ICG2022-74
https://doi.org/10.5194/icg2022-74
10th International Conference on Geomorphology
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Estimating bedload in a poorly-gauged mountain river: Coto river (Cantabrian Mountains, NW Iberian Peninsula)

Daniel Vázquez-Tarrío[1], Rosana Menéndez-Duarte[2], and Raquel Martínez Álvarez[3]
[1]Polythecnic University of Madrid (UPM), Madrid, Spain (danielvazqueztarrio@gmail.com)
[2]Department of Geology, University of Oviedo, c/ Jesús Arias de Velasco, s/n, 33005 Oviedo, Spain
[3]Máster Geotecnología y Desarrollo de Proyectos GIS, University of Oviedo, Spain

Plenty of sediment-transport equations and models have been proposed for the estimation of bedload volumes and rates in mountain streams. Some of the more 'modern' equations incorporate explicit considerations of complex phenomena (e.g., hiding/exposure effects, armour breakup) and provide reliable bedload computations based on section-averaged hydraulic parameters. However, due to the strong non-linearity of sediment transport, bedload equations are highly sensitive to the input parameters. Then, some doubts appear when facing poorly gauged river reaches, which is a common situation in many mountain rivers, i.e., gauging data are usually scarce and incomplete for mountain streams, as well as the availability of robust rating curves is rare.

In this work, we evaluated the uncertainties inherent to the application of bedload equations in the case of poorly gauged mountain streams, and we test a workflow to follow in such situations. This workflow involves three steps: (i) first, using the available gauging records from neighbouring basins to reconstruct the flow duration curve of the ungauged stream; (ii) then, using a flow-resistance equation to solve the hydraulic geometry relations; and finally, (iii) computing bedload volumes based on a sediment transport equation. This workflow was tested with a database of 33 Idaho (USA) mountain streams, and we documented that it could potentially approximate annual bedload volumes in an ungauged situation.

Then, we posed the following question: could this observation be extrapolated to 'similar' mountain streams located in other regions? To approach this question, we selected the Coto river, a gravel-bed stream located on the Cantabrian Mountains (NW Spain). Bedload data derived from particle tracking (tagged stones) were available for this river, so it was possible to compare the field measurements with the outputs obtained from bedload equations. First, we based on available data for 27 gauging stations located across the Cantabrian mountains to reconstruct the flow duration curve of the Coto river. Then, we measured Coto river's cross-section, bed slope and grain-size in order to apply a flow resistance equation and to solve the hydraulic geometry relations. Finally, we applied a bedload equation, and we estimated an annually averaged bedload volume of 900 m^3/year. The estimated bedload volumes are coherent and in good agreement with those derived from tracer observations.