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How do river channels aggrade? An investigation into the importance of upstream drivers (water discharge and sediment supply) on sediment aggradation using analogue modelling

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Stratigraphic architecture of fluvial deposits is often interpreted as a record of changes in accommodation created by absolute sea-level change, subsidence, or a combination of both (downstream drivers). An increase or decrease in accommodation causes the fluvial system to respond by either aggrading or degrading to a new equilibrium slope. However, in recent years the role of upstream drivers, such as water discharge and sediment supply (volume and grain-size distribution), in controlling equilibrium slopes has gained more importance, however we still lack significant understanding of these upstream processes. It is important to be able to differentiate between stratigraphy influenced by upstream and downstream drivers in the field because fluvial deposits represent an important archive of environmental changes. Traditionally, downstream drivers are often invoked to explain past accommodation changes, but in actuality there are rarely robust constraints on the cause of these space changes. At present there is still no well-documented examples of upstream versus downstream driven stratigraphic architecture. One way to address this issue is by undertaking analogue modelling (i.e. flume experiments) as this permits the isolation of individual parameters, such as water discharge, and allows us to investigate their role on the fluvial system in a controlled environment.

In the first part of the project that we present here, we investigate how sediment aggradation within a channel develops through time by using a quasi-2D flume. We have designed and manufactured a narrow (0.05 m), long (2.4 m) flume with an initial gradient of zero. We aim to (i) investigate how aggradation occurs through time using a series of different water discharges, sediment supplies and sediment concentrations and observe the resulting equilibrium slopes; (ii) perturb the system once equilibrium is reached to observe the readjustment of the system to new conditions; (iii) carry out a series of experiments varying downstream drivers (i.e. sea-level) which theoretically produce the same amount of aggradation as the upstream parameters we have used do, we will then be able to compare any similarities or differences in stratigraphy. Ultimately we will use these results to scale up to a fully three-dimensional analogue model (i.e. a wide flume, approximately 1 m) that produces channels and floodplains. We can then investigate how the

upstream and downstream changes seen in the narrow flume are translated into the wider flume.

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