



Spatially distributed modelling of pesticide leaching at European scale with the PyCatch modelling framework

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The modelling of pesticide transport through the soil and estimating its leaching to groundwater is essential for an appropriate environmental risk assessment. Pesticide leaching models commonly used in regulatory processes often lack the capability of providing a comprehensive spatial view, as they are implemented as non-spatial point models or only use a few combinations of representative soils to simulate specific plots. Furthermore, their handling of spatial input and output data and interaction with available Geographical Information Systems tools is limited. Therefore, executing several scenarios simulating and assessing the potential leaching on national or continental scale at high resolution is rather inefficient and prohibits the straightforward identification of areas prone to leaching.

We present a new pesticide leaching model component of the PyCatch framework developed in PCRaster Python, an environmental modelling framework tailored to the development of spatio-temporal models (<http://www.pcraster.eu>). To ensure a feasible computational runtime of large scale models, we implemented an elementary field capacity approach to model soil water. Currently implemented processes are evapotranspiration, advection, dispersion, sorption, degradation and metabolite transformation. Not yet implemented relevant additional processes such as surface runoff, snowmelt, erosion or other lateral flows can be integrated with components already implemented in PyCatch. A preliminary version of the model executes a 20-year simulation of soil water processes for Germany (20 soil layers, 1 km² spatial resolution, and daily timestep) within half a day using a single CPU. A comparison of the soil moisture and outflow obtained from the PCRaster implementation and PELMO, a commonly used pesticide leaching model, resulted in an R² of 0.98 for the FOCUS Hamburg scenario. We will further discuss the validation of the pesticide transport processes and show case studies applied to European countries.