EFFECTS OF WATERSHED DELINEATION FROM GRID DEMS IN GIS TO NON-POINT SOURCE WATER POLLUTION MODELLING

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A watershed is a region in which all the rainfall coming from the land drains to a particular body of water or common point. Watersheds allow us to evaluate the quality and quantity of our water resources geographically. Watershed assessment is the measurement and use of chemical, physical, and biological properties to determine the current health of streams.

The requirement to digitally delineate accurate watershed boundaries is a routine task necessary in numerous natural science disciplines. The base topographic data necessary for watershed analysis in many jurisdictions is typically contained within two primary photogrammetrically interpreted base topographic layers: the hydrology (streams, rivers, wetlands, lakes, etc.), and the elevation (contours, spots, digital terrain model points, etc.). From these two data sources, a flow direction corrected, single line, vector hydrology network and a raster digital elevation model can be developed. There are numerous approaches to watershed delineation, but the most accurate implementations employ both these enhanced data sets in extracting watershed divides.

Pollutants and sediments found in surface waters can often be traced to specific point sources where management actions can be focused to improve water quality. In many other instances, however, pollutants and sediments cannot be traced to distinct points of origin. In these cases, water quality can be examined in a larger spatial context to relate landscape patterns (both natural and anthropogenic) with downstream pollutant and sediment loads. Similarly, predicting the impacts of land use changes on water quality requires an understanding of the physical processes related to non-point source pollution. Delineation of the watersheds is one of the most important stages of this process since it will provide information in the determination of the total potential of the hydrologic parameters such as suspended sediment and flow within a certain watershed. Commercial GIS softwares usually offer solutions using digital elevation models (DEMs) based on grid approach. For this purpose, water flow direction and flow accumulation grids are derived from drainage network. Selection of flow accumulation threshold value is a critical issue in delineating watersheds (especially for sub-watersheds). However, there is not a reliable method to define this value at different DEM resolutions. A proposal is made for determining appropriate flow accumulation threshold value to extract drainage network by comparing different proposals on this subject. Its effects to the watershed delineation and hence to the non-point source pollution modelling are shown in a case study, using 5-metre and 30-metre DEMs in ArcGIS software.