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Flood hazard assessment in data poor areas – is the limited data available reliable?

Micha Werner (1) and Abebe Angassa Besha (2)

(1) UNESCO-IHE Institute for Water Education, P.O. Box 3015, 2601 DA Delft, the Netherlands. (m.werner@unesco-ihe.org) & Deltares, P.O. Box 177, 2600 MH Delft, Netherlands. (micha.Werner@deltares.nl), (2) Adama University, P.O. Box 1888, Adama, Ethiopia (abebesha@gmail.com) & UNESCO-IHE Institute for Water Education, P.O. Box 3015, 2601 DA Delft, the Netherlands.

Assessing flood hazards requires good quality hydrological and topographical data of the reach of interest. Unfortunately such data is not always available, particularly in many developing countries. Additionally, there is often little meta-data available, making interpretation of artefacts found in the data difficult. Remote sensing data, including digital elevation models and images of flood extent provides the potential of complementing the scarce ground data, but the reliability of these needs to be carefully assessed against data on the ground to avoid misinterpretation. This paper addresses the data available for flood hazard assessment in the Fogera Floodplain in the Upper Blue Nile basin in Ethiopia, which is susceptible to flooding from the Ribb and Gumera rivers. Although there is some data available, observed levels and flows from the main gauge on the Ribb River exhibits curious flat-topping during high flow periods. Some studies attribute this effect to extensive floodplain inundation, or simply due to erroneous data, but in most studies the little data that is available is gratefully used with little heed for its quality.

In this study models are developed for the reach in order to validate the behaviour of the data on the hypothesis that the data is indeed correct. These show, however, that the data from the gauge should be considered unreliable, in any case during high flow periods. The study also shows that bias in the remotely sensed elevation data is significant for the floodplain, with the higher resolution Advanced Space-borne Thermal Emission and Reflection Radiometer (ASTER) data being less reliable than the lower resolution Shuttle Radar Topography Mission (SRTM) data. The effect of choices in model structure is also investigated. A simple HEC-RAS one dimensional routing model providing flood extent simulations that could be considered reasonable when compared to e.g. flood extent data from the Dartmouth Flood Observatory is discarded, as the behaviour of the model is deemed unrealistic. Improving the model structure provides a model that is plausible, but now underestimates the flood extent, while a hybrid 1D-2D model of the reach using the SOBEK code results in a more realistic simulation of the inundation patterns in the floodplain. The paper underlines the importance of assessing data quality in flood inundation modelling, as well as the need for carefully analysing model behaviour to reduce uncertainties due to inappropriate model structures and data.