The probability distribution of bedload transport rates

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Bedload transport, the sliding, rolling or hopping motion of sediment particles over a river bed, has long been recognised to be a stochastic process. I derive the Birnbaum-Saunders distribution as a probability distribution function for the transport rates at a given water discharge. This distribution can be derived from simple assumptions without reference to the specific physics of sediment transport and should thus be widely applicable. The function is successfully tested using a high-resolution bedload transport dataset from the Pitzbach stream, Austria. Most of the deviation between the observed and the predicted distribution can be explained by the approximations made in the derivation.