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Flood Hazard Mapping over Large Regions using Geomorphic Approaches

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Historically, man has always preferred to settle and live near the water. This tendency has not changed throughout time, and today nineteen of the twenty most populated agglomerations of the world (Demographia World Urban Areas, 2015) are located along watercourses or at the mouth of a river. On one hand, these locations are advantageous from many points of view. On the other hand, they expose significant populations and economic assets to a certain degree of flood hazard.
Knowing the location and the extent of the areas exposed to flood hazards is essential to any strategy for minimizing the risk. Unfortunately, in data-scarce regions the use of traditional floodplain mapping techniques is prevented by the lack of the extensive data required, and this scarcity is generally most pronounced in developing countries. The present work aims to overcome this limitation by defining an alternative simplified procedure for a preliminary, but efficient, floodplain delineation. To validate the method in a data-rich environment, eleven flood-related morphological descriptors derived from DEMs have been used as linear binary classifiers over the Ohio River basin and its sub-catchments, measuring their performances in identifying the floodplains at the change of the topography and the size of the calibration area. The best performing classifiers among those analysed have been applied and validated across the continental U.S. The results suggest that the classifier based on the index ln(hr/H), named the Geomorphic Flood Index (GFI), is the most suitable to detect the flood-prone areas in data-scarce environments and for large-scale applications, providing good accuracy with low requirements in terms of data and computational costs.

Keywords: flood hazard, data-scarce regions, large-scale studies, binary classifiers, DEM, USA.