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Innovative experiment for long term high resolution study of bed-load sediment transport

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The study of bed-load sediment transport has traditionally been supported by experimental investigations, where the movement of few marked grains is followed mostly from a planar view of the channel bed. However, collecting such information is not an easy task. In the field, the reconstruction of grains' trajectories along the river reach is limited by the recovery rate of deep buried tracers and by the time interval between subsequent surveys. On the other hand, laboratory experiments suffer from the spatial dimension of the flume and, consequently, the limited temporal extent of the investigation. This, in turn, has resulted in data shortcoming with difficulty in predicting bed-load sediment transport. To overcome the previous limitations, a new experiment was performed in an annular flume of 2 metres diameter. Because of the internal recirculation of water and bed material, the annular flume simulates a long length of river, where the flow is generated by the rotation of its boundaries. With the internal system operating in equilibrium, it is thus possible to study the long-term transport processes of bed-load particles. This was achieved by creating a uniform movable bed of transparent glass beads that allowed for the clear visualisation of black tracing particles even when deep-buried. An experiment was performed where the motion of the black tracers under weak transport conditions was closely monitored at 30 Hz for approximately 6 hours. The long collection of particles' positions on the surface and within the channel bed, has provided with important data on grains' displacement. With such information it has been finally possible to statistically describe the typical motion parameters, such as the travelling distance and time and, most importantly, the resting time.