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Surface processes in an active rift setting: a source to sink approach from the Sperchios delta, central Greece

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This study presents an integrated source to sink approach to understand the controls on the distribution of sediments source areas, sediment routing and downstream fining in the Sperchios rift system, central Greece. The Sperchios Rift forms an active half-graben basin, which is controlled by major NW–SE trending faults. Detailed sedimentological analysis (grain size, macro/micro faunal, geochemical and mineral magnetic analysis) in conjunction with 14C age constraints reveal the stratigraphic evolution of the Sperchios delta, located at the eastern part of the rift, including the presence of a Holocene transgressive - regressive wedge overlying Late Pleistocene alluvial deposits. The process-based stratigraphic model SedFlux2D is used to simulate the delta evolution and model scenarios are compared with the measured data. A series of sensitivity tests are used to explore uncertainties associated with variations in sediment supply, tectonic subsidence rate, and Holocene relative sea level. We discuss the effects of the major controls, in particular the rate of relative sea-level rise and tectonic subsidence rate, on accommodation creation and thus delta architecture in this active rift setting during the Holocene. The transition from transgression to regression is found to be mainly controlled by the slowing rate of relative sea level rise that occurred approximately 5500 kyrs ago. Finally, we compare the sediment volumes and grain size variations preserved in the Sperchios delta to onshore erosion rates inferred from data collected on bedrock erodibility, measurements of downstream fining, as well as stream-power/transport capacity for both transverse and axial drainage networks. This comparison, when combined with information on relative uplift/subsidence patterns due to active extensional tectonics, allows us to develop a semi-quantitative, process-based source-to-sink model for this area.