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Too many check dams? Simulating check dam failures and river stability at centennial time scales

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Check dams are structures to stabilize mountain rivers by decreasing flow velocity and reducing channel erosion. Over long-time scales (100 years) a series of check dams constructed in a river reach can have significant effects on sediment and water dynamics and river channel responses. Given the high costs of check dam maintenance, the question then arises: what would happen geomorphologically if check dams were not maintained and allowed to structurally deteriorate? Herein we apply a Landscape Evolution Model (CAEASAR-Lisflood) to a Swiss pre-alpine catchment (Gürbe River) containing 80 check dams that stabilize the main river. These longstanding structures afford a sense of security for downstream communities by mitigating small- and mid-scale flood and debris flow hazards. Using CAEASAR-Lisflood, we simulate different scenarios of river stability and sediment yield at centennial time scales. High spatial and temporal resolution rainfall data driving the landscape evolution model is generated by a stochastic spatially distributed rainfall generator (STREAP). Scenarios consider the quantity and location of check dams that are neglected, subsequently collapse, and release large amounts of sediment. By doing this we are better able to understand how the neglect of check dams cascades through the catchment and provides information about optimal check dam placement and amount. Preliminary model results indicate that check dams in the Gürbe catchment reduce sediment yield by 50%, and >80% of the check dams are needed to maintain a stable river.