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Granular motions near the threshold of entrainment

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Our society is continuously impacted by significant weather events many times resulting in catastrophes that interrupt our normal way of life. In the context of climate change and increasing urbanisation these "extreme" hydrologic events are intensified both in magnitude and frequency, inducing costs of the order of billions of pounds.

The vast majority of such costs and impacts (even more to developed societies) are due to water related catastrophes such as the geomorphic action of flowing water (including scouring of critical infrastructure, bed and bank destabilisation) and flooding. New tools and radically novel concepts are in need, to enable our society becoming more resilient.

This presentation, emphasises the utility of inertial sensors in gaining new insights on the interaction of flow hydrodynamics with the granular surface at the particle scale and for near threshold flow conditions. In particular, new designs of the "smart-sphere" device are discussed with focus on the purpose specific sets of flume experiments, designed to identify the exact response of the particle resting at the bed surface for various below, near and above threshold flow conditions. New sets of measurements are presented for particle entrainment from a Lagrangian viewpoint.

Further to finding direct application in addressing real world challenges in the water sector, it is shown that such novel sensor systems can also help the research community (both experimentalists and computational modellers) gain a better insight on the underlying processes governing granular dynamics.