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How Widespread Are Nonlinear Responses to Allogenic Perturbations in the Stratigraphic Record?

Although numerous investigations, particularly theoretical studies, have demonstrated that nonlinear responses to allogenic forcing are likely to occur in sediment-dispersal systems, a natural tendency exists to interpret allostratigraphic units in terms of relatively simple, one-dimensional external controls. Few well-documented real-world examples exist, for stratigraphically relevant timescales, of nonlinear responses to allogenic forcing. Here, a case is presented of fluvial longitudinal-profile adjustment under conditions of rapid climate and sea-level change associated with the last deglaciation. Previous interpretations invoked a fairly simple interaction of these two controls, where downstream aggradation due to relative sea-level rise occurred coeval with upstream incision due to climate-controlled reduced sediment supply. It is hypothesized that this type of response could also be triggered exclusively by climate change, where aggradation in the downstream reaches is the result of a propagating sediment wave fed by upstream incision, that exceeded sediment transport capacity and was still en route seaward by the time a subsequent, rapid climate change disrupted the prevailing boundary conditions. This possible explanation raises a number of challenging questions, including (1) how can such hypotheses be tested in a rational fashion? (2) how common could such responses be in the stratigraphic record? and (3) should such responses be referred to as allogenic or autogenic?