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Looking Inside Turbidity Currents: The Effects of Spatial and Temporal Changes In Velocity, Concentration and Grain Size on Depositional Properties

The spatio-temporal evolution of particulate gravity currents was investigated in a series of flume experiments. Flows of relatively low density first propagated as a quasi-steady jet, before developing coherent spatial and temporal trends in velocity, grain size and concentration. Quasi-steady input currents evolved down flume into classically-waning flows, indicating that flow steadiness may not necessarily be indicative of the flow generation mechanism. Moreover, the fore-most parts of the flow travelled more rapidly that the hind-most parts. Hence, the length and duration of the current systematically increased along the length of the flume. Natural scale flows may therefore wane more rapidly in proximal regions than distal ones. This may impact upon sedimentation style, with capacity-driven deposition potentially more prevalent proximally. In competence-driven areas of sedimentation, flow transit times across bedform stability fields are likely to increase progressively downstream, potentially increasing the likelihood of bedform development in more distal regions. Grain size maxima were recorded in the head. Within the flow body a consistent pattern of upward fining then coarsening was observed. The coarsening upward trend can be related to an upward flux of coarse particles from head, which subsequently settle downwards into body. The above observations for low-density flows will be confronted with flows of higher density. Also, the velocitys, concentration and grain-size will be used to construct synthetic deposits, the spatial characteristics of which will be described in detail and compared with natural analogues.