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Identification of hotspots of flood risk in High Mountain Asia region based on geomorphology and climate data

Mariam Khanam¹, Giulia Sofia¹, Efthymios I. Nikolopoulos², and Emmanouil N. Anagnostou¹

¹University of Connecticut, Storrs, CT, USA

²Florida Institute of Technology, Melbourne, FL, USA

High Mountain Asia (HMA) has the most complex terrain with active hydrologic and geomorphologic processes. Climate change has expedited glacial melt and altered monsoon rain intensity. This has increased flood vulnerability across the region. There have been a few initiatives to measure the vulnerability locally. However, to identify hotspots of flood risk across the region, investigation of the entire HMA region is necessary. Unfortunately, in ungauged basins, the use of traditional floodplain mapping techniques is prevented by the lack of the extensive data required. The present work aims to provide a remote sensing-based flood-risk assessment model that maps and quantifies susceptibility in flood-prone areas. We developed a procedure for floodplain delineation based on high-resolution terrain data and a geomorphic classifier, coupled with satellite-derived extreme rainfall quantiles, and records of past flood events. For this work, we used the unique 8-meter Digital Elevation Models (DEMs) for HMA that are available at the NASA National Snow and Ice Data Center Distributed Active Archive Center (NSIDC DAAC). The geomorphic classifier is based on the Hydraulic Scaling Function automatically derived from the DEM, which is used to normalize topography according to the ratio between the local elevations along the drainage network and the riverbanks. We assess the flood risk hot spots for a specific year based on the spatial distribution of flood losses, drainage density, flood-prone areas, and rainfall. This local flood-risk assessment framework, gradually applied across the entire HMA domain, will increase the awareness of flood risk, towards improved measures for flood risk reduction.