

A method for tracing flow paths from contours using distance transform

Yanlan Wu[1]; Takashi Oguchi[2]; Hai Hu[1]

[1] Wuhan Univ.; [2] CSIS, Univ. Tokyo

Water flow processes operating on the earth's surface play a fundamental role in shaping various landform elements such as stream networks, valleys and watershed boundaries. In the digital environment, surface flow paths have been conventionally derived from a grid-based DEM, where flow directions are assigned based on the direction of steepest descent determined from grid-cell elevations. However, the assigned flow direction pattern often includes problems such as unrealistic direction of flow paths especially in nearly flat areas and depressions. A new method for tracing flow paths is proposed to avoid these problems by two means: 1) Instead of a grid-based DEM, raster contour lines are used as input data; and 2) Not elevation values but information derived from the distance transform performed on a contour map is used to assign flow directions. The proposed method has been implemented using the C++ programming language. The results obtained by the new method were compared with those from the existing grid-based methods including the most popular D8 method and its improved algorithms such as Rho8, FD8, FRho8 and DEMON. The new method resulted in better agreement with the actual stream networks shown in topographic maps, especially in gentle areas. The use of contour lines makes the new method free from digitizing and interpolation errors, which often occur when a grid DEM is generated from a topographic map. The new method also permits the assignment of flow directions to cells located in a depression. The high availability of contour maps is another advantage of the new method. The method will benefit various hydrological analyses and applications.