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Applying modified high resolution airborne LiDAR DTM for floodplain mapping

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Today, airborne LiDAR derived digital terrain models (DTM) are used in the research context and various scientific disciplines. In hydrology such high resolution DTMs are used for computing flood simulations, calculating roughness maps, floodplain mapping, etc. The presented approach outlines the strength of a LiDAR derived DTM (1m) in comparison to a photogrammetric derived DTM (10m). By implementing an interpolated river bed model, which is derived by using terrestrial measured river cross sections and hence modifying the high resolution DTM for hydraulic task floodplain mapping and modeling routines, could be improved. The river bed interpolation routine includes an automatic bridge detection algorithm to delete bridge pillars in the relevant river cross sections. Furthermore, the position of riverbanks, which are a contributing factor in the field of hydraulic modeling and influence the results of the hydraulic simulations, can be detected. Once the DTM is modified, river cross profiles can be extracted directly on each position along the river axis and can be used as input for hydraulic models. In this study the software HEC-RAS is used to calculate different floodplain areas on the basis of the HQ30, HQ100 and HQ200 flood scenarios, which are calibrated on key data of the flood in August 2005. The comparison of the floodplain area in the city of Innsbruck (Tyrol, Austria), modeled on the basis of a modified LiDAR derived DTM, with those from the HORA study (Hochwasserrisikozonierung Austria), shows remarkable differences. These differences result from (i) the different hydraulic modeling methods and (ii) the used DTMs, which HORA does not consider flood protection measures. The results show that the resolution of the used DTM is the determining factor for modeling adequate floodplain areas whereas the applied hydraulic model has secondary effects. The grade of accuracy attained by this approach is reflected by the numbers ,of flooding affected buildings (e.g. for HQ30: 6 versus 1875, for HQ100: 7 versus 1970, for HQ200: 1333 versus 2034). The substantial differences of both approaches can also be shown by the calculated flood plain areas.