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Contrasting Modern and 10Be- derived erosion rates for the Southern Betic Cordillera, Spain

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In Europe, Southeast Spain was identified as one of the regions with major treat of desertification in the context of future land use and climate change. During the last years, significant progress has been made to understand spatial patterns of modern erosion rates in these semi-arid degraded environments. Numerous European projects have contributed to the collection of modern erosion data at different spatial scales for Southeast Spain.

However, these data are rarely analysed in the context of long-term changes in vegetation, climate and human occupation. In this paper, we present Modern and Holocene denudation rates for small river basins (1 to 10 km^2) located in the Spanish Betic Cordillera. Long-term erosion data were derived from cosmogenic nuclide analyses of river-borne sediment. Modern erosion data were quantified through analysis of sediment deposition volumes behind check dams, and represent average erosion rates over the last 10 to 40 years.

Modern erosion rates are surprisingly low (mean erosion rate = 0.048 mm y-1; n=36). They indicate that the steep, sparsely vegetated hillslopes in the Betic Cordillera cannot directly be associated with high erosion rates. 10Be -derived erosion rates integrate over the last 37500 to 3500 years, and are roughly of the same magnitude. They range from 0.013 to 0.243 mm y-1 (mean denudation rate = 0.062 mm y-1 $\pm$ 0.054; n=20).

Our data suggest that the modern erosion rates are similar to the long-term erosion rates in this area. This result is in contrast with the numerous reports on human-accelerated modern erosion rates for Southeast Spain. Interestingly, our new data on long-term erosion rates show a clear spatial pattern, with higher erosion rates in the Sierra Cabrera and lower erosion rates in Sierra de las Estancias, and Sierra Torrecilla. Preliminary geomorphometric analyses suggest that the spatial variation that we observe in long-term erosion rates is related to the gradient in uplift rates of the Betic Cordillera.