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Comments on 'Law of Stream Relief in Horton's Stream Morphological System' by Yu-Si Fok

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The average stream relief as an extension of the Horton-Strahler stream ordering system appears logical. Equating average stream relief Hu with the product of stream length Lu and stream slope Su, each of which is related to stream order U, implies that Hu should also be related to stream order.

The development of equation 8 from equation 4 is not clear to me. If it is assumed that equation 8 is correct, it presents an estimate of the average stream relief for any stream order if the relief is known for a first order stream. Fok defines the ratio of average relief Rh as $Rh = H_U/H_{U-1}$, where U is the stream order. He then states in equation 8 that the average stream relief, with stream U of any given order in the basin, is $Hu = H_1\ Rh^{U-1}$. Written in slightly different form, the equation is

$$Hu = H_1\left(\frac{H_U}{H_{U+1}}\right)^{U-1}$$

If $H_U > H_{U-1}$, then solving for the specific case where $U = 2$ gives

$$H_2 = H_1\left(\frac{H_2}{H_3}\right)^1$$

Then $H_2 > H_1$, which is contrary to the original inequality. Likewise if $H_U < H_{U-1}$, then solving for the specific case where $U = 2$ gives

$$H_2 = H_1\left(\frac{H_2}{H_3}\right)^1$$

Then $H_2 < H_1$, and the equation again fails to satisfy the specified conditions.

The equation will satisfy the specified conditions if either of two modifications is made. Either the ratio Rh can be inverted or the negative exponent can be used for the term. Mathematically the two modifications accomplish the same objective. Thus equation 8 would be written as

$$Hu = H_1\left(\frac{1}{Rh}\right)^{U-1} = H_1\ (Rh)^{-(U-1)}$$

if Rh is left (as defined by the author) as the ratio of the average relief of order U to that of the next higher order $U + 1$.

Modifying equation 8 also requires changes in equations 9 and 10. These modifications do not affect the remainder of the paper because, although introduced, they are apparently not used subsequently to develop the information presented in Table 1.

Although the author implies that the six empirical constants of the three equations presented in Table 1 were determined independently, this fact is unclear because the values in the table also satisfy equations 6 and 7. Inclusion of the correlation coefficient for each equation in addition to the standard error of estimate would be most helpful and enlightening when regression equations are used as they apparently were in Table 1.

REFERENCES

Fok, Yu-Si, Law of stream relief in Horton's stream morphological system, *Water Resour. Res.*, 7(1), 201–203, 1971.

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