Reply to comment by Allan D. Woodbury on "Entropy theory for derivation of infiltration equations"

Vijay P. Singh[1]

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[1] The author is grateful to *Woodbury* [2012] (hereinafter referred to as Woodbury) for his constructive and insightful comments on his paper [*Singh*, 2010]. Woodbury makes three main comments, including (1) number of constraints, (2) hypothesis on the cumulative distribution of infiltration, (3) application to deterministic systems, and (4) alternative approaches. Let me respond to each comment.

[2] *Singh* [2010] employed the total probability theorem (also called the normalization constraint) in entropy maximizing for deriving the probability density function (PDF) of infiltration capacity rate, and then a hypothesis on the cumulative probability distribution (CDF) for deriving the Horton equation. Woodbury is correct to note that in total two pieces of information (or two constraints) are used. His point is well taken, although it can be argued that the total probability theorem is not a constraint because all PDFs must satisfy it and therefore no constraint is used in entropy maximizing for deriving the PDF of the Horton equation.

[3] Second, the hypothesis on the CDF of infiltration capacity rate used in deriving the Horton equation does not accord with the uniform PDF resulting from entropy maximizing. Woodbury is correct to note this inconsistency.

[4] Third, Woodbury is correct to point out that entropy formalism can be applied to systems that are not necessarily stochastic. He goes on to illustrate this point in the extended maximum entropy-based derivation of the Horton equation which is quite illuminating. Fundamental to his derivation in this case is the definition of $f_I(t)) = i(t)/S$ which directly follows form equation (3). In this case, $f_I(t)$ does not need to be interpreted as a PDF.

[5] Fourth, Woodbury presents two alternative approaches for deriving the Horton equation: (1) extended maximum entropy and (2) minimum relative entropy. Both these approaches are appealing and useful.

[6] A. D. Woodbury should be complimented for enriching the discussion on the derivation of the Horton equation.

References

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[1]Department of Biological and Agricultural Engineering, Texas A&M University, College Station, Texas, USA.

Corresponding author: V. P. Singh, Department of Biological and Agricultural Engineering, Texas A&M University, 321 Scoates Hall, College Station, TX 77843, USA. (vsingh@tamu.edu)

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