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A network scale, intermediate complexity model for simulating channel evolution over years to decades

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5 **Abstract**

6 Excessive river erosion and sedimentation threatens critical infras-
7 tructure, degrades aquatic habitat, and impairs water quality. Tools for
8 predicting the magnitude of erosion, sedimentation, and channel evo-
9 lution processes are needed for effective mitigation and management.
10 We present a new numerical model that simulates coupled river bed
11 and bank erosion at the watershed scale. The model uses modified ver-
12 sions of Bagnold's sediment transport equation to simulate bed erosion
13 and aggradation, as well as a simplified Bank Stability and Toe Ero-
14 sion Model (BSTEM) to simulate bank erosion processes. The model is
15 mechanistic and intermediate complexity, accounting for the dominant
16 channel evolution processes while limiting data requirements. We apply
17 the model to a generic test case of channel network response following
18 a disturbance and the results match physical understanding of channel
19 evolution. The model was also tested on two field data sets: below

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