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Selection and modelling of a hydrologic catchment to be used in the aquatic risk assessment for plant protection products – A case study for pome fruit in Belgium

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Risk assessment at landscape scales is currently discussed in Europe as an option to improve the validity and relevance of regulatory Environmental Risk Assessment (ERA) for plant protection products (PPP). For aquatic risk assessment, the hydrologic catchment is considered the assessment unit for landscape scale analyses.

The identification of catchments with a high chance of aquatic PPP exposure depends on the entry route considered, which can be either by spray drift deposition, drain flow or runoff. For spray drift related exposure it is critical to analyse and rank catchments by their specific crop cultivation locations in proximity to water bodies. Hence, site selection needs to be detached from the availability of hydrological gauging data, at least in the first step. Nevertheless the final hydrological catchment setup should constitute a scenario with a plausible hydrological model set up to be used for further predictive substance simulations. Consequently, in a second step, the availability of gauging data needs to be considered.

In the present case study a representative catchment for orchard plantations (pome fruit, spray drift) in Belgium was selected by means of a spatial site selection process and a hydrological catchment model was set up. The work flow was organized in the following way:

i. The site selection approach consisted of a spatial proximity analysis of 730 catchments with respect to the co-occurrence of orchards and water bodies. Site selection was conducted with publicly available, spatially explicit geodata.

ii. A representative catchment was identified characterised by large orchard areas in the vicinity of streams and ponds.

iii. The final catchment area was delineated by the location of the corresponding gauging station (Rummen, 150 km^2 catchment area).

iv. Catchment modelling was conducted with publicly available (geo-) data and a fully distributed catchment model set up with the hydrological programming library ‘Catchment Modelling Framework (CMF)’. The CMF setup allows retrieving water and solute fluxes for each connected element in the catchment (single fields, river segments) at any time step.

v. The entire data collection and modelling process was accompanied by an uncertainty analysis.

First model results (no calibration) show well matched streamflow response to rainfall events, as well as typical seasonal specific periods of discharge and recharge. The associated data uncertainty analysis identifies a high variation of predicted discharge in the catchment, mainly caused by the choice of the precipitation data and the PET calculation.