Pesticide use on urban hard surfaces potentially leads to long-term exposure in urban aquatic environment

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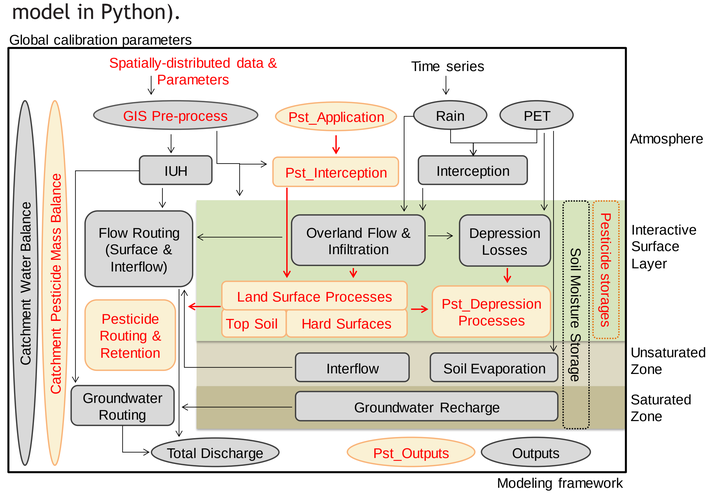
Background

- The worldwide **urbanization** leads to increase of hard surfaces (e.g. driveways, roof areas, roads) with artificial materials (e.g. asphalt, concrete, brick).
- Pesticide use on and around **hard surfaces** for urban weed and pest control can be a significant source of pesticides in urban surface waters.
- Estimating pesticide runoff dynamics from hard surfaces is becoming increasingly relevant for urban water and water quality management.

- This poster presents the application of a new urban pesticide runoff model, ***WetSpa-PST***[1] (***WetSpa*** for ***PeST***icides) to a residential drainage area[2] (Meerhout, Belgium), where a monitoring study was conducted to estimate the runoff dynamics of **glyphosate** and its main metabolite aminomethylphosphonic acid (**AMPA**).

Overview of the WetSpa-PST model

- WetSpa-PST is an extension of the modular hydrological model **WetSpa-Python**[3] (Water and Energy Transfer between Soil, Plants and Atmosphere model in Python).



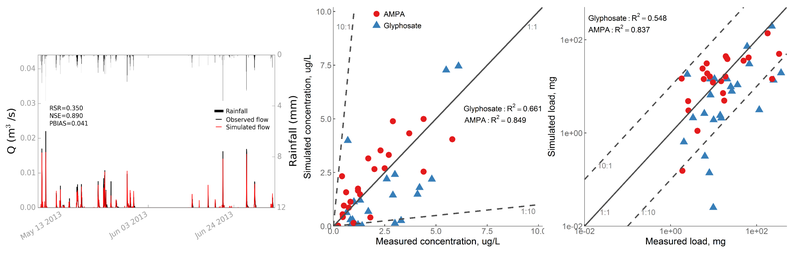
Key characteristics of WetSpa-PST:

- A **Catchment-scale** runoff and pesticide transport model
- For up to **10 pesticides**, and **3 metabolites** for each parent substance
- **Fully-distributed** to account for spatial details of the urban features
- **Processes** can be simulated at **different time steps**, depending on data availability and the characteristic temporal scale of each process.

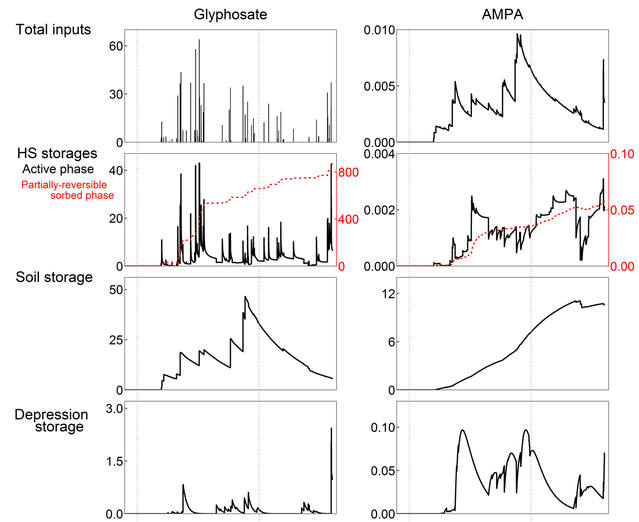
Setup and calibration of WetSpa-PST for Meerhout

To set up the WetSpa-PST model for the Meerhout case study, the following spatial maps (resolution: 1 m × 1 m, 30 min) were used as input maps:

- The model calibration using PEST[4] was conducted in two stages, first the hydrological model and then the pesticide model, with
  - A simulation duration of three months (May 01 to August 01, 2013), and
  - A calibration period of 58 days (May 07 to July 03, 2013).
- After calibration, the simulated concentrations and loads were within one order of magnitude of the observed concentrations and loads.



Hard surfaces potentially act as pesticide reservoirs



- A large fraction of glyphosate and AMPA (>85 % of total inputs) was still stored in the study area after the simulation period of three months.
- Hard surfaces act as **reservoirs** for the strongly-adsorbing glyphosate.
- Glyphosate and AMPA occurrence would potentially **persist throughout the year** in the receiving water.

Conclusions and perspectives

- The WetSpa-PST model can reasonably reproduce pesticide runoff concentrations and loads in the monitoring study.
- The potentially persistent occurrence of glyphosate highlights chronic risks to biota in urban waters due to pesticide exposure.
- This is particularly relevant for hydrophobic pesticides such as pyrethroids due to their stronger sorption capacity.
- Regulatory exposure modeling and risk assessment for urban pesticides should include their long-term effects to the aquatic ecosystems.

References

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