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The effect of clusters on surface based transport modeling

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Clusters are common bedforms that develop as part of the surface structure of gravel and sand channels. Surface grains may re-arrange during a receding flood flow or a sustained low flow such that the larger size fractions group into clusters of two or more grains. These clusters can increase the sheltering effect of the large grains and also the shear stress necessary to mobilize fine sediment sizes. Transport models, both surface and subsurface beds, continue to show scatter when compared to observed transport data. Residuals, the ratio of predicted to measured transport value, remain even when the transport model accounts for the coarser surface sediments through adjustment of the hiding factor.

This work examines whether clusters may be responsible for some of the mismatch between predicted and observed transport rates. The Wilcock and Crowe Surface Based Transport Model has been used to predict the transport from beds for which fractional transport data were available. Residuals were then examined against channel bed surface structure. Data from the flume runs used to develop the SBTM were analyzed and clusters were identified from photographs of the channel bed surfaces. Specific residuals were then analyzed for corresponding cluster presence. This analysis provides a first estimate of how the presence of clusters can cause predicted transport rates to deviate from observation.