Self-similarity characteristics in the organization of natural river networks on the basis of Shreve's ordering scheme

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Abstract

Natural river networks exhibit interesting scaling laws representing their fractal features. One of the most widely-known laws is Horton's law which illustrates log-linear characteristics between the stream order and geomorphological measures (the number of branches, length of branches, and drainage area). Horton's law is based on Horton-Strahler ordering scheme. This ordering scheme apparently creates an omission in accounting of first-order segments which are primary collectors of rainfall within a basin. An alternative ordering scheme is Shreve's ordering scheme. Nevertheless, most studies on river network organization thus far have been implemented on the basis of Horton-Strahler ordering scheme. In this study, we investigate how self-similarity characteristics of natural river networks emerge in the Shreve's ordering framework. We investigate whether scaling principles similar with Horton's and Hack's laws appear in the Shreve's framework. Our study on a Vietnamese river basin shows power-laws (instead of log-linear) in relationships between stream number, main stream length, and stream area and stream orders.

Keywords: Self-similarity, Shreve's ordering system, Horton's laws

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