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Interactive comment on "Physical theory for near-bed turbulent particle-suspension capacity" *by* Joris T. Eggenhuisen et al.

M. Tilston

miketilston@hotmail.com

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Regarding the use of turbulence characteristics from the near bed region of clear-water shear flows in the force balance to determine capacity versus competency driven depositional processes in particle laden density flows: I would like to direct the authors to a recent article by Bennett et al. (2013) entitled "Turbulence suppression by suspended sediment within a geophysical flow". In it, the authors employ a well-known experimental set-up to study the effects of suspended sediments on the flow's turbulence characteristics. In it they make the observation that the flow's turbulent kinetic energy (TKE) is inversely proportional to suspended sediment concentration but, importantly, its turbulent length scales ($\lambda \equiv k\hat{}(3/2)/\varepsilon$) and time scales ($\tau \equiv k/\varepsilon$), where k and ε are the turbulence production and dissipation terms, are constant for all suspended sediment concentrations. The authors conclude that the apparent loss in turbulence production

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Discussion paper

results from converting the fluids kinetic energy (or sediment suspension potential) to the kinetic energy of the suspended particles. Taking this thought further, it implies that clear-water values of TKE represent k (the systems total turbulence production) and the "apparent" reduction in TKE with increasing suspended particle concentrations is the result of a portion of k having already been expended in maintaining particle suspension. In theory, turbulence should be fully damped with higher particle concentrations, not because its production has been decreased, but because all of the turbulent energy produced by the system is used exclusively for the purposes of maintaining sediment suspension, and the system is carrying its maximum potential suspended load.

In the context of the present manuscript, the above view on the relationship between TKE and suspended sediment concentration appears to justify the use of clear-water turbulence statistics in their force balance. Here, the authors state that capacity driven deposition occurs when F_turb-F_g=0, which can be interpreted to read as the apparent turbulent forces (F_(ãĂŰturbãĂŮ_app)) can be described as F_(ãĂŰturbãĂŮ_app)=F_turb-F_g. In other words, the flow's measurable turbulence characteristics are the result of its natural (clear water) turbulence, which is then modulated by the particles suspended in the flow. In this way, their argument is entirely consistent with the observations of Bennett et al. (2013), and maximum sediment concentrations are achieved when F_(ãĂŰturbãĂŮ_app)=0 (i.e. flow is artificially laminarized by it's suspended sediment load). As such, I would commend the authors on deriving such an elegant (and deceptively simple) approach that can equate the onset of capacity driven deposition to the cessation of fluid turbulence, and I would highly recommend incorporating the above observations into the discussion to alieve any skepticism that might exist on the use of clear-water turbulence parameters in describing the suspension potential of particle laden flows.

Sincerely, Mike Tilston

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