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A spatially distributed model for the estimation of present water erosion rates in Mediterranean badland areas

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Denudation processes are well widespread in different areas of Italy producing loss and depletion of soil, landsliding, economic damages and hazard conditions. The indirect estimation of soil erosion rates is still one of the main research challenges of the scientific community in the field of geomorphology, due to the difficulty of generalizing results from direct field monitoring.
Clayey terrains outcropping in many parts of Italy are frequently affected by accelerated erosion processes, producing landforms known as calanchi and biancane badlands. Badlands are frequently considered to be landscapes that are characteristics of dryland areas. Semi-arid badlands are frequent throughout the Mediterranean, the better-known examples being located in various parts of Spain and southern Italy. Nevertheless, they also occurred in wetter areas, as in Central Italy, where high topographic gradients, bedrock weakness and high intensity rainstorms coexist. The importance of studying badlands dynamics is due to the very high erosion rates and the rapidity of morphodynamics observed at those sites.
With the aim of attempting a zonation of estimated water erosion rates in catchments widely affected by badland areas, some empirical equations that statistically correlate the values of measured suspended sediment yield to some geomorphic and climatic parameters (Tu denudation index) have been worked out again by means of a grid analysis (Tu grid analysis). Preliminary results, obtained after Tu grid analysis application in several Italian catchments, have been compared to measured denudation rates at hillslope scale, showing how the method well estimates erosion rates at badland sites. These encouraging preliminary results encounter some challenges for future investigations, such as: i) how much the detail of input data influences the results? ii) can the method be extended for erosion estimates in areas characterized by different morphoclimatic conditions? iii) can the method be combined with a sediment connectivity model that spatially identifies sediment transport pathways and deposition areas, beside sediment sources sites?