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An improved method for the parameterization of sediment trapping in VFSMOD

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The most widely implemented mitigation measure to reduce transfer of pesticides to surface water bodies via surface runoff are vegetative filter strips (VFS). To reliably model the reduction of surface runoff, eroded sediment and pesticide load by VFS an event-based model is needed. The most commonly used model for this purpose is VFSMOD. VFSMOD simulates reduction of total inflow (ΔQ) and reduction of incoming eroded sediment load (ΔE) mechanistically. These variables are subsequently used to calculate the reduction of pesticide load (ΔP). While ΔP can be relatively well predicted from ΔQ, ΔE and some other variables, errors in ΔQ and ΔE will propagate to ΔP. Hence, for strongly sorbing compounds, an accurate prediction of ΔE is crucial. The most important parameter characterizing the incoming sediment in VFSMOD is the median particle diameter d50. The objective of this study was to derive a generic d50 parameterization methodology for sediment trapping in VFSMOD that can be readily used for regulatory VFS scenarios.

Four studies with 16 hydrological events were selected for modelling. A first set of VFSMOD simulations, following the SWAN-VFSMOD sediment parameterization with d50 = 20 µm yielded a general overestimation of ΔE. Consequently, a maximum-likelihood-based calibration and uncertainty analysis with the DREAM-ZS algorithm was performed for the 16 events. The resulting d50 values were all in the low range (1.3-5.4 µm) and did not allow to establish a robust relationship to predict a wider range of d50 from the available explanatory variables. To increase the sample size and the range of d50 values, the comprehensive Kinston dataset for a loamy sand in North Carolina was calibrated with DREAM-ZS. Calibration was performed separately for each hydrological event. Further data points with measured particle size distributions in run-on were assimilated from the literature. The extended test data set of d50 values and explanatory variables was analysed using an extended multiple linear regression (MLR) approach and Classification and Regression Trees (CART).

A good calibration of event totals and outflow hydrographs could be achieved for most events and VFS treatments of the Kinston site. The calibrated d50 values yielded a wider range (2-16 µm) than

the initial 16 events.

The improved d50 parameterization method derived with MLR/CART will be adopted in the next version of SWAN-VFSMOD to provide more realistic quantitative mitigation within FOCUS STEP4.