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The Importance of Precise Digital Elevation Models (DEM) in Modelling Floods

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Digital elevation Models (DEM) are important inputs for topography for the accurate modelling of floodplain hydrodynamics. Floodplains have a key role as natural retarding pools which attenuate flood waves and suppress flood peaks. GPS, LIDAR and bathymetric surveys are well known surveying methods to acquire topographic data. It is not only time consuming and expensive to obtain topographic data through surveying but also sometimes impossible for remote areas. In this study it is aimed to present the importance of accurate modelling of topography for flood modelling. The flood modelling for Samsun-Terme in Blacksea region of Turkey is done. One of the DEM is obtained from the point observations retrieved from 1/5000 scaled orthophotos and 1/1000 scaled point elevation data from field surveys at x-sections. The river banks are corrected by using the orthophotos and elevation values. This DEM is named as scaled DEM. The other DEM is obtained from bathymetric surveys. 296 538 number of points and the left/right bank slopes were used to construct the DEM having 1 m spatial resolution and this DEM is named as base DEM. Two DEMs were compared by using 27 x-sections. The maximum difference at thalweg of the river bed is 2m and the minimum difference is 20 cm between two DEMs. The channel conveyance capacity in base DEM is larger than the one in scaled DEM and floodplain is modelled in detail in base DEM. MIKE21 with flexible grid is used in 2- dimensional shallow water flow modelling. The model by using two DEMs were calibrated for a flood event (July 9, 2012). The roughness is considered as the calibration parameter. From comparison of input hydrograph at the upstream of the river and output hydrograph at the downstream of the river, the attenuation is obtained as 91% and 84% for the base DEM and scaled DEM, respectively. The time lag in hydrographs does not show any difference for two DEMs and it is obtained as 3 hours. Maximum flood extents differ for the two DEMs, larger flooded area is simulated from scaled DEM. The main difference is observed for the braided and meandering parts of the river. For the meandering part of the river, additional 1.82 106 m3 water (5% of the total volume) is calculated as the flooded volume simulated by using the scaled DEM. For the braided stream part 0.187 106 m3 more water is simulated as the flooded volume by the scaled DEM. The flood extent around the braided part of the river is 27.6 ha larger in the simulated flood map obtained from scaled DEM compared to the one obtained from base DEM. Around the meandering part of the river scaled DEM gave 59.8 ha more flooded area. The importance of correct topography of the braided and meandering part of the river in flood modelling and the uncertainty it brings to modelling are discussed in detail.