

From slope morphometry to morphometric processes: an integrated approach of field survey, geographic information system morphometric analysis and statistics in Italian badlands

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Abstract

Calanchi (singular: calanco) represent a typical example of badlands in the Italian peninsula, which rapidly evolve on clayey terrains such as the widespread Pliocene–Pleistocene marine clays. The present study aimed at investigating the role of the slope morphometry on the typology and distribution of morphogenetic processes in a calanchi area located in southern Italy. The research included detailed geomorphological surveying as well as morphometric and statistical analyses. The study area was first subdivided into individual hydrographic units (HUs), for which field survey allowed to identify the dominant denudation processes, their intensity and the distribution of the associated landforms (pipes, rills, gullies and landslides). The morphometry of each HU was characterised by calculating the morphometric slope index (MSI) on a reconstructed digital elevation model. By statistically comparing the morphogenetic and morphometric data, the influence of the slope morphometry on the type, distribution and evolution of the calanchi erosion process has been highlighted. In particular, through a cluster analysis, the groups of HUs having similar dominant processes were identified, and by applying the analysis of variance, the effect of the MSI on the identified clusters was analysed. Two clusters were identified, which revealed the relative importance of morphogenetic processes and the strict connection between surface and subsurface landforms. These two clusters were discriminated by the MSI value (high MSI favoured mass movements, while low MSI favoured gully

erosion and piping), highlighting the importance of slope morphometry in driving the morphogenetic hillslope processes.

Keywords: calanchi and badlands, slope morphometry, morphogenetic processes, statistical analysis, Sicily (Italy).

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FROM SLOPE MORPHOMETRY TO MORPHOGENETIC PROCESSES: AN INTEGRATED APPROACH OF FIELD SURVEY, GEOGRAPHIC INFORMATION SYSTEM MORPHOMETRIC ANALYSIS AND STATISTICS IN ITALIAN BADLANDS

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ABSTRACT

Calanchi (singular: calanco) represent a typical example of badlands in the Italian peninsula, which rapidly evolve on clayey terrains such as the widespread Pliocene–Pleistocene marine clays. The present study aimed at investigating the role of the slope morphometry on the typology and distribution of morphogenetic processes in a calanchi area located in southern Italy. The research included detailed geomorphological surveying as well as morphometric and statistical analyses. The study area was first subdivided into individual hydrographic units (HUs), for which field survey allowed to identify the dominant denudation processes, their intensity and the distribution of the associated landforms (pipes, rills, gullies and landslides). The morphometry of each HU was characterised by calculating the morphometric slope index (*MSI*) on a reconstructed digital elevation model. By statistically comparing the morphogenetic and morphometric data, the influence of the slope morphometry on the type, distribution and evolution of the calanchi erosion process has been highlighted. In particular, through a cluster analysis, the groups of HUs having similar dominant processes were identified, and by applying the analysis of variance, the effect of the *MSI* on the identified clusters was analysed. Two clusters were identified, which revealed the relative importance of morphogenetic processes and the strict connection between surface and subsurface landforms. These two clusters were discriminated by the *MSI* value (high *MSI* favoured mass movements, while low *MSI* favoured gully erosion and piping), highlighting the importance of slope morphometry in driving the morphogenetic hillslope processes. Copyright © 2015 John Wiley & Sons, Ltd.

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