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Bed load transport formulas in dam break flows

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Classic formulas for bed load transport have been widely applied to river and channel dynamics with satisfactory results. Most of these equations were developed under ideal or steady flow conditions, which make them relevant for studying sediment transport processes in natural streams. However, they are not suitable in situations of dam break flows. In these cases, sediment concentration in lower layers of the flow is very high and could be nearly the same as that of bed material [1]. In order to account this phenomenon in the formulation, Wu and Wang [2] introduce the correction factor kt for the transport stage number. This correction factor does not only recover sediment concentration features in lower layers, but also dynamic pressure characteristics of the flow, which are mainly present in the dam break wavefront. By an iterative solution procedure, the kt value was developed for the Taipei and Louvain-la-Neuve tests, and it was used to address the sediment transport process with the Van Rijn formulas [3]. Nevertheless, albeit the results from Wu and Wang were acceptable, there was no research in the type of bed load transport formula applied from those existing in the literature.
Although suspended load is of a greater importance, the bed load regulates the bed profiles in sediment transport processes. Bed material profiles also induce changes in the free surface flow. The longitudinal bed gradient infers in velocity changes and even can provoke dynamic pressure. Consequently, choosing a proper bed load formula is essential, since a wrong choice could imply including undesirable secondary effects in the flow. In this regard, for the sake of clarity, a comparison between the classic bed load transport formulas performance is done in this work. As a framework the Taipei and Louvain-la-Neuve test cases are considered. The transport stage number can be rearranged in each of the traditional equations [4,5], so the newfangled correction proposed by Wu and Wang can be investigated in them. Finally, recommendations for using the best bed load transport formulas are given.

REFERENCES

[1] Fraccarollo, L., & Capart, H. (2002). Riemann wave description of erosional dam-break flows. Journal of Fluid Mechanics, 461, 183-228.
[2] Wu, W., & Wang, S. S. (2007). One-dimensional modeling of dam-break flow over movable beds. Journal of hydraulic engineering, 133(1), 48-58.
[3] Van Rijn, L. C. (1984). Sediment transport, part I: bed load transport. Journal of hydraulic engineering, 110(10), 1431-1456.
[4] García, M. H. (Ed.). (2008). Sedimentation engineering: processes, measurements, modeling, and practice (No. 110). ASCE Publications.
[5] Alonso, C. V., Neibling, W. H., & Foster, G. R. (1981). Estimating sediment transport capacity in watershed modeling. Transactions of the ASAE, 24(5).