



Sediment concentration profiles in bed-near-bed layers under unsteady flow and sediment conditions : a CT-Scanned flume investigation

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This paper presents a case study from a CT-scan flume experiment on the variation in sediment transport (concentration) under transitional, initially high-regime (but decreasing), sub-critical flow with bed erosion or no net aggradation. The objective is to better understand sediment transport during unsteady flows such as during a wining flood. In particular, the effect of mud-aggregate transport on sediment concentration in the bed-near-bed continuum was addressed.

CT-scans were taken during sediment transport, with plane beds or dunes being the bed state. The density material (water and/or sediment) in over 105 volumes (voxels, each approximately equivalent to a grain of 0.8 mm) were analysed. Computed Tomography technology provides high-resolution results, both in time and space, and allows recognition of subtle changes in the shape of relative sediment concentration profile with bed states.

The migration and attrition of mud aggregates in this experiment increased the mean volume fraction sediment concentration in the bed-near-bed layer (lower 5% of the flow) by a factor of about 2, from an inital value of 0.12 up to 0.25, and back to 0.13 when the supply ended. Also, the presence of mud-aggregates in the preserved deposits (transported as bedload) increases bed porosity.

This case study demonstrates the great potential of Computed Tomography in process-oriented, experimental sedimentology. The community would benefit from more collaborative research using this technology, including data sharing as suggested by initiatives such as the Sediment Experimentalists Network (<http://workspace.earthcube.org/sen>)