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Assessing TanDEM-X for Improved Flood Estimates in Small Island Developing States

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Small Island Developing States such as Fiji are highlighted as particularly vulnerable to hazards such as flooding, as well as the impacts of future climate change. Yet, there is little quantitative analysis of the current or future risks, largely due to either absence or inadequacy of existing data. Although space-borne Synthetic Aperture Radar Digital Elevation Models (DEMs) have improved the ability to represent topography in hydrodynamic models in data-sparse catchments, the relatively-coarse resolution has thus far limited detailed analysis at the small island scale. Following the recent release of the DEM TanDEM-X by the German Aerospace Center at a 12m resolution, there is an opportunity to utilise remote sensing datasets for hydraulic modelling at a greater resolution. This research tests the capacity of the TanDEM-X to facilitate improved flood estimates in a data-sparse, small island context – the largest Fijian island of Viti Levu, with an area of 10,388km2 and a population of 898,000 (2016). Firstly, a method using principles of mathematical morphology was developed to process the TanDEM-X from a Digital Surface Model to a Digital Terrain Model, removing vegetation and building artefacts. Following this, the processed TanDEM-X was utilised by the LISFLOOD-FP hydrodynamic model to simulate estimates of current and future flood inundation across the five main catchments in Viti Levu. The modelled flood extents and water depths were compared with hydrodynamic simulations using the Shuttle Radar Topography Mission-based MERIT DEM (resolution of ∼90m), with both assessed against validation data to determine the relative improvement in predictive capacity. These findings will offer useful information for the remote sensing and hydrology community regarding the application of TanDEM-X in flood inundation modelling studies, whilst also bolstering support for the scientific assessment of flood risk in Small Island Developing States – a particularly urgent task under projections of future climate impacts on small island communities.