Application of PEARL to the FOCUS Surface Water drainage scenarios

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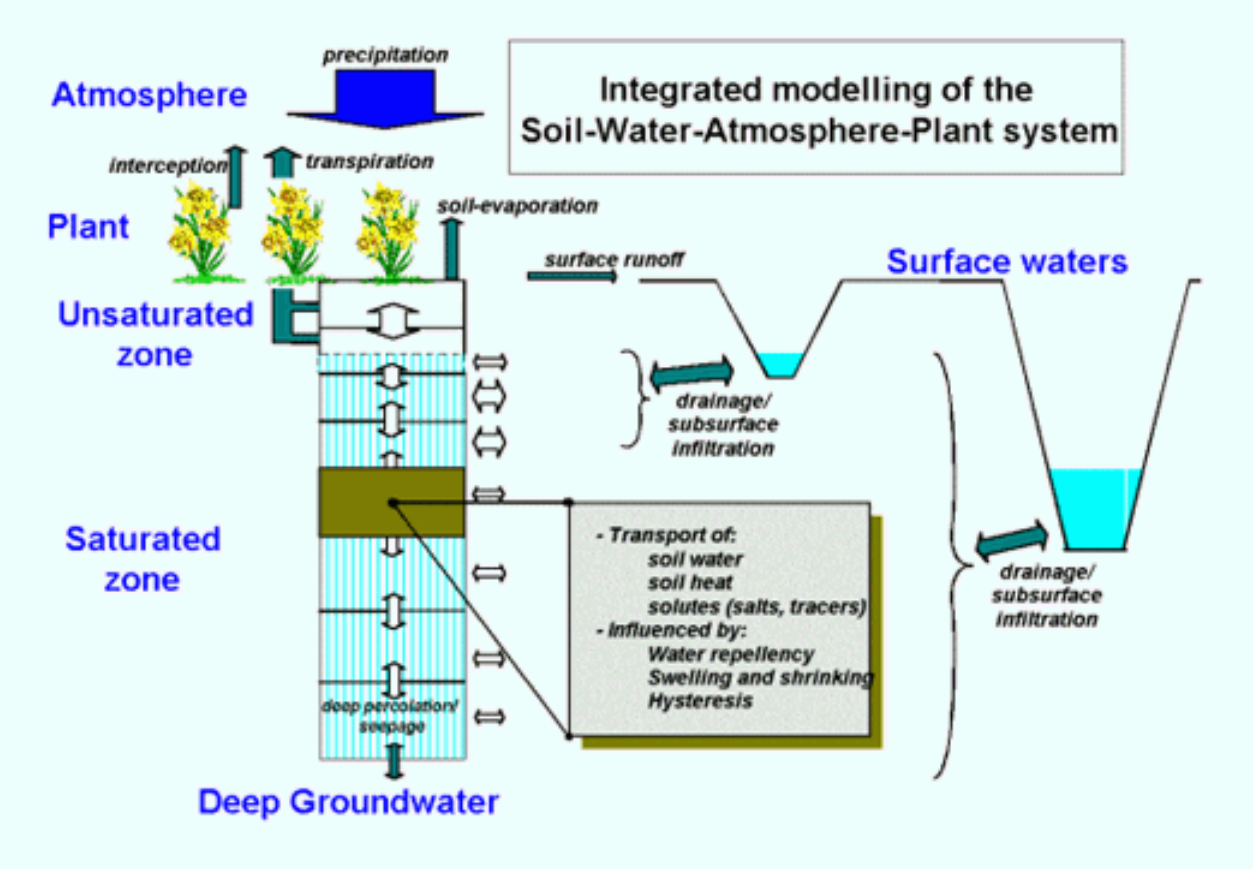
Introduction

- New version of SWAP suitable for Dutch clay soils; state-of-art concept of macropore system
- Assess the possibilities of the application of SWAP to drainage scenarios of FOCUS_SW
    - Lanna, Brimstone, Vredepeel, Skousbo, La Jailliere, Thiva
- SWAP results to be compared with results of FOCUS_MACRO

Hydrology: processes for soil - plant system in the SWAP model



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Hydrology: conceptual differences MACRO and SWAP (1)

Potential evapotranspiration

MACRO: Penman-Monteith; with LAI and GLAI

SWAP: Penman-Monteith; only LAI
different for distribution over E and T

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Hydrology: conceptual differences MACRO and SWAP (2)

Actual transpiration

- MACRO:
  - depending on uptake roots
  - water stress: Feddes
  - compensation for water stress dry layers by uptake from wet layers water stress factor = 0.1
- SWAP
  - depending on uptake roots
  - water stress: Feddes

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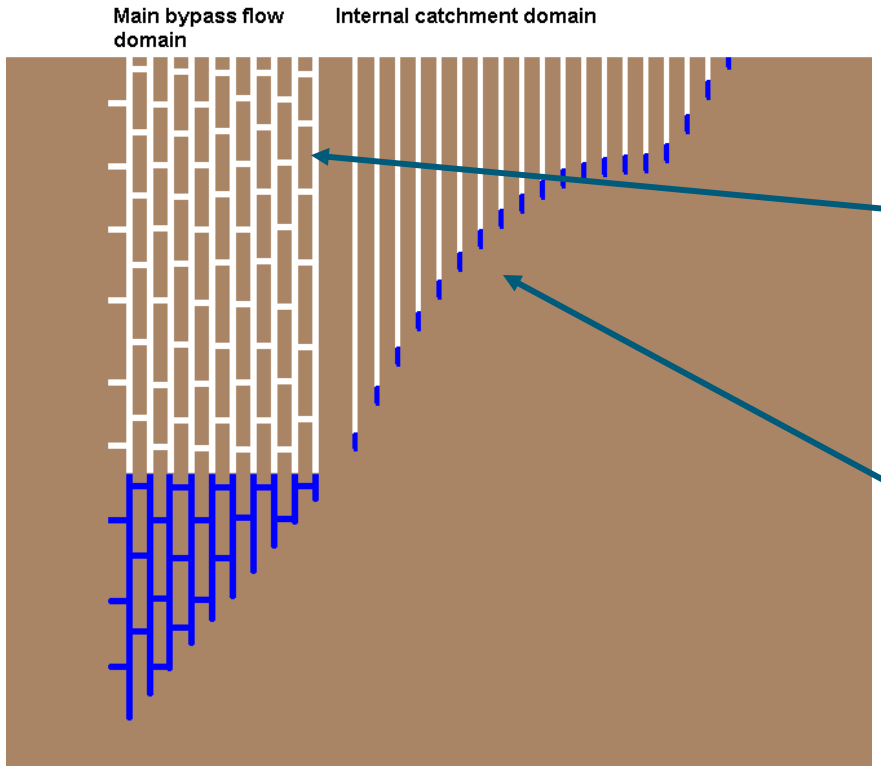
Hydrology: conceptual differences MACRO and SWAP (3)

Macropore system in SWAP



Main bypass domain:
- transport water deep in profile
- rapid drainage

Internal catchment domain:
- infiltration of trapped water into unsaturated matrix at different depths

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Parametrisation procedure

Parameterisation similar to that for MACRO as far as possible

Calibration of some SWAP input parameters to obtain the same water balance as MACRO

Compare target concentrations in soil and drains calculated using PEARL with those calculated by MACRO

Selection of crop for comparisons: winter cereals

Example substance A for surface water scenarios

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Scenario input data

Table 1. Characteristics of the soils and drainage systems

Scenario	**Drain depth (m)**	**Drain spacing (m)**	**Organic matter content topsoil (kg/kg)**	**Clay content in top soil (%)**
Lanna	1.0	13.5	0.0344	47
Brimstone	0.55	2.0	0.0568	54

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Water balance for Lanna scenario using SWAP and MACRO

Scenario	Rain (mm)		Evaporation (mm)		Drains (mm)		Percolation (mm)	
	SWAP	MACRO	SWAP	MACRO	SWAP	MACRO	SWAP	MACRO
Lanna	535	534	348	348	166	162	12	5
Brimstone	623	623	324	337	288	282	8	1

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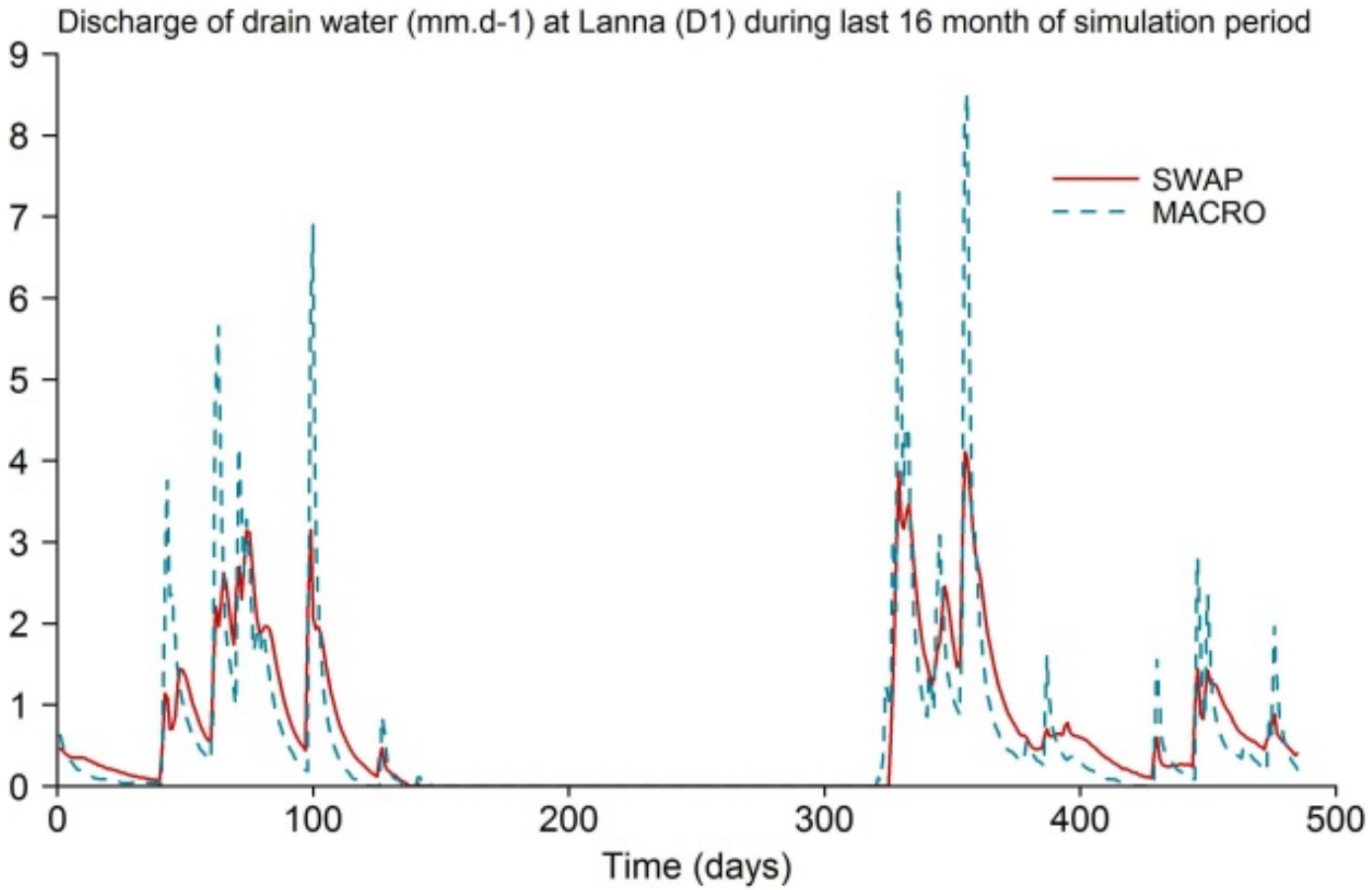
Drain discharge for Lanna scenario



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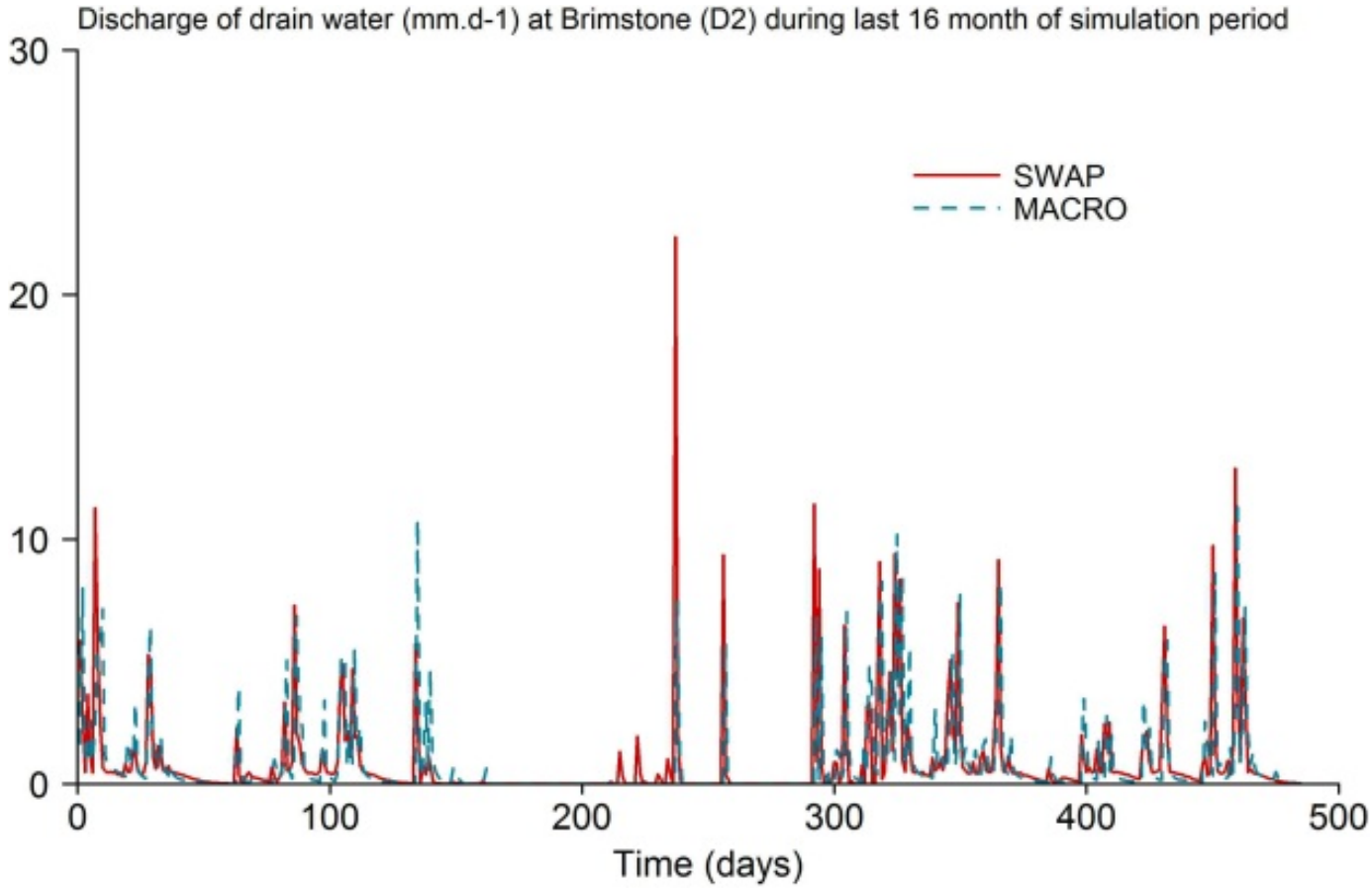
Drain discharge for Brimstone scenario



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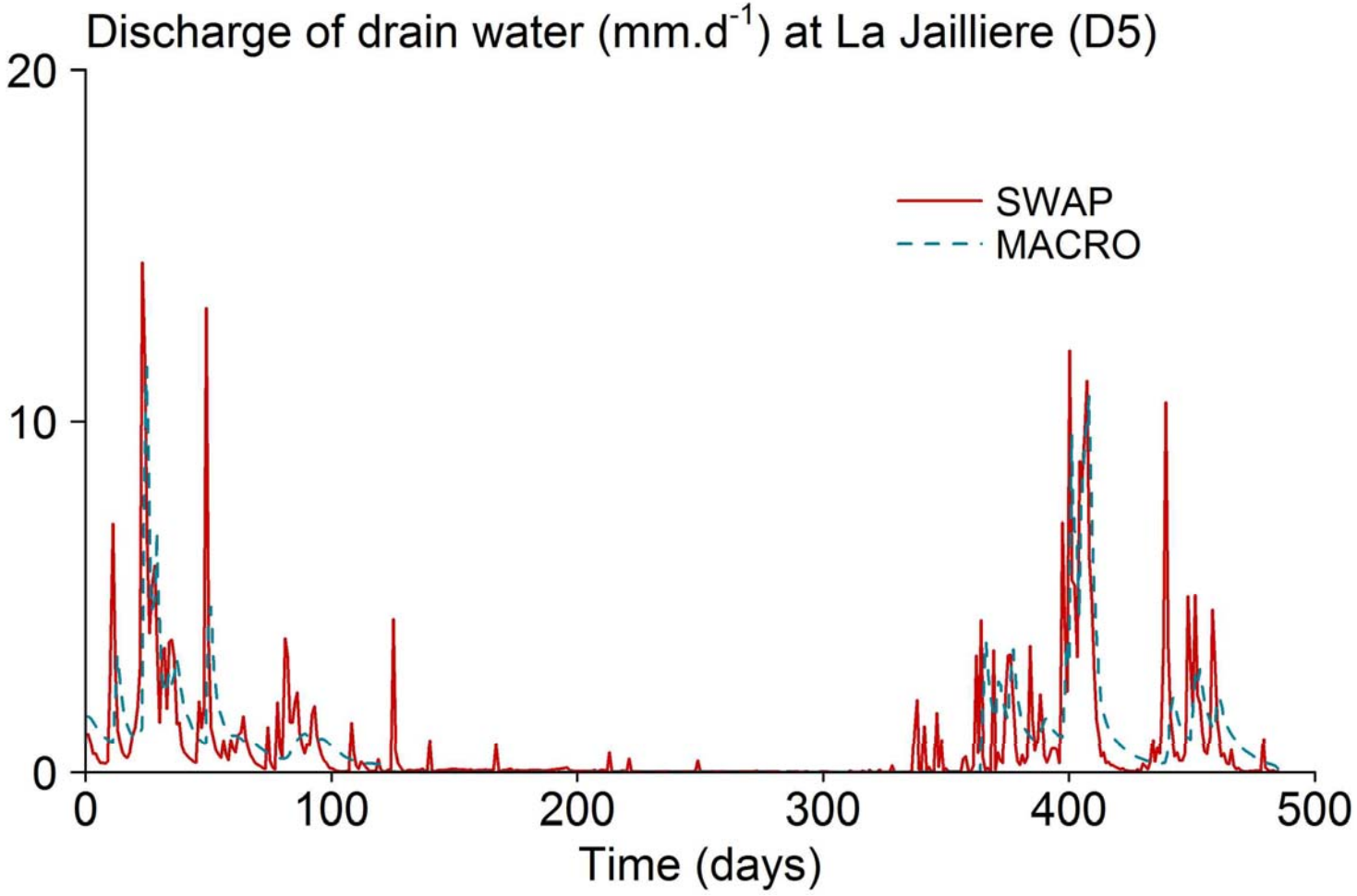
Drain discharge for La Jailliere scenario



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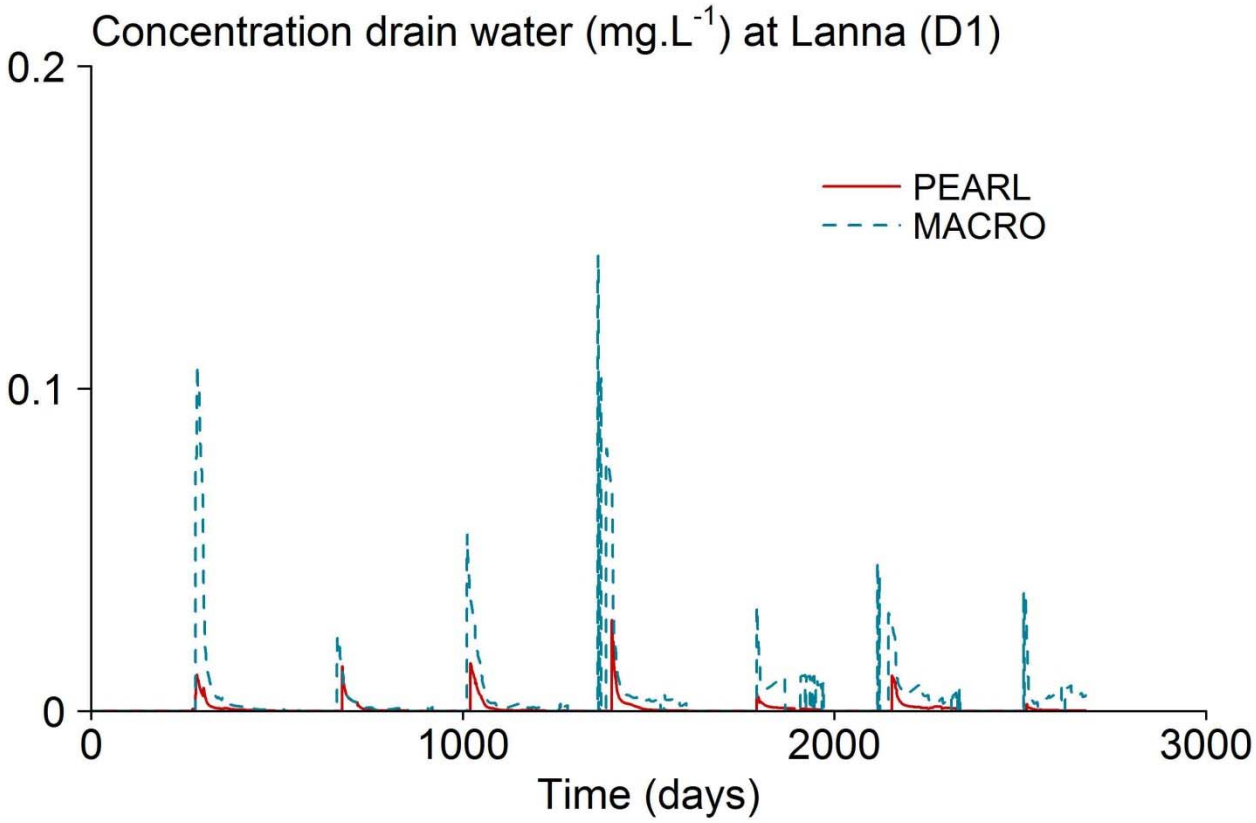
Comparison MACRO and SWAP

- Overall good agreement between the temporal patterns of the drainage flux computed with both models
- The peaks computed with MACRO for Lanna are somewhat higher than those computed with SWAP

Concentration of substance A in drain water for Lanna scenario



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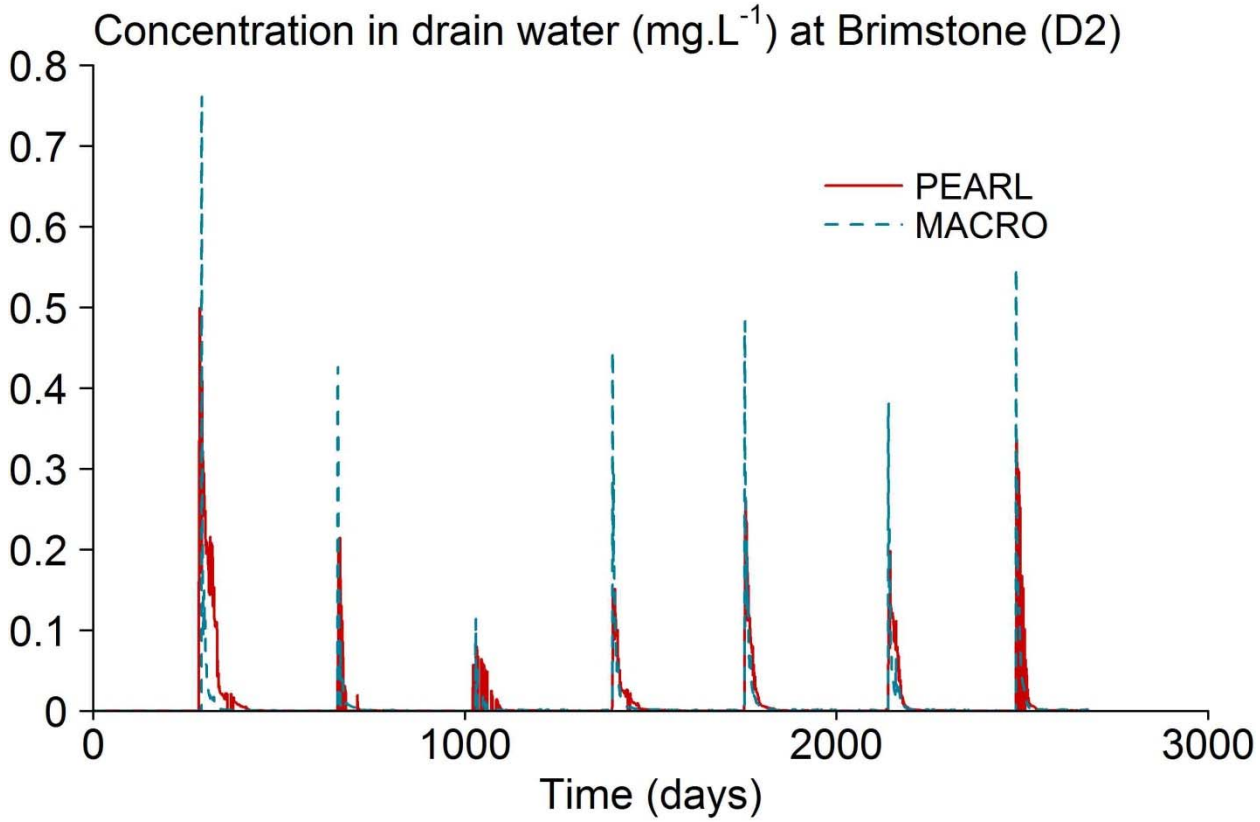
Concentration of substance A in drain water for Brimstone scenario



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Comparison MACRO and PEARL

- The timing of peak events calculated with PEARL corresponded to those computed with MACRO

- The order of magnitude of the daily peak concentrations are also in agreement

Conclusions

- The new PEARL model with the option for macropore flow is appropriate to assess the fate of plant protection products in soils with preferential flow.
- The first results of testing the new PEARL model on the fate of plant protection products in heavy clay soils are similar to those obtained by MACRO.

Recommendations

- For further improvement of concentrations in drain water calibration of flow related macropore parameters are needed
- Testing the PEARL model against experimental datasets, e.g. Lanna or Brimstone
- The sequential calibration strategy may have to be modified for preferential flow models

Thank you for your attention

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