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Methods to estimate erosion rates in tectonically uplifted areas: examples from Betic Cordillera and Tyrrhenian margin of the Apennines

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Erosion processes are strongly related to surface uplift associated with tectonic movements, despite several factors cause considerable time-space variability of erosion rates. In this work we discuss different approaches to estimate medium to long-term erosion rates in areas experimenting moderate to low tectonic uplift. We present examples from the Betic Cordillera (SE Spain) and from the Tyrrhenian margin of the Appenines (Central Italy).

Erosion rates in the Guadix-Baza Basin (Betic Cordillera, SE of Spain) have been calculated from a volumetric estimation of sedimentary loss by river action since the late Pleistocene. This volumetric calculation is based on the reconstruction of a glacis surface formed by a thick calcrete layer, dated in 42.6 ky, that capes the basin sedimentary infilling. The resulting erosion rates range between 4.28 and 6.57 m^3/ha/yr. These erosion rates, much higher than in other similar Neogene basins in the Betic Cordillera, suggest long-term large-scale isostatic uplift for this basin. Besides, individual erosion rates for Guadix and Baza sub-basins (11.80 m^3/ha/yr and 1.77 m^3/ha/yr respectively) suggest different stages of drainage pattern evolution in both sub-basins, partially related to the down-throwing due to very recent activity along the Baza fault.

Erosion rates, expressed by the mean suspended sediment yield (*Tu index*), have been

estimated for the major river basins of the Tyrrhenian margin of the Apennines (Central Italy). This index has been calculated by using empirical equations derived from simple and multiple statistical correlations between geomorphic and climatic parameters, and measured suspended sediment yield. Erosion rates estimated at catchment scale range between 2 and 25 T/ha/yr. They are function of the catchment area and of the distribution of erosion “hot spots”. The latter are represented by small subcatchments affected by badlands, where mean short-term erosion rates, obtained from field-monitoring, are about 4-5 cm/yr (i.e. about 900 T/ha/yr). In the post-thickening evolution of the Apennines orogen, extensional tectonics affected the Tyrrhenian margin since the Late Miocene, originating a series of NW-SE elongated sedimentary basins. As a consequence of pluton emplacement due to extensional magmatism, this sedimentary sequence was uplifted since the Late Pleistocene up to several hundreds of meters above sea level. Used index is thus comparable with medium to long-term erosion rates, as expectable considering that the geomorphic parameters used in the *Tu* equations reflect the response by drainage network to external inputs.

As the two sample areas are very similar for their climatic and morphological outlines and were both affected by medium to low uplift rates since the Late Pleistocene, we have attempted a cross validation between the two methods for the erosion rate estimation. Erosion rates by volumetric estimation in the Guadix-Baza Basin of the Betic Cordillera fall in the middle of the range obtained for the major river catchments of the Tyrrhenian margin of the Apennines. The consistency of results confirms the reliability of the obtained long-term erosion rates. Even though high, they are likely to be the result of the positive feedback deriving from the concurring inputs of tectonic and morpho-climatic conditions.