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How close are we to the perfect smart pebble?

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Micro Mechanical Electrical Sensors (MEMS) have been tested the last decade for the monitoring of geophysical flows extensively. In the context of sediment transport, the concept of ‘’smart pebble” (a mobile multi-sensor capable of capturing local dynamics) is useful for capturing short-term single grain dynamics mainly relevant to the case of entrainment.

Typically, these sensors can measure local acceleration (m/s^2) and angular velocities (rad/s), and they are applied to a range of commercial and industrial applications (low to mid-range accuracy). However, by implementing these sensors in the study of sediment transport, we open a number of challenges which are simultaneously technical and theoretical. For example, the question of optimum sampling frequency is relevant to the capabilities of the sensor (processing, battery life etc.) but also theoretical in as sediment transport does not occur at the same frequency across all the natural regimes systems. In this poster, three different requirement analyses will be presented for a smart pebble. One analysis will correspond to the case of river sediment transport, one to the case of hillslope sediment transport and one to coastal sediment transport. The conclusions will be supported by preliminary in-situ measurements from the three different environments (Calder River, Dunbar coast and Glen Ogle hills, Scotland) derived by a porotype smart pebble capable of recording $\pm$400g of acceleration and $\pm$1200 rad/sec of angular velocity changes.