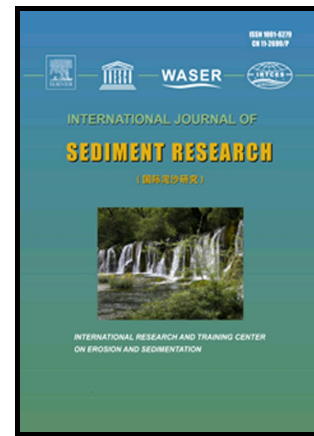


Author's Accepted Manuscript

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www.elsevier.com/locate/ijsrc

PII: S1001-6279(16)30115-9
DOI: <http://dx.doi.org/10.1016/j.ijsrc.2016.11.001>
Reference: IJSRC92

To appear in: *International Journal of Sediment Research*

Received date: 14 February 2016
Revised date: 13 November 2016
Accepted date: 14 November 2016

Cite this article as: Mohamed Elhakeem, A.N. (Thanos) Papanicolaou and Achilleas G. Tsakiris, A probabilistic model for sediment entrainment: The role of bed irregularity, *International Journal of Sediment Research* <http://dx.doi.org/10.1016/j.ijsrc.2016.11.001>

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A probabilistic model for sediment entrainment: the role of bed irregularityMohamed Elhakeem¹, A .N. (Thanos) Papanicolaou^{2*} , Achilleas G. Tsakiris ³

Abstract: A generalized probabilistic model is developed in this study to predict sediment entrainment under the incipient motion, rolling, and pickup modes. A novelty of the proposed model is that it incorporates in its formulation the probability density function of the bed shear stress, instead of the near-bed velocity fluctuations, to account for the effects of both flow turbulence and bed surface irregularity on sediment entrainment. The proposed model incorporates in its formulation the collective effects of three parameters describing bed surface irregularity, namely the relative roughness, the volumetric fraction and relative position of sediment particles within the active layer. Another key feature of the model is that it provides a criterion for estimating the lift and drag coefficients jointly based on the recognition that lift and drag forces acting on sediment particles are interdependent and vary with particle protrusion and packing density. The model was validated using laboratory data of both fine and coarse sediment and was compared with previously published models. The study results show that all

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