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Morphometric analysis of drainage network in the northern sector of the southern Italian foredeep: implications for fluvial denudation processes and Late Quaternary geomorphological evolution

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We present new data about the morphological and stratigraphic evolution and the rates of fluvial denudation of an area located in the northernmost sector of the foredeep of the southern Apennines. The study area is the medium- to low-relief sector located between the easternmost part of the Daunia Apennine and the Apulian foreland of the Gargano promontory. This area is characterized by several orders of terraced fluvial deposits disconformably overlying lower Pleistocene marine clay and organized in a staircase geometry, which recorded the emersion and the long-term incision history of this sector since mid-Pleistocene times. Geomorphological analyses have been carried out in order to retrace the landscape evolution of the area and its relationships with tectonic- and eustatic-induced variations of base-levels of erosion. Drainage network morphometry and the estimation of several topographic attributes have been added to the data collected through photo-aerial geomorphological interpretation and field survey. Drainage pattern, morphometric indexes and geological data seem to indicate that the thrust front is not active in the Late Quaternary.

Paleotopographic reconstruction of ancient base-levels of erosion has permitted to calculated missing volumes. The estimation of eroded volumes in river valleys was performed through a GIS-aided calculation supported by a DEM with spatial resolution of 8 m, using the several orders of terraced deposits recognized in the area. The mapped remnants of relict geomorphological land surfaces have been interpolated by geospatial analysis and subtracted pixel by pixel to the present-day topography. Then, denudation rates were calculated on the basis of the relative age assigned to the deposits. Middle to upper Pleistocene denudation rates estimated by means of such an approach are about 0.1 mm/y, in good agreement with data coming from direct and indirect evaluation of transport sediment yield. The analysis of longitudinal river profiles using the stream power erosion model provided additional information on the incision rates of the studied area. The Late Quaternary uplift rate (0.15 mm/y), calculated on the basis of the elevation above sea level of the marine deposits outcropping in the easternmost sector of the study area, is quite similar to the erosion rates average value, so suggesting a steady-state fluvial incision.