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Evaluation of drainage morphometric parameters derived from newly released ALOS World 3D 30-m (AW3D30) DEM for the Head Watershed of Western India

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Morphometric analysis of drainage basin provides quantitative information related to various basin descriptors which help in understanding basin evolution, terrain characterisation, structure control and basin geometry of the drainage basin. Basin morphometric descriptors reflect the hydrologic response of a watershed which is utilised for various hydrological and geomorphological analysis such as flood modelling and sediment transport. A satellite-derived digital elevation model (DEM) is routinely used for the extraction of basin morphometric parameters. Most of the research pertaining to the DEM quality for basin morphometry extraction is limited to study region due to geographically dynamic nature of vertical errors which makes it necessary to evaluate the accuracy of DEMs to understand its capability in representing basin morphometry for an area.

In the present study, the drainage network of a head watershed Varekhadi was derived from the survey of India topographic maps (Scale = 1:50,000) and recently released Advanced Land Observing Satellite ('DAICHI') DEM (AW3D30). Later, common morphometric parameters are considered for the analysis. The calculated basin morphometric parameters of drainage network derived from AW3D30 was compared with reference drainage network derived from SOI toposheet. Further, the capability of all AW3D30 to represent linear, areal and relief aspect of the drainage basin was also evaluated. Morphometric parameters comparison of stream network derived from DEM dataset is an indirect way of assessing the accuracy of DEM. The accuracy of AW3D30 derived drainage network was compared on the basis of elementary basin descriptors (basin area, perimeter and basin length), linear descriptors (stream order, stream length, bifurcation ratio and stream length ratio), basin area descriptors (drainage density, stream frequency, drainage texture, length of overland flow, shape (form factor, elongation ratio and circularity ratio)) and basin relief descriptors (basin relief, relief ratio, ruggedness number and Melton ruggedness number). Later, it is also suggested to examine the effect of DEM quality on hydrological modelling of the watershed. It will help researchers understand the sensitivity of hydrological model outputs for different DEM datasets.