



A new algorithm for single flow direction simulation on grid digital elevation models based on cumulative transfer deviations

Pengfei Wu (1,2) and Jintao Liu (1,2)

(1) Hohai University, State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, China(wpf@hhu.edu.cn), (2) Hohai University, College of Hydrology and Water Resources, China

Flow direction is an essential hydro-geomorphological parameter. Although the multiple direction algorithms are more widely studied, there is still renewed interest in revisiting single direction algorithms for watersheds subdivision, flow distance estimation and channel processes models. Here we propose a new single direction algorithm to extract flow paths on grid DEMs. All flow in a cell is supposed as a package to leave the point source along an ideal direction ranging from 0° to 360° , which is adjusted based on the steepest slope direction. The package finally arrivals one neighboring cell, and the output direction points to the downstream cell center. There are deviations between ideal directions and output directions. These deviations are used to adjust point source locations of downstream cells, so flow is not forced to set out from cell centers. While other algorithms considering the upstream deviations partly, such as D8-LTD and iGD8, direction calculation of one cell is affected by each of its upstream cells in the new method. Later, the proposed algorithm was compared with three existing single direction algorithms (D8, D8-LTD, iGD8) on both abstract hillslopes and real hillslopes. Results show that flow paths of hillsides extracted by the new algorithm are more consistent with slope lines than other algorithms. Standard deviations of deviation distance between extraction flow paths and theoretical paths are calculated for all flow paths. Mean Standard deviations of using our method is less than 30% compared with D8, and slightly less than D8-LTD and iGD8 all the time.