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Implementation of runoff attenuation features into a landscape evolution model for the assessment of the impact on catchment sediment dynamics

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Runoff attenuation features such as bunds and leaky barriers are increasingly incorporated into catchment flood management schemes. However, with any structure resulting in a barrier to flow, sediment dynamics are also affected, which will in turn affect the feature's hydraulic effectiveness over time. The geomorphological impact of these features is often overlooked. This work looks at using the CAESAR-Lisflood landscape evolution model to assess how to implement runoff attenuation features into a catchment and evaluate their corresponding impact on sediment dynamics and subsequent change to water storage efficacy. The simulations were based on a small catchment, situated south of the Yorkshire Dales, UK, where the land is primarily used for grazing livestock. Features were implemented through the editing of the underlying topography allowing features to be fully erodible and scenarios were created based on feature shape, size and quantity. Of the features implemented, there was no unified response to the flood event simulated. Generally, many of the features themselves were affected by erosion, reducing their ability to hold water over time. Fewer features experienced deposition upstream compared to those experiencing erosion, which may suggest scour as opposed to sedimentation as a management issue that would need to be monitored. Nonetheless, the model scenarios run permitted an optimal design and layout of runoff attenuation features within the catchment to be established.