Modelling particle entrainment in mountain torrents: Linking turbulence to local bed geometry and to the grain surface – Coupled Problems 2015

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ABSTRACT

The quantification of sediment transport in steep gravel bed channels is highly dependent on the prediction of incipient particle motion, which is commonly done by estimating the critical shear stress at the channel bed for a given grain. However, turbulence was discovered to play a key role in particle entrainment, questioning the common approaches[1][2].

We aim to go a step further by numerically looking at the interactions between the turbulent structures and a non-spherical grain sitting in a pocket of varying shape situated in a mountain torrent channel.

The proposed research couples three numerical codes: The large scale turbulent structures and their dependency on the stream bed topography are modelled with a hybrid URANS-LES approach using the Finite Volume CFD Code OpenFOAM. Turbulent flow is generated beginning at an upstream step and following the bed topography down to the position of the pocked containing the particle of interest. At the pocked, a one-way coupling to a high-resolution LES simulation will be realized representing the flow at the pocked by the Lattice-Boltzmann code PALABOS or by the Finite Volume Code CFDEM, allowing comparison of both methods. The turbulent flow at the pocked is then linked by a four-way coupling to the DEM representation of the grain modelled in LIGGGHTS, using a multisphere approach to represent grain shape.

The model is capable of resolving the interaction between the grain, the flow, the pocked and the local topography with respect to turbulence. It will be used to study the influence of the grain environment and grain shape on initiation of motion.

REFERENCES

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