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Modelling Late Holocene Evolution of the Rio Bergantes, Spain

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Our understanding of quaternary landscape evolution is largely based on interpretations from sedimentary archives and other empirical reconstructions of landscape evolution. Landscape evolution models (LEMs) could, in principle, complement and augment this field-based understanding of landscape evolution. Indeed, LEMs have been used to analyse process dominance and process interactions, albeit mostly in idealized landscapes or under hypothetical environmental conditions. Results from LEM simulations are rarely compared or contrasted with empirical data, even though such comparisons would be essential for establishing confidence in the ability of the LEMs to adequately replicate actual landscape evolution.

Here we present results from an extensive data-to-model comparison exercise, using the CAESAR landscape evolution model to simulate late Holocene evolution (3500 years) of the Rio Bergantes, Spain. Simulated results are compared with observed sequences of valley filling and cutting as derived from the Rio Bergantes' fluvial archive. The simulations start from a reconstructed palaeo-DEM and an estimated palaeo-regolith. The simulations are further controlled by a high-resolution artificial stochastic rainfall record that was constrained by lower resolution empirical data. Results show that the model can adequately simulate the spatial variation and the magnitude of valley cut and fill. However, simulation outputs are very sensitive to bedrock elevation and initial regolith thickness.