Discriminating Meandering and Braided Channel Patterns on the Basis of Discharge and Slope using a Physical Laboratory Model: the Emriver-River Process Simulator

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Introduction

Braided rivers are characterized by relatively higher values than meandering rivers. Previous studies have shown that meandering and braided channel patterns can be discriminated on the basis of discharge. Wolman (1957) discriminating natural meandering patterns could be produced under laboratory conditions (a stream table), to investigate whether this relationship could be produced under laboratory conditions. The present study used a commercially available physical model, the Emriver-River Process Simulator, to investigate whether this relationship could be produced under laboratory conditions. Slopes, with the aid of Lappin & Wolman (1957) discriminating natural meandering and braided channel patterns on the basis of discharge (from Bridge, 2003).

River channel pattern is controlled primarily by sediment transport rate and stream power, which are larger, a function of channel discharge (Q) and slope (S). Discrimination of the form (Q/\(S^n\)) have been shown to be effective in discriminating between meandering and braided forms. We use a commercially available physical model, the Emriver-River Process Simulator, to investigate whether this relationship could be produced under laboratory conditions. Slopes, with the aid of Lappin & Wolman (1957) discriminating natural meandering and braided channel patterns on the basis of discharge (from Bridge, 2003)

Experimental Setup & Procedure

The physical model is the commercially available physical model, the Emriver-River Process Simulator, manufactured and distributed by Wittenberg River Research & Design. The model is a flat bed of 3.2 m long, 0.61 m wide, and 1.65 m deep. The stream reaches are fabricated from a stainless steel sheet material, with a head gauge that measures water level and a weir that is positioned to discharge water down the model channel. Discharge was measured with an electric meter and water velocity using an electromagnetic flow meter. The model was equipped with a water velocity meter and a water level sensor. Water quality was measured using an optical sensor and a laser level. Prior to each experimental run, sediment was added to the model to simulate a natural river bed. The model was operated at a range of discharge and slope settings (Q/\(S^n\)). The data form two clearly defined fields of meandering and braided channels. The line demarcating the fields is defined by the equation \(Q/\(S^{n_a}\) = \(Q/\(S^{n_b}\)).

Discussion & Conclusions

In the equation for the line demarcating the meandering and braided fields, \(Q/\(S^n\) is a function of the stream power and sediment transport rate. This function is modified by the threshold value of \(Q/\(S^n\) for natural rivers, which are typically 10^5 to 10^5 m/s for meandering and 10^6 to 10^6 m/s for braided channels. The line demarcating the fields is defined by the equation \(Q/\(S^{n_a}\) = \(Q/\(S^{n_b}\)) = \(Q/\(S^{n_c}\) - \(Q/\(S^{n_d}\)).

Results

Data were plotted as a log-log graph of sediment transport rate vs. discharge. The data form two clearly defined fields of meandering and braided channels. The line demarcating the fields is defined by the equation \(Q/\(S^{n_a}\) = \(Q/\(S^{n_b}\)) = \(Q/\(S^{n_c}\) - \(Q/\(S^{n_d}\)).

References Cited


Lappin, R., 1957, A study of the shape of channels formed by natural streams flowing in erodible material: Missouri River Div.


Yamuna River, India, exhibiting a meandering channel pattern. This river is an ideal example of a meandering channel pattern. The data form two clearly defined fields of meandering and braided channels. The line demarcating the fields is defined by the equation \(Q/\(S^{n_a}\) = \(Q/\(S^{n_b}\)) = \(Q/\(S^{n_c}\) - \(Q/\(S^{n_d}\)).

Yamuna River

Broahapatra River, Bangladesh, exhibiting a braided channel pattern. This river is an ideal example of a braided channel pattern. The data form two clearly defined fields of meandering and braided channels. The line demarcating the fields is defined by the equation \(Q/\(S^{n_a}\) = \(Q/\(S^{n_b}\)) = \(Q/\(S^{n_c}\) - \(Q/\(S^{n_d}\)).

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