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Evolution of river profile of experimental mountain building

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River profiles and their evolution during mountain building are investigated and the characteristics of river profile under mountain steady-states are examined by rainfall-erosion experiments under various uplift rate. Miniature landforms are developed with constant uplifting of sand-block (mixture of fine sand and kaolinite) and artificial rainfall. Four experiments are operated under the uplift rate of 0.2 mm/h, 0.5mm/h, 1.2 mm/h and 5.0 mm/h. Based on landform measurement, 1 cm grid elevation models are constructed. Streams are generated by basin analysis with the elevation models.

Relationship between the slope of channel (S) and the catchment area (A) are examined. Plots of log S and log A (S-A plots) show convex, linear and slightly concave forms as mountain building progress. In the mountain steady-states, the S-A plots show slightly concave forms, and the forms are stable until end of uplifting. It is deduced that S-A plots become linear forms if they are at steady-state by stream-power incision model. But our result shows that S-A plots under steady-state shows slightly concave forms, expressing that channel slopes at downstream becomes relatively steep than those deduced by the model. This situation should be result of downstream increasing sediment flux, which is important factor of graded river but neglected by the traditional stream-power incision models.

Keywords: rainfall-erosion experiment, uplift, river profile, equilibrium, sediment flux