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Interactive comment on "Inertial drag and lift forces for coarse grains on rough alluvial beds" *by* Georgios Maniatis et al.

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Having designed and conducted similar experiments and performed analysis of instrumented particles' data, I have read this paper with interest. It is interesting to see an attempt for field implementation even though not a comprehensive one. There are number of comments that follow below which may be useful for the authors to consider: âĂć The resisting forces (FDcr and FLcr) are not fixed nor are equal to the initial resisting force (which can vary significantly) while the particle is transported (as has even been shown for the case of incipient entrainment) [1]. âĂć Lines 165-200: the authors attempted calculating the drag and lift forces as derived from the total force acting on the particle which is in turn estimated from the particle's accelerometer. Particle's acceleration can result from combinations of drag and lift forces [2] therefore the authors

claim that the drag and lift forces (or respective impulses) can be calculated from the accelerometer's readings, is not valid. âĂć Lines 210-215: The authors' claim that impulses can be calculated directly from particle's motion (sensor's readings) is not valid, as according to Valyrakis et al. [3] and Celik et al. [4] the flow impulses (or energetic flow events) impart momentum (or energy respectively) for a particle's motion at a certain efficiency (depending on the characteristics of the flow structure driving the particle's motion). Thus, the impulses the authors refer to are not flow impulses according to the theories being cited [5,6,2]. It would be interesting to have flow hydrodynamic measurements so as to enable comparison of the inertial impulses the authors estimate with flow impulses. âĂć Details around the flow conditions in the controlled flume experiments are missing. In particular: o The flow seems to be non-uniform because of the locally raised bed where the particle rests and also the presence of a smooth bed upstream this section combined with the short length of the raised bed render the flow not fully developed. o The flow depth and the range of flow conditions tested are not mentioned; this is even more important if the flow depth is of the same order of the particle's size, as in this case the particle may interact with the free water surface and the mechanics of entrainment are different from what the traditional hydraulic literature on incipient motion is discussing. o The authors do not measure any flow hydrodynamics that could be linked to the sensor's metrics they present. Bed shear stress which is based on the bed surface slope is mentioned but it is not commented on how bed slope value was obtained (measured or estimated and how). o For the ellipsoid there is a strong effect of the orientation of the initial placement on the dominance of the forces and the resulting mode of entrainment. More emphasis on this dependency could be discussed in this works. âĂć For the field work there is no comprehensive description of the flow and bed surface characteristics over which the particle is being transported.

1. Valyrakis et al. "Incipient rolling of coarse particles in water flows: a dynamical perspective," in Proc. Riverflow, Braunschweig, Germany, June 2010, pp.769-776. 2. Valyrakis et al., "Role of instantaneous force magnitude and duration on particle entrainment," JGR: Earth Surface, vol. 115, no. F2, pp. 1-18, Apr. 2010. 3. Valyrakis et

al., “Entrainment of coarse particles in turbulent flows: An energy approach,” JGR, vol. 118, no. 1, pp. 42-5, Jan. 2013. 4. Celik et al.,” Instantaneous pressure measurements on a spherical grain under threshold flow conditions,” J. Fluid Mech., vol. 741, pp. 60-97, Feb. 2014. 5. Diplas, P. et al., “The role of impulse on the initiation of particle movement under turbulent flow conditions,” Science, vol. 322, no. 5902, pp. 717-720, Oct. 2008. 6. Celik et al., “Impulse and particle dislodgement under turbulent flow conditions,” Phys. Fluids, vol. 22, pp. 1-13, Apr. 2010.

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