frontiers | Frontiers in Earth Science

TYPE Editorial
PUBLISHED 07 November 2022
DOI 10.3389/feart.2022.1074270

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Quaternary Science, Geomorphology and Paleoenvironment, a section of the journal Frontiers in Earth Science

RECEIVED 19 October 2022
ACCEPTED 24 October 2022
PUBLISHED 07 November 2022

CITATION
Kociuba W, Navas A and Mao L (2022), Editorial: Modern geomorphic processes: From source to sink and from survey to models.
Front. Earth Sci. 10:1074270.
doi: 10.3389/feart.2022.1074270

Editorial: Modern geomorphic processes: From source to sink and from survey to models

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KEYWORDS

geomorphic processes, remote sensing—GIS, from source to sink, from survey to models, landscape responses to global environmental changes

Editorial on the Research Topic
Modern geomorphic processes: From source to sink and from survey to models

This special issue "*Modern Geomorphic Processes: From Source to Sink and From Survey to Models*" deals with the globally-observed increased dynamics of geomorphological processes, with associated long- and short-term changes in landforms. It addresses these issues at a range of spatial scales and geographical contexts, and with a range of field-to-models approaches that will be of interest for specialists interested in the study of the geomorphic implications of ongoing environmental changes. The seven scientific papers selected for this special issue represent recent research on landscape responses to global environmental changes occurring in different types of landscapes and regions of the world. In terms of data acquisition, the authors used modern remote sensing methods, and the results were processed using GIS software and machine learning techniques.

Lizaga et al. reports the application of remote sensing and field acquired data to monitor soil erosion and the uplift of fine particles causing soil nutrient loss and reduced water quality in Mediterranean mountain environments. This study was conducted over 5 years in three catchments with different land use. Time-trend analysis of several indices allowed an assessment of the soil response in terms of particle size export to changes in land use, vegetation status and rainfall distribution. The authors highlight the significant influence of heavy rainfall and vegetation cover on the size fraction of exported sediment, but also reveal the existence of more complex factors influencing export dynamics. The results of this study suggest that changes in land use, combined with short-term changing precipitation trends, probably explain most of the changes in sediment yield.

A study of the Gotland and Fåro island coasts (Sweden), conducted by Strzelecki et al., sheds new light on the evolution of the rocky coasts of the Baltic Sea. The authors investigated the limestone landforms (rauks) preserved along the coasts of several Swedish

islands. They reconstructed the processes responsible for their formation and analysed the contemporary geomorphological processes transforming the rauks. By using novel survey methods such as Schmidt hammer test, traverse microerosion meters and terrestrial laser scanning, they demonstrated the dominance of mesoscale changes in coastal platform morphology over microscale lowering of sea level by abrasion. They also reconstructed the sequence of events and identified the main causes of the behaviour of the rauks along the modern coast of the Baltic islands.

Xie et al. conducted a series of weathering-leaching rainfall simulations on four types of badland sediments under controlled conditions to identify how climatic factors affect rock weathering. The analyses of physical and chemical changes in the rocks showed that under semi-natural conditions, high drying temperature increases mechanical disintegration by promoting the rate and magnitude of moisture changes (wetting-drying alterations), while high rain intensity and acid rain have no obvious effect. In contrast, low temperature, high rainfall intensity and acid rain promote chemical weathering, and the influence of climatic and lithological factors on chemical weathering decreases in the order: mineral composition > rain intensity > temperature > rain acidity.

Cheraghi et al. discuss the effectiveness of landscape evolution models in the light of the results of small-scale laboratory experiment and a calibrated landscape evolution model. The model simulations were able to capture the main morphology of the network of incised landscape evolved under a heterogeneous rainfall. Similarly to what reported previously, a power-law relation was observed in the discharge exceedance probability for the experimental data. However, the model was not able to reproduce the small scale viability of surface micro-roughness. A lower cut-off on the scale of applicability of the general landscape evolution equation is thus identified, complementing notable work on the upper cut-off underpinned by runoff-producing areas.

Zydroń et al. used machine learning approach to identify areas susceptible to landslides in the Flysch Carpathians (Poland). Along with geomorphic changes, landslides cause damage to infrastructure and often loss of life. The authors prepared landslide susceptibility maps with a resolution of 10 × 10 m using eleven different machine learning algorithms analysing 10 environmental factors. The resulting models were validated using accuracy, recall, G-means and area under the receiver operating curve metrics. The results confirmed that algorithms based on decision tree classifiers are suitable for the preparation of landslide susceptibility maps, and also point at the future applications for geohazard early warning systems.

Czapiewski presents the practical application of Digital Surface Models (DSM) derived from the use of Unmanned Aerial Vehicles (UAV) to assess geomorphic changes in peatland areas (Bory Tucholskie, Poland). The author discusses the practical aspects and procedures of using such field approach and the derived database. The input parameters in UAV imaging that provide the highest accuracy for the derived DSM were identified, which is relevant given the widespread use of these surveys in environmental studies. The author demonstrated the high accuracy of derived DSM models relative to LiDAR-derived data. He also showed that UAV-derived DSMs can be a viable alternative to standard surveys, with the added advantage of low cost and accuracy.

Yu et al. analysed heavy mineral assemblages on a long time scale demonstrating the existence of three stages of tectonic-sedimentary evolution in the Palaeogene area of Nanpu Sag (China). Seismic interpretation, palynology, heavy minerals and drill core samples were used to constrain the factors controlling the sedimentary dispersion in the rift basin. The results show that the main factors were the synergy of the evolution of tectonic activity and the adjustment of the evolution of topography, with a minor role for climatic factors. Four sets of sediment dispersion patterns were determined. Their findings are applicable for predicting the spatial distribution of sandy bodies in the rift basin and for search potential oil and gas targets in the rift basin.

The appointed Guest Editors Ana Navas, Luca Mao and Waldemar Kociuba were responsible for the peer-review process for this Research Topic, and the preparation of this Research Topic would not have been possible without the help of the numerous selected peer reviewers. The dedicated work and valuable contributions from the contributing paper authors and all reviewers are greatly acknowledged.

Author contributions

Conceptualization WK, AN, and LM; writing WK, AN, and LM; editing, WK, AN, and LM. All authors have read and agreed to the published version of the editorial.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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