Flow resistance estimation in mountain streams

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The quantification of flow resistance in complex natural channels continues to be a key source of uncertainty in basic research, engineering, and environmental management. The objectives of this study were to develop a relationship for predicting Darcy-Weisbach friction factor f and to compare its predictive capabilities with the empirical equations developed by Hey (1979), Jarrett (1984), Bathurst (1985), Mussetter (1989) and Bathurst (2002). We performed a meta-analysis of data compiled from a wide range of sources and flow conditions in mountain streams. The regression algorithm included stratification of the compiled dataset by key channel and flow parameters, best subsets regressions using Mallow's Cp, and a four-fold cross validation procedure. Our analyses yielded a dimensionless two-part equation which predicts f more accurately than existing relationships, especially for mountain streams with relatively large bed material and friction slope values greater than 0.04.