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In-Stream Sediment Dynamics for predicted environmental concentration calculations of plant protection products in the FOCUSSW Scenarios

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The exposure assessment for the EU registration procedure of plant protection products (PPP), which is based on the 'Forum for the co-ordination of pesticide fate models and their use' (FOCUS), currently considers only periods of 12-16 months for the exposure assessment in surface water bodies. However, in a recent scientific opinion of the European Food Safety Authority (EFSA) it is argued that in a multi-year exposure assessment, the accumulation of PPP substances in river sediment may be a relevant process. Therefore, the EFSA proposed to introduce a sediment accumulation factor in order to account for enrichment of PPP substances over several years in the sediment. The calculation of this accumulation factor, however, would consider degradation in sediment as the only dissipation path, and does not take into account riverine sediment dynamics.
In order to assess the influence of deposition and the possible extent of substance accumulation in the sediment phase, the hydraulic model HEC-RAS was employed for an assessment of in-stream sediment dynamics of the FOCUS stream scenarios. The model was parameterized according to the stream characteristics of the FOCUS scenarios and was run over a period of 20 years. The results show that with the distribution of grain sizes and the ranges of flow velocity in the FOCUS streams the main sediment process in the streams is transport. First modeling results suggest that about 80% of the eroded sediment mass from the adjacent field are transported to the downstream end of the stream and out of the system, while only about 20% are deposited in the river bed. At the same time, only about 30% of in-stream sediment mass stems from the adjacent field and is associated with PPP substance, while the remaining sediment consists of the substance-free base sediment concentration regarded in the scenarios. With this, the hydraulic modelling approach is able to support the development of a meaningful sediment accumulation factor by considering in-stream sediment dynamics and estimating long-term sediment deposition and substance burial in the river bed. At last, the study shows that the development of a scientifically sound and justifiable sediment accumulation factor for a long-term exposure assessment is only possible by considering the relevant riverine sediment processes.