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Modeling of glacier-induced lahars using ASTER and SRTM terrain data

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Lahars are one of the major and most far-reaching hazards from volcanoes.Ice and snow masses on volcanoes can multiply these hazards in terms of magnitude and frequency of occurrence. Volcano-ice disasters have killed several ten thousand people in the past decades and caused millions of USD of damage. On many glacier-clad volcanoes, the effects of ice have not adequately been considered for hazard assessments, or hazard assessments have not been made at all. Lahar models are readily available today but the availability of digital elevation models (DEM), an essential model input, is often a critical factor. Recent remote sensing instruments have now made possible the generation of DEM's of nearly any location on earth derived from along-track stereo imagery (ASTER), or interferometric SAR (SRTM). The present contribution evaluates the potential of ASTER and SRTM digital terrain data for lahar modeling. The study is focused on lahars from Popocatepetl volcano, Mexico, which has resumed eruptive activity in 1994. Glaciers on top of Popocatepetl have significantly retreated since 1994 and were occasionally affected by eruption-induced melting processes with subsequent lahar generation. Two topography-based models for lahar simulation are applied with DEMs generated from ASTER and SRTM data. Model verification is done with photogrammetry-based terrain information and field observations. The results show that both, ASTER and SRTM data, allow for reasonable lahar simulations. The 90m SRTM DEM shows less gross errors but less details in the simulations whereas the 30m ASTER DEM allows for a higher degree of modeling details but experiences problems particularly in steep north-facing slopes.In conclusion, ASTER and SRTM terrain data bear a large yet to be exploited potential for lahar modeling on volcanoes and for mass movement modeling in mountain regions in general, in particular in areas where high-resolution DEMs are not available.