IAHS2017-202
IAHS Scientific Assembly 2017

Exploring the Potentials and Limitations of SRTM Data in Flood Extent Modelling: A Case Study of the Lower Limpopo, Mozambique

Paulina Bastviken (1), Giuliano Di Baldassarre (2,3), and Johanna Mård (4)

(1) Groundwater Monitoring, Geological Survey of Sweden, Uppsala, Sweden, (2) Department of Earth Sciences, Uppsala University, Uppsala, Sweden, (3) Centre for Natural Disaster Science, CNDS, Uppsala, Sweden, (4) Department of Earth Sciences, Uppsala University, Uppsala, Sweden

Several regions in the world are presently faced with increasing flood risk due to climatic and population changes. An essential step within flood disaster risk reduction is to identify areas that can potentially be flooded, i.e. floodplain mapping, which can reduce societal vulnerability as it helps raise risk awareness, inform urban planning (if present), and support emergency response. Floodplain mapping, however, requires many data, which are not always available. Hence, on-going research is investigating the possibility of using space borne remote sensing data that are freely and (almost) globally available, as topographic input and regionalization methods to estimate design floods. In this context, we explored the usability of SRTM (Shuttle Radar Topography Mission) data for floodplain mapping in Africa. Our study aimed to assess the potentials and limitations of deriving flood inundation maps using SRTM data of 90 m resolution as topographic input of a hydraulic model. In particular, we simulated two high-magnitude flood events, which occurred in 2000 and 2013 in the Lower Limpopo Basin (Mozambique), using a simple 2D model, i.e. LISFLOOD-FP. Model outcomes were evaluated against satellite imagery of the two flood events, and a single roughness coefficient was calibrated to minimize differences between simulations and satellite observations of flood extent. High water marks surveyed in the field after the 2000 flood were also used to test the model. The agreement between simulated and observed flooding was found to be around 70%, which is a satisfactory model performance considering the use of one single free parameter. Simulation inaccuracies were mainly attributed to (1) limitations of the SRTM data, in terms of describing riverbed geometry and floodplain micro-topography, (2) reservoirs and streams temporarily connecting to the river system during high flow conditions, and (3) cloud cover in satellite imagery reducing the quality of flood extent reference data. The comparison between maximum simulated high water levels and observed high water marks leads to average absolute errors of about 2 m, which is within the uncertainty bounds of the topographic data. The findings of this study indicate that there is high potential in using SRTM data to support hydraulic modelling of floods and mapping of high-magnitude flood event risk in data-scarce areas. They also show, for this specific test site, that a flood inundation model calibrated with a given flood event can properly simulate a stronger (and thereby more rare) flood event with similar accuracy.