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Combining stream terraces analysis, longitudinal profiles modelling and catchment-scale geomorphometry for estimating trend and rates of valley incision: new insights from Central Apennines (Italy)

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This work provides new insights on the use of a combined multidisciplinary approach for estimating trend and rates of valley incision in tectonically active mountainous landscape. To this aim, here we present the results of a combined analysis including stream terraces investigation, longitudinal profiles modelling and time-dependent, catchment-scale, geomorphometry obtained in the headwater sector of the Tronto River basin, located in the southern epicentral area of the 2016-2017 seismic sequence of Central Italy.
The most relevant tectonic structures in the area are the Mt. Gorzano fault (south-eastern sector), the Sibillini Mts thrust (western sector) and the southern tip of the active Vettore fault, ie the seismogenic structure responsible for the 2016 mainshock.

Geomorphometric analysis and stream long-profiles modelling were performed using a 5 m-gridded DTM obtained starting from the altimetric dataset included in the 1:5,000 topographic maps available for the whole study area in vector format. Time-dependent catchment-scale R/S_r metrics and long-profile indices (*SL* and χ) were computed respectively using the hydrological tool in ESRI® ArcGIS and the TopoToolbox working in Matlab®. Stream terraces dataset derives from field survey, integrated with the visual inspection of a DTM-derived hillshade map and aerial/satellite imagery interpretations.

The combination of R/S_r time-dependent metrics and stream terraces analysis allows to infer the timing of the base level changes during upper Quaternary and the long-profiles modelling provided interesting results for better comprehending the effects of these changes on the fluvial system. The analysis here performed provided new data useful for better understanding the trend and rates of the valley deepening in the headwater sector of the Tronto River, to reconstruct basin-scale modifications such as stream captures and, more in general, resulted useful for better comprehending the morphoevolution of this tectonically active key area of the Apennines. Nonetheless, our study did not allow to unravel the role exerted by the single active tectonic structures in the present and past fluvial morphodynamics, because of the superimposed effects of large gravitational rock slope failures on the spatial pattern of long-profiles anomalies and local base level variations.