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Impact of short range variability of soil and substance properties on regional scale atrazine exposure to groundwater

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We analyse the uncertainty in median and percentile predicted environmental concentrations (PEC) of atrazine, when modelling exposure to groundwater at the regional scale. We consider the propagation of the input uncertainty on atrazine half live time (DT50), percentage of organic matter (OM) and soil moisture ([U+F071]), due to unknown short range variability of these parameters within a calculation unit corresponding to a soil mapping unit. The uncertainty propagation analysis was performed for an agricultural relevant area within the Molignée catchment in the Southern part of Belgium. The uncertainty analysis was performed using the Monte Carlo simulation technique, adopting latin hypercube sampling of reconstructed probability density functions to obtain convergent results with limited number of samples (1000 model runs), analysing as well the median as percentile predicted environmental concentrations.
The deterministic simulations suggest that the expected exposure for atrazine can be important, in particular for these soil types that have low organic matter content. The stochastic Monte Carlo simulations suggest that PEC uncertainty is largely influenced by uncertainty on OM, less by uncertainty on DT50 and not by the uncertainty on volumetric moisture content. The impact on median PEC of OM uncertainty, and to a lesser extent to DT50 uncertainty, suggests that the exposure model is significantly non-linear in the expected uncertainty ranges of these parameters. This justifies the use of stochastic simulation when assessing regional exposure. In such cases, the reconstruction of the joint probability density function of uncertain factors deserves particular attention since the characterization of the probability density function of underlying factors, including the correlation structure between the parameters, exhibit impacts on median and percentile PEC.