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Near-bed turbulent flow hydrodynamics in gravel-bedded streams subjected to imposed sand transport.

R. Ferreira (1), L. Ferreira (1), A. Ricardo (1), and M. Franca (2)

(1) Instituto Superior Técnico, TULisbon, Dptm. Engenharia Civil e Arquitectura, Av. Rovisco Pais, 1049-001 Lisboa, Portugal., (2) Dept. Civil Engr. and IMAR-CMA, University of Coimbra, Portugal

Sand grain-sizes may be found in excess in mountain rivers as a result of erosion of unprotected soil in the catchment. By triggering changes in the river morphodynamics, this may result in severe changes in the turbulent flow hydrodynamics.
This study is aimed at the characterization of the near-bed turbulent flow in gravel-bedded rivers subjected to imposed sand transport. Special emphasis is given to the mean velocity profiles, to the stress terms in the equation of conservation of momentum and to the production terms in the equation of conservation of turbulent kinetic energy (TKE).
To accomplish the proposed objectives, conditions similar to those found in nature, in what concerns the flow and the characteristics of the bed material, were reproduced in the laboratory. Three experimental tests simulated different stream conditions: (i) undisturbed openwork gravel bed; (ii) framework-supported gravel bed with a sand matrix and, (iii) framework-supported gravel bed with imposed sand transport at near-capacity conditions. Instantaneous velocity maps were obtained with Particle Image Velocimetry (PIV). The collected data was analysed and theoretically framed with double-averaged methods (DAM). Changes in the velocity profiles, in form-induced and Reynolds stresses and in TKE production terms are discussed vis-à-vis changes in the bed texture associated to different rates of sediment transport.