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At what scales can global scale remotely sensed data be used to accurately define correct catchment area for large scale hydrological models

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Large domain hydrological models generally rely on remotely sensed topography for delineating subbasins and catchments and defining the flow direction links between grid boxes or subbasins. There currently exist a number of readily available global river routing networks, for example, Hydrosheds and HYDRO1K. These networks are hydrologically conditioned topographical databases for which the accumulated flow area upstream of each grid point has been calculated. This study evaluates the usefulness of these data sets for delineating and linking subbasins for the HYPE hydrological model to simulate catchments at varying scales. This was done for a pan-European application of the HYPE model. The calculated upstream area of a catchment delineated using HYDROSHEDS or HYDRO1K was compared with the published upstream area of gauging stations from the European Water Archive and the Global Runoff Data Centre. From these databases 832 gauges situated in independent catchments ranging from 200 km2 to 482000km2 across Europe were chosen as validation points. Although the median subbasin resolution within the model is 215 km2, the validation of HYDROSHEDS made within this study suggests that HYDROSHEDS in most useful for delineating catchments at scales greater than 5000 km2. The area of 87 % of catchments sized 5000 to 50000 km2 could be correctly estimated (to within 5 %). For catchments of scale 500 km2 to 5000 km2, the areas of only 63 % of 375 catchments around Europe could be correctly estimated using HYDROSHEDS data. The HYDRO1K data was deemed only suitable for even larger scale catchments > 50 000 km2 because the area of less than half of the catchments smaller than 50000 km2 tested could be correctly calculated from the HYDRO1K data. This validation of river routing networks may be used to indicate the likelihood of correctly delineating a catchment area at different scales from these data sets and has implications for extracting hydrolgoical data from large domain models at various scales or when using global data sets to set up local models in data poor regions.