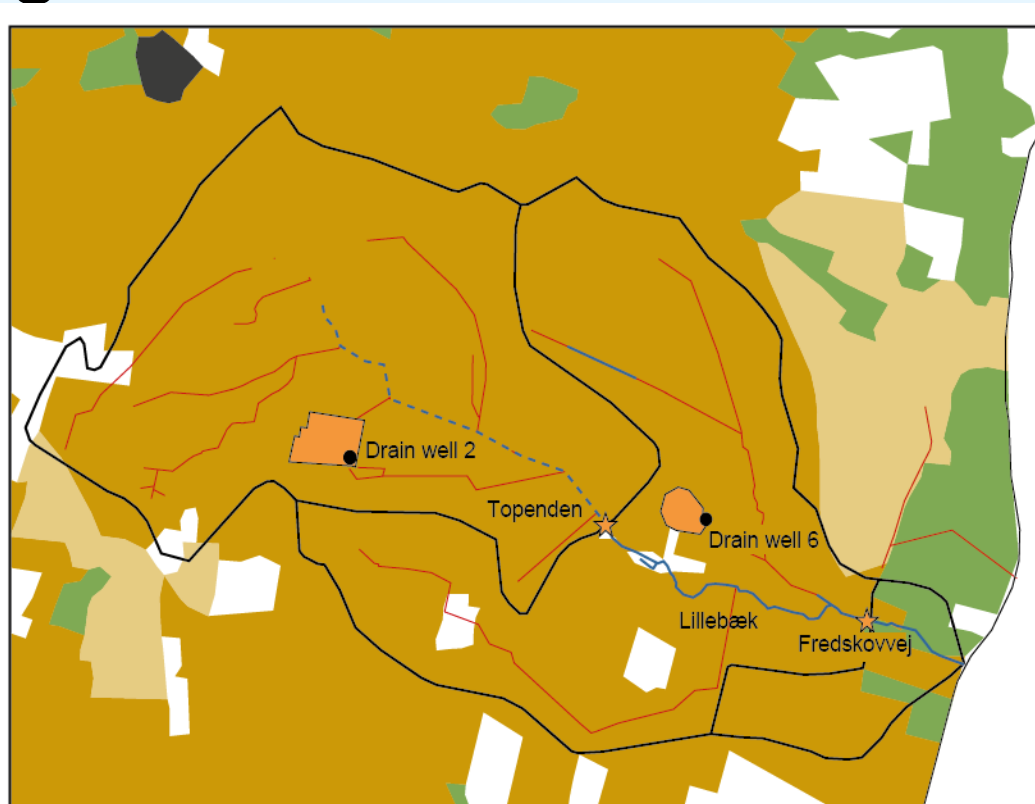
- › 4.35 km<sup>2</sup> , 86% agriculture
- › Intensive tile-drained

## Stations:

- › 2 stream stations
- › Upstream culverted

## Monitoring

- › Flow-proportioned intensive sampling 1999-2000
- › 49 pesticides + metabolites





# Pesticide monitoring

## › More types found in culvert streams

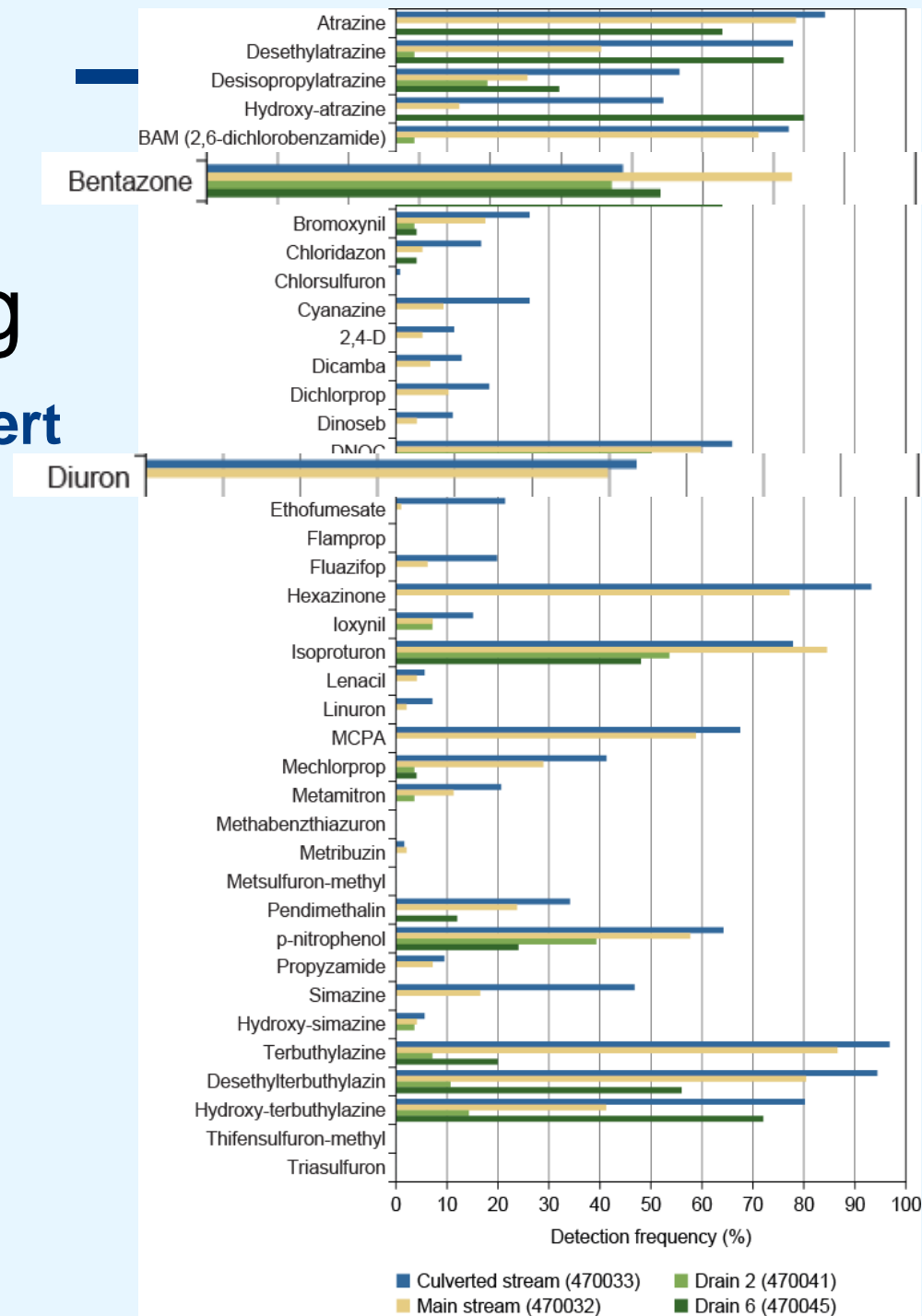
- › 38-22 in culvert stream
- › 31-16 in downstream

## › Bentazone

- › Herbicide, soluble
- › leaching to groundwater

## › Diuron

- › Herbicide

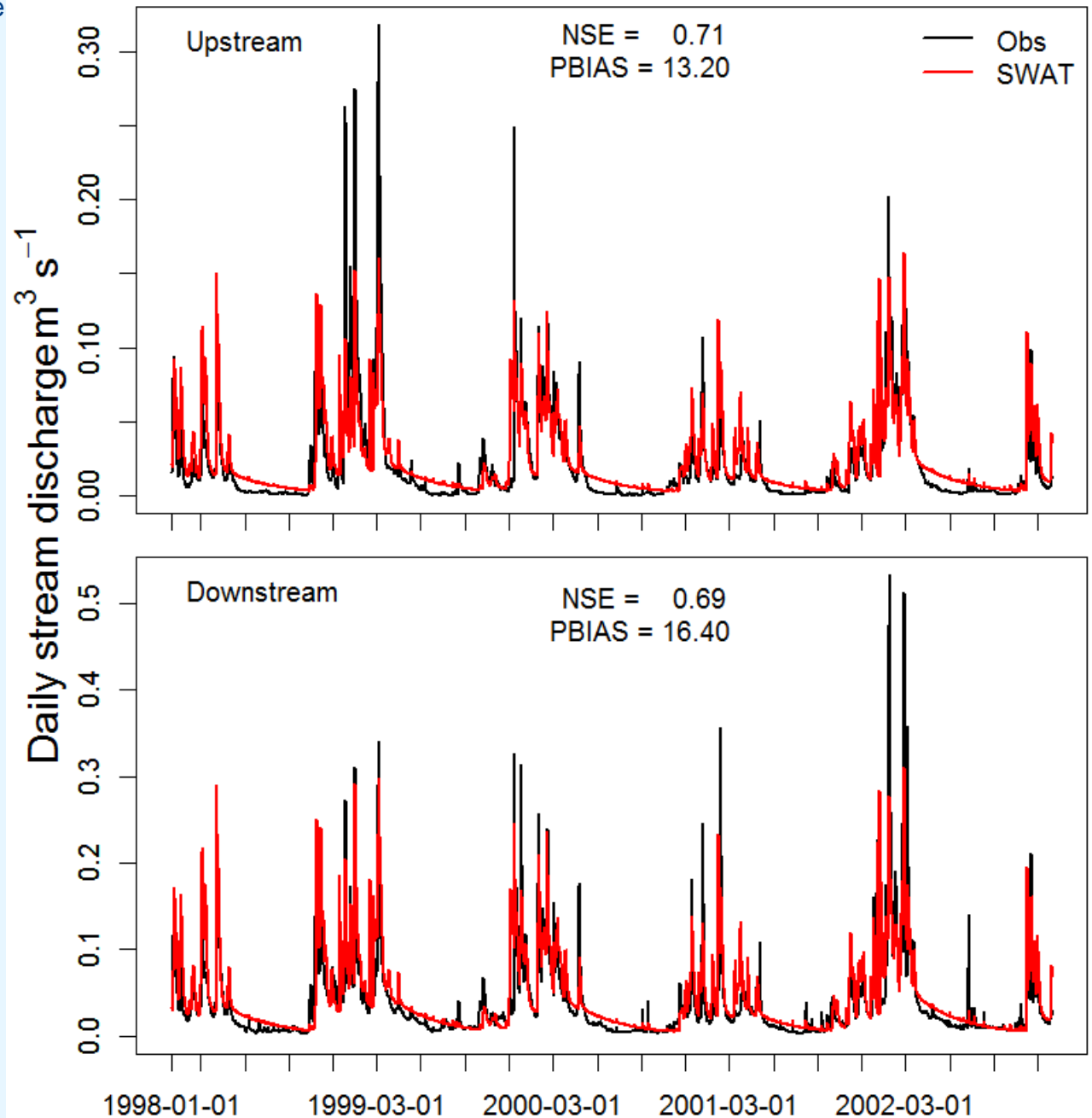




# SWAT

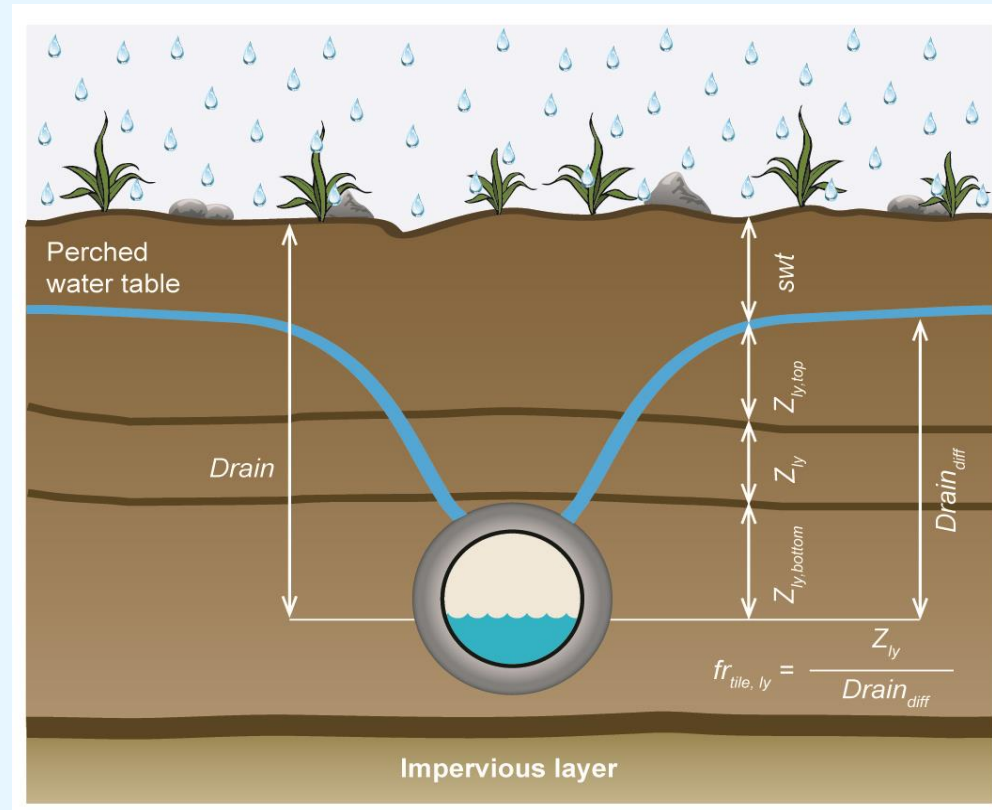
## Discharge

- › Calibrated at downstream station
- › Good results at upstream station



# Pesticide tile drains

- › **Leaching in SWAT**
  - › Pesticide content in soil layers  $sol_{pst}_{ly}$
- › **Tile drain flow in SWAT**
  - › Whole soil profile
- › **Divide tile drain flow for each soil layer  $fr_{tile,ly}$**
- ›  $sol_{pst}_{tiledrain} = \sum sol_{pst}_{ly} \cdot fr_{tile,ly} \cdot q_{tile}$

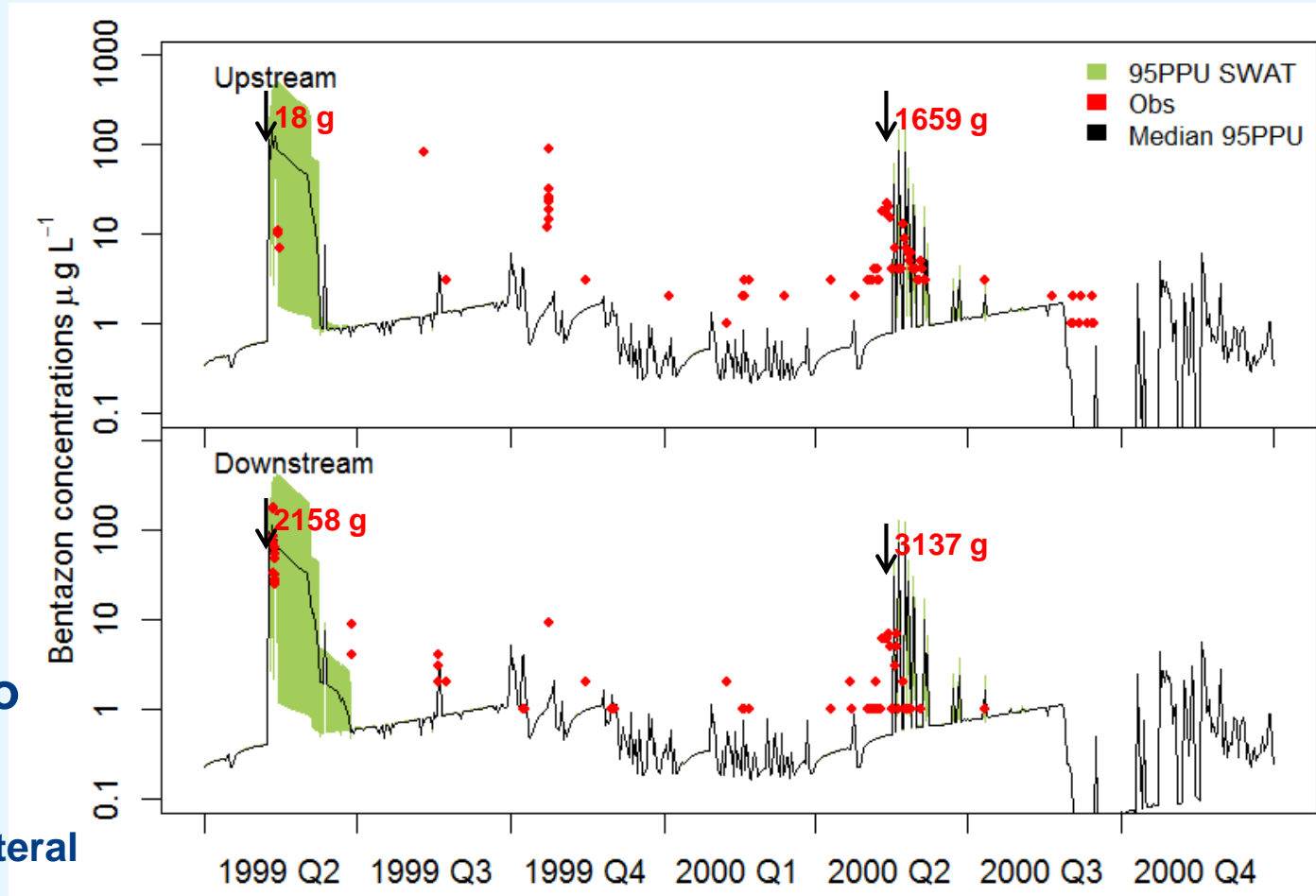




# SWAT

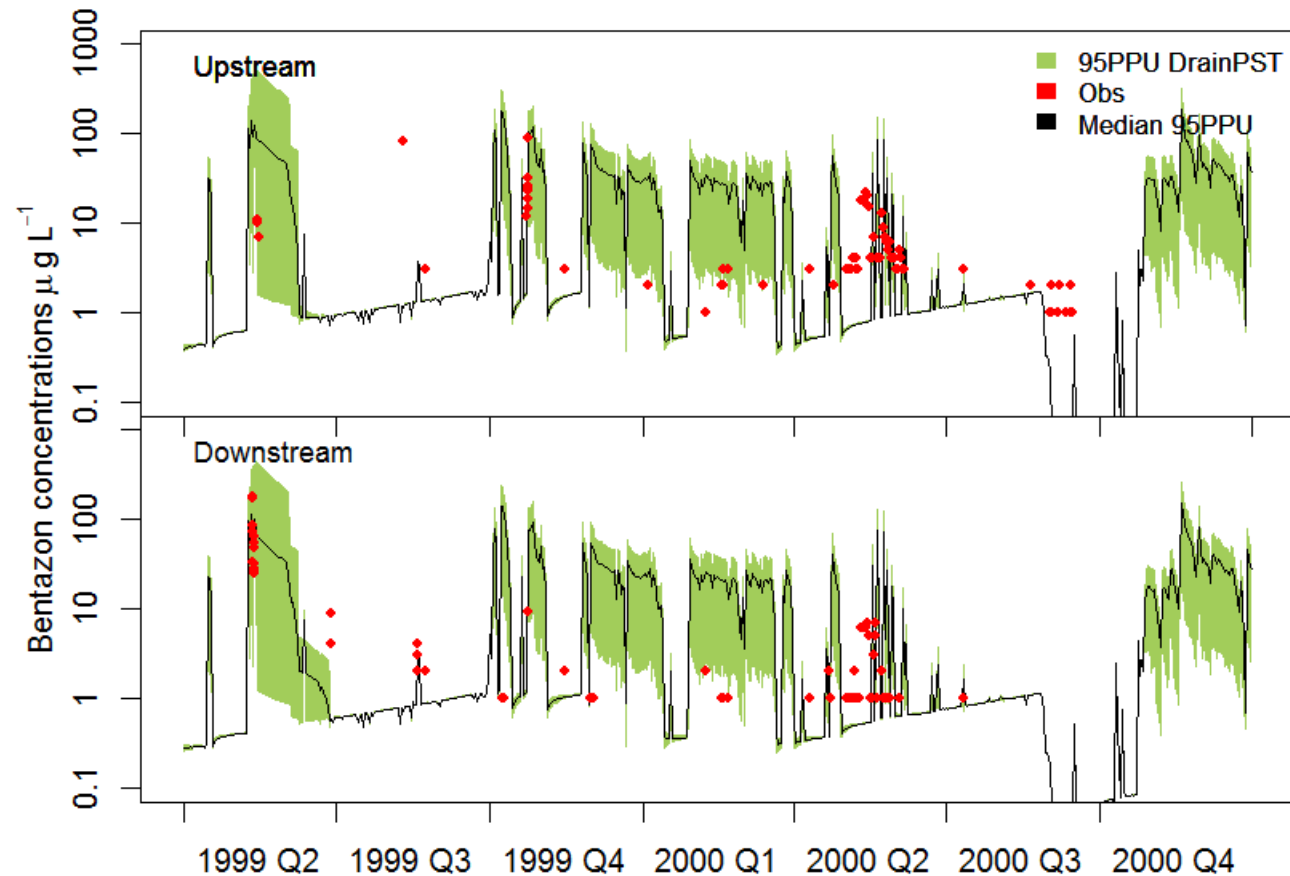
## Bentazone

- › Observation: loading not related to application
- › SWAT: no application no load
- › Only from lateral flow



# DrainPST

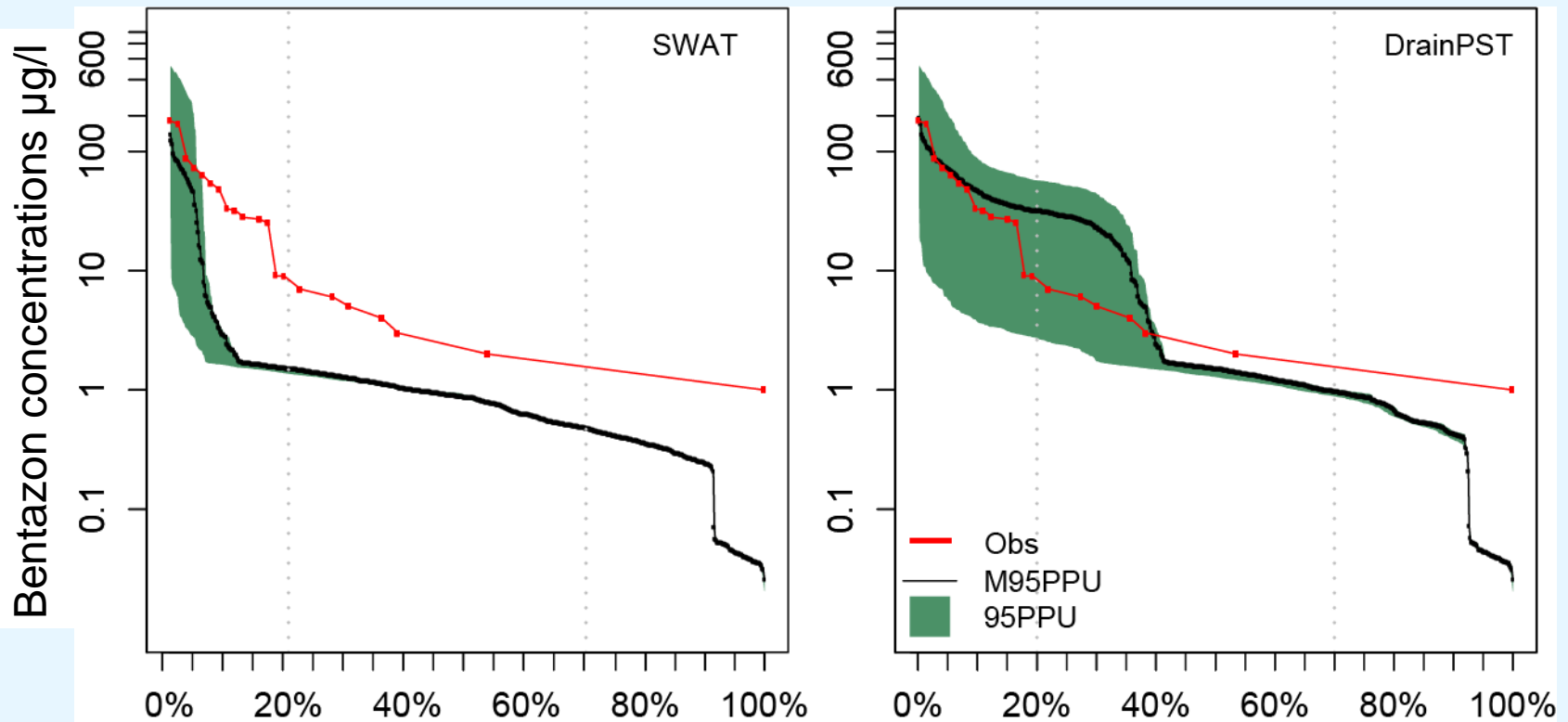
- › **More dynamics in winter when tile drains are active**





# Probability of Exceedance

- › DrainPST-Better for high concentrations
  - › Underestimate low concentrations



Probability of exceeding the concentration

# Macropore flow, sediment & pesticide

## › Macropore flow

### › Onset when

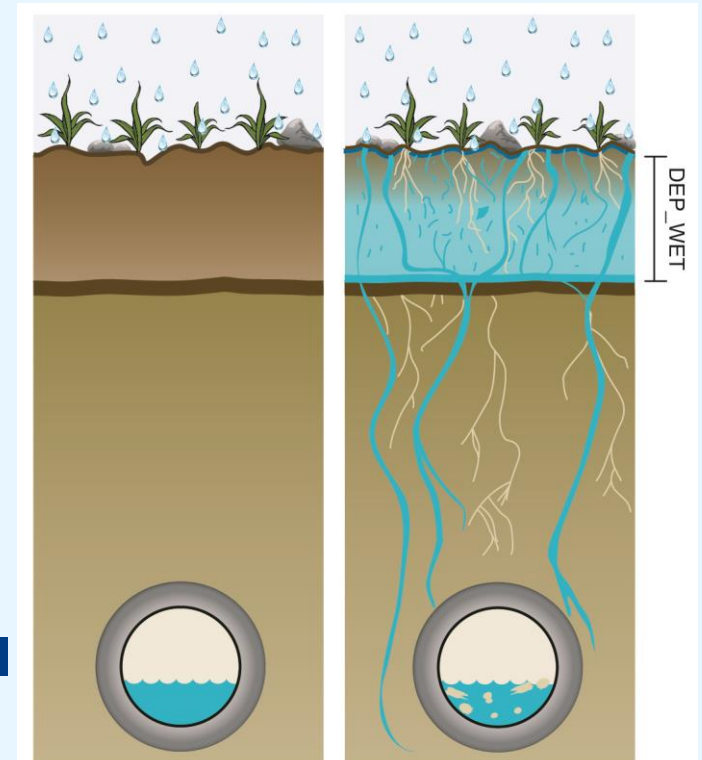
- › Precipitation > infiltration capacity
- › Soil moisture in wet layer > threshold

### › Fraction of infiltration

## › Sediment – MACRO model

- › Detachment from rainfall energy
- › Filtered along soil matrix
- › Loss & replenish detached soil pool

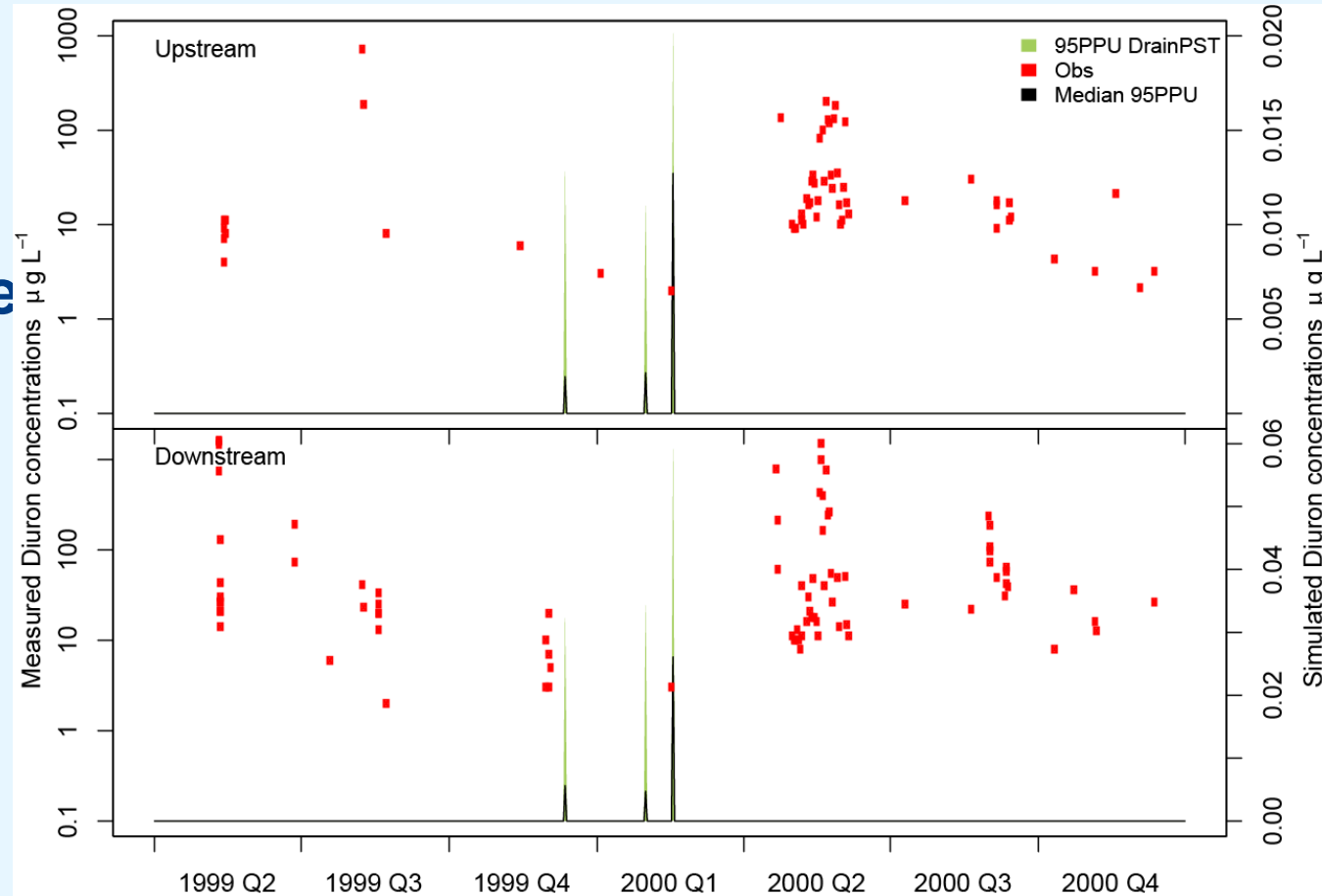
## › Sorped pesticide transport with sediment





# Diuron

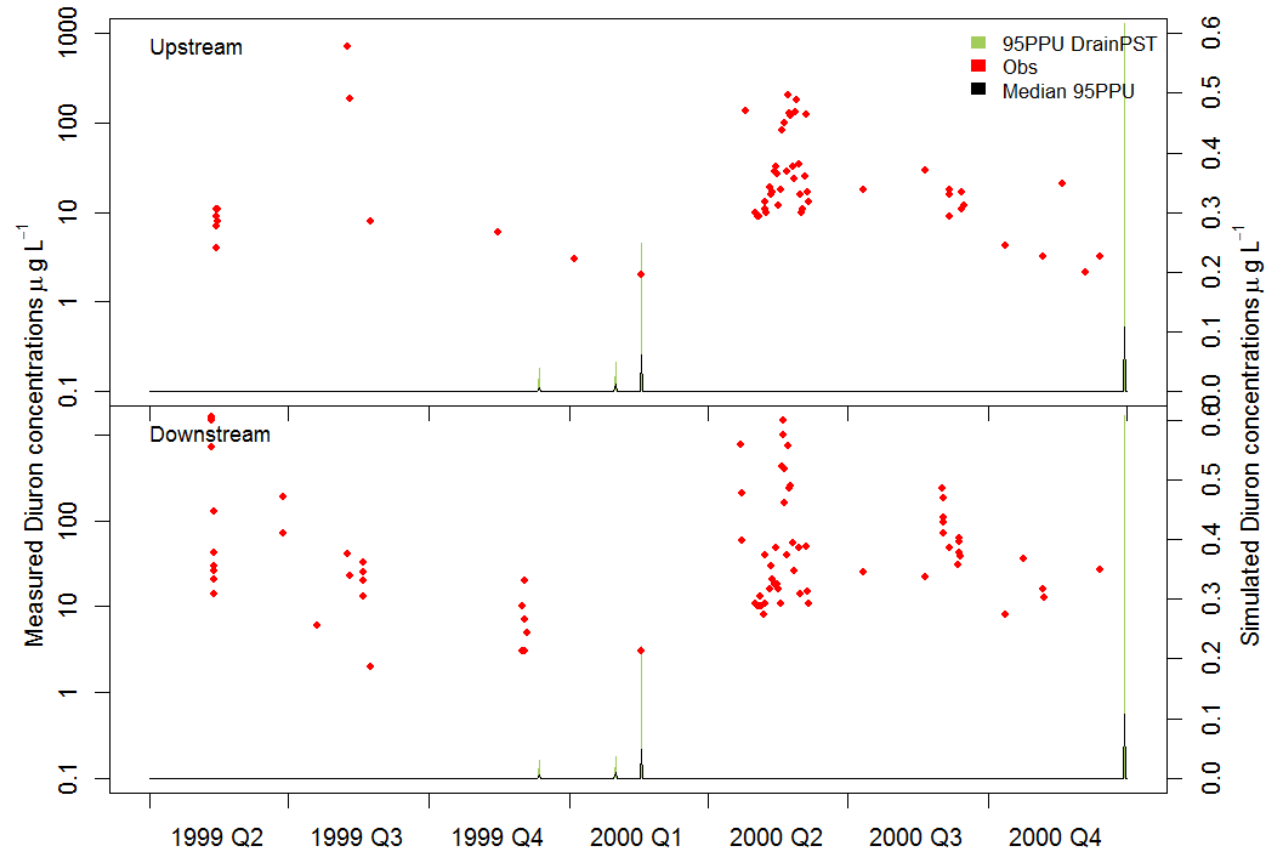
- › SWAT underestimate
  - › 4 magnitude
- › Only from sediment erosion





# DrainPST

- › Still underestimate
- › One magnitude higher than SWAT





# Possible improvements

- › **Improved model for the case-study area**
  - › **More tile-drained fields**
  - › **More local weather stations**
- › **Include additional transport pathways for sediment-bound pesticides**
  - › **accumulated pesticides in tile drain pipes?**
- › **Modified conditions for the onset of macropore flow**
  - › **Not so critical, more frequent**
- › **More parameters for macropore sediment & pesticide**
  - › **Enrichment ratio?**
  - › **Detachment energy?**