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Accounting for variation in rainfall intensity and surface slope in wash-off model calibration and prediction within the Bayesian framework

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Abstract

Exponential wash-off models are the most widely used method to predict sediment wash-off from urban surfaces. In spite of many studies, there is still a lack of knowledge on the effect of external drivers such as rainfall intensity and surface slope on the wash-off prediction. In this study, a more physically realistic "structure" is added to the original exponential wash-off model (OEM) by replacing the invariant parameters with functions of rainfall intensity and catchment surface slope, so that the model can better represent catchment and rainfall conditions without the need of lookup table and interpolation/extrapolation. In the proposed new exponential model (NEM), two such functions are introduced. One function describes the maximum fraction of the initial load that can be washed off by a rainfall event for a given slope and the other function describes the wash-off rate during a rainfall event for a given slope. The parameters of these functions are estimated using data collected from a series of laboratory experiments carried out using an artificial rainfall generator, a 1 m^2 bituminous road surface and a continuous wash-off measuring system. These experimental data contain high temporal