Geophysical Research Abstracts
Vol. 19, EGU2017-2352, 2017
EGU General Assembly 2017

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There are many methods and equations for estimating bedload flux in steady flow conditions. Yet, very little is known about the effect of very unsteady flows, such as flash floods, on bedload flux. The unpredictable nature of the floods together with many logistic difficulties and safety issues in monitoring explain this gap in knowledge. Global climate change may increase flood event occurrence, making their understanding even more crucial. This research focuses on two durations of flash floods where the flow is most rapidly changing: a) flash flood bore arriving on dry river bed and b) flash flood bore arriving on a column of moving water.
The methodology of our study is based on the demonstrated ability of the Eshtemoa gauging station to automatically monitor the variation of bedload flux depending on flow and bed characteristics, along with innovative equipment including hydrophones and geophones for capturing acoustic signals of bedload sediments (1 Hz), video cameras for continuous monitoring of water surface velocity (by the LSPIV method to determine its structure and velocity) and 3-D velocimetry for characterizing turbulence (40 Hz). Additional to these, a well-planned deployment was carried out, including alerting sensors and cellular transmission, enabling to be onsite when bores arrive.
During the winter of 2015-2016 two flow events were sufficiently large to transport significant amounts of bedload; the magnitude of the larger event occurs once in a few years. Calibration between the acoustic indirect sensor and the direct slot sampler allow determination of bedload flux at a frequency of 1 Hz. Analyses of the two events indicate an increase of the turbulent nature (increase of the turbulent kinetic energy and the instantaneous vertical velocities), shear stress and bedload flux during the rising limb in the first two minutes of bore arrival.