Effectiveness of UAV-based DTM and satellite-based DEMs for local-level flood modeling in Jamuna floodplain

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Abstract

Open-source, satellite-based digital elevation models (DEMs) are widely used for flood modeling. However, studies on effectiveness of these DEMs in depicting local-level flood processes are limited. This study generated a highresolution digital terrain model (DTM) based on unmanned aerial vehicle (UAV) photogrammetry and used in a two-dimensional (2D) hydrodynamic model (HEC-RAS) to simulate the flood processes in a floodplain environment of the Jamuna River in northern Bangladesh. The effectiveness of a few satellite-based DEMs was also compared with this DTM by using the DEMs in the same hydrodynamic model. Field data for two flood seasons were collected to develop the model. The results indicate that the 2D model with UAV-based DTM provides the flood parameters, such as flood arrival time, depth, duration and extent, better than those from the satellite-based DEMs. Of the opensource DEMs, the FABDEM and the WorldDEM™ have the least errors and provide better results compared to the SRTM30, ALOS PALSAR, and ASTER DEMs. The UAV technique with ground control points and field measurements for the tree-canopy and water areas is very useful in generating a fit-for-purpose DTM. The findings of this study would be useful for terrain generation and DEM selection for local-level flood modeling elsewhere.

Keywords:

digital elevation model, digital terrain model, flood modeling, HEC-RAS 2D, unmanned aerial vehicle survey

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