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Effects of grid scale and resulting initial bed disturbance differences on the evolution of braided rivers

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Physics-based models have been increasingly developed in recent years and applied to simulate the braiding process and evolution of channel units in braided rivers. Braided rivers are the river network system characterized by the staggered distribution of bars and channels. In the numerical calculation, the grid scale affects the behavior process and morphological description of braided rivers. In this paper, a 2D numerical model is used to simulate the evolution of the braided rivers where the transport of load bed sediment plays a dominant role. In the natural scale braided rivers evolution modeling, the difference of the braided rivers' morphological characteristics under different grid scales is discussed, and the influence of different distribution of topographic disturbance caused by grid scale difference on the morphological characteristics of braided rivers is discussed. The study shows that the grid scale does not affect the description of braided rivers evolution process, and braided rivers evolve in the same way regardless of grid scale (within a reasonable range). However, the statistical characteristics of braided rivers are greatly affected by the grid scale. The braiding index increases as the grid scale decreases, but when the grid scale decreases to a certain extent (20m in this paper), the braiding index no longer increases. The number and average height of bars in braided rivers increase with the decrease of grid scale, and the average area of bar near riverbed also increases with the decrease of grid scale, but the average area of bar near water surface does not change with the change of grid scale. In general, the higher the grid resolution is, the more similar the bar morphology in the numerical model is to that in natural rivers. In addition, the different distribution of topographic disturbance caused by the grid scale difference has an influence on the braiding intensity and the bar morphology of the braided rivers, but the influence degree is much smaller than that caused by the grid scale difference.