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Detailed geomorphological mapping from high resolution DEM data (LiDAR, TanDEM-X): two case studies from Germany and SE Tibet

D. Loibl
Institute of Geography, RWTH Aachen University, Aachen, Germany (d.loibl@geo.rwth-aachen.de)

Two major obstacles are hampering the production of high resolution geomorphological maps: the complexity of the subject that should be depicted and the enormous efforts necessary to obtain data by field work. The first factor prevented the establishment of a generally accepted map legend; the second hampered efforts to collect comprehensive sets of geomorphological data. This left geomorphologists to produce applied maps, focusing on very few layers of information and often not sticking to any of the numerous standards proposed in the second half of the 20th century. Technological progress of the recent years, especially in the fields of digital elevation models, GIS environments, and computational hardware, today offers promising opportunities to overcome the obstacles and to produce detailed geomorphological maps even for remote or inhospitable regions. The feasibility of detailed geomorphological mapping from two new sets of digital elevation data, the 1 m LiDAR DTM provided by Germany's State Surveying Authority and the upcoming TanDEM-X DEM, has been evaluated in two case studies from a low mountain range in Germany and a high mountain range in SE Tibet. The results indicate that most layers of information of classical geomorphological maps (e.g. the German GMK) can be extracted from this data at appropriate scales but that significant differences occur concerning the quality and the grades of certainty of key contents. Generally, an enhancement of the geomorphographical, especially the geomorphometrical, and a weakening of geomorphogenetical contents was observed. From these findings, theoretical, methodological, and cartographical remarks on detailed geomorphological mapping from DEM data in GIS environments were educed. As GIS environments decouple data and design and enable the geomorphologist to choose information layer combinations freely to fit research topics, a general purpose legend becomes obsolete. Yet, a unified data structure is demanded to ensure that data collected by different scientists or in different studies can be exchanged and reused.