Importance of using a high-resolution Digital Elevation Model (DEM) for a hydrological study for a Small Island Developing State (SIDS), Mauritius

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SUMMARY

Small Island Developing State (SIDS), in particular those considered as high islands, are known to have varying steep gradients towards the sea. This change of topography causes surface runoff to move with relatively high velocity during heavy rainfall events, resulting in rapid increase in flood depth at low lying vulnerable areas. In Mauritius, most of the infrastructural developments and population density are located along the flat plains, foot of mountains and hills, nears rivers and around the coast. As such, by nature of their location, the infrastructures and community are directly exposed to high risk of flood loss. To remediate any flood risk, hydrological studies are needed, and these require high-resolution Digital Elevation Models (DEMs). Mauritius currently possesses two types of LiDAR derived DEM; the 2008 DEM, with a horizontal resolution of 10m and vertical resolution of 1m, and the 2019 DEM, with a horizontal resolution of 1m and vertical resolution of 10cm. Since, no further LiDAR DEM has been commissioned at national level. Hydrological studies have mostly been undertaken using the 2008 DEM, as it is only since last year, 2025, that the 2019 DEM was published. Flood is a growing problem in the island of Mauritius. The present study was aimed at comparing the two DEMs in hydrological studies, to highlight the extent to which a coarse DEM can impact on both location and design of infrastructure for floodwater management. Two sites namely Quatre Bornes and St Pierre were studied with both DEMs and the software ArcGIS Pro. After generating the natural flowpaths, classified into major and minor flowpaths, these were uploaded into QField app for facilitating site reconnaissance of the existing water bodies features. The major and minor water flow paths derived from both DEMs have enabled the identification of existing drains, natural drains or rivers within both sites. It has also been observed that there is a major difference among the sizes of the catchments generated with both DEMs. The information gathered on sites showed that with the coarser DEM (2008) the accuracy of mapping existing features varied between 4.7% to 12%, while the more refined DEM (2019), the accuracy ranged between 60.7% to 62%. This study concluded that for a small island

where topography changes over small distances, the use of coarse DEMs in hydrological studies, will be subject to very high level of inaccuracy. This study draws the attention of the research communities, students, consultants or governmental bodies, involved in the design of stormwater management networks on the importance of high-resolution DEM in hydrological studies of small high islands.