D08

Investigation of Geomorphological Properties Using Voronoi Discretization

○ Roberto V. DA SILVA, Masato KOBIYAMA, Yosuke YAMASHIKI, Kaoru TAKARA

Geomorphological properties derived from watersheds play a major role in many hydrological analysis and modeling. Basin area, drainage density, river length and slope and width function are some of the information that can be derived from this data and that are applied to the simplest hydrological models, such as the Rational Method, and to the most complex physically-based distributed models. The number of links, or points, in a watershed are related to their respective distances to the outlet by the so called width function. The area-distance function is a particular case of the width function since it uses total area instead o the number of links. These functions are of great importance when investigating a watershed hydrological behavior. The Geomorphological Unit Hydrograph can be derived from a width function and the TOPMODEL uses the area-distance function for flow routing. Area-distance function is usually used for distributing the hydrograph in time, but curiously not to investigate which area is contributing to the hydrograph at each time. The possibility of coupling area-distance with some other space function and distribute the hydrograph also in space could be a very useful way to investigate flow generation or contaminant sources for example. The present work investigated the possibility of extracting the area-distance function and relating them to the Horton-Strahler stream-ordering system using Voronoi cells. Voronoi cells are constructed from triangulated irregular networks (TIN's) and have the advantage of providing a natural framework for finite-difference modeling and a better representation of topographic surface through the TIN structure. A graphical framework was implemented in Matlab in order to import watershed coordinate points from raster files, create TIN and Voronoi networks, solve for pits and flat areas, define drainage network, classify rivers according to the Horton-Strahler method and extract area distance function relating it to river order. This method was tested in three watersheds located in the south of Brazil: (1) Pequeno River watershed with an area of 104 km², (2) Cubatão River watershed with 394 km² and (3) Pinus I watershed with 0.16 km². A discussion about the comparison of the area-distance functions was carried out and the relation between area-distance and stream ordering seems reasonable for hydrological modeling.