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The importance of drainage network evolution for transient landscape development in the actively extending central Italian Apennines

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The central part of the Italian Apennines forms a complex geodynamic setting that has been affected by active normal faulting and regional uplift over the last 3 Myrs. The area is characterised by a large number of fault-bounded basins distributed across a >60 km wide zone along the crest of the mountain range. Continuously changing boundary conditions due to fault interaction and differential regional uplift, additionally affected by climatic oscillations, has led to a transient development of the landscape over a range of length scales. At individual fault block scale, landscape transience is evidenced by narrowing and steepening of river channels directly upstream of faults that increased their slip rate over time, leading to enhanced sediment discharge and changes in sediment characteristics from these perturbed catchments. At a regional scale, transient landscape evolution is evidenced by alternating lacustrine and fluvial sediments in most of the basin stratigraphies, showing transitions between endorheic and exorheic conditions, changes in the fluvial connectivity of the drainage network, and intense fluvial incision. In the past, the evolution of the regional drainage network has been primarily described as a passive response to external forcing (e.g. regional uplift or climate change). Recent surface process modelling work by the authors, however, argues that drainage network development should be considered more as a driving mechanism because of its profound impact on the landscape by generating abrupt shifts in local base levels and in sediment dispersal patterns. Here we synthesise modelling results with published field observations and new morphological constraints to demonstrate the contribution of drainage network evolution to transient landscape development in the central Apennines. By comparing and contrasting field observations with model results, we develop a self-consistent, process-based framework for understanding the complex transient landscape evolution occurring in this complex geodynamic setting.