Decoupling Allogenic Forcing from Autogenic Processes: Clastic and Carbonate Experimental Stratigraphy

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Decoupling external (allogenic) forcing from internally generated (autogenic) "noise" written in the sedimentary and stratigraphic records remains a fundamental goal in the sedimentary geosciences. One of the major stumbling blocks for distinguishing allogenic and autogenic origins in the stratigraphic record lies in the lack of quantitative understanding of autogenic processes. So far no existing computational models can explicitly model geomorphic self-organization. However, flume studies with sediment and water, which clearly show self-organized, internally driven sediment transport processes, do give the opportunity to model and investigate autogenic processes under controlled boundary conditions. Autogenic processes occur at frequencies less than those of the basin-scale response. Yet the time scale over which internal processes operate are also modified when coupled with external forcing and can be significantly extended.

We present two flume experiments with clastic sediments conducted under both static relative sea level and active relative sea-level rise to explore the effects of coupling autogenic processes with environmental forcing on the time scale of autogenic processes. In contrast to ongoing theoretical and experimental studies of autogenic processes in clastic sedimentary systems, there are still fundamental tools missing that are needed to understand autogenic processes in carbonate system. These include 1) response time scale for carbonate basin, and 2) laboratory experiments for carbonate sedimentation. Here we revise the carbonate basin time scale, and also present an initial result from a flume experiment for carbonate precipitation using artificial spring water.