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An assessment of digital elevation models (DEMs) and their ability to capture geomorphic and hydrologic properties at the catchment scale

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Digital elevation model (DEM) data quality is paramount for accurate representation of the land surface and drainage network within the geomorphologic and hydrologic fields of research. This issue was investigated within a small agricultural catchment in the New South Wales, Australia for a high resolution 5m DEM and coarser 25m DEM produced by government. A hierarchical scaling approach, in conjunction with ground truth data, were used to investigate the effect of increasing DEM grid size on a number of geomorphic and hydrologic descriptors (i.e. area-slope relationship, cumulative area distribution, hypsometric curve, width function, Strahler and stream network statistics), as well addressing the issue of source data accuracy. The impact of DEM data quality on catchment hydrological properties was assessed using wetness indices. Results of qualitative and quantitative assessments indicate that as DEM grid size was increased, the landscape became increasingly smoothed, average slope gradients decreased, and the drainage network became increasingly simplified. Geomorphic descriptors such as the width function, cumulative area distribution and hypsometric curve appear largely insensitive to DEM scale while the area-slope relationship looses definition in the diffusive region of the curve at large grid scales whereas the fluvial region appears largely insensitive. A comparison of long-term field soil moisture data with wetness indices derived from DEMs clearly demonstrates that high resolution DEM data is needed to capture soil moisture and biogeochemical properties. This study has demonstrated that prior to the use of DEMs and DEM-derived products, the

suitability of the DEM resolution must be assessed and the accuracy of the source data used to generate the DEM requires evaluation. The findings have implications for hydrological and biogeochemical modelling.