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A critical review of conceptual and empirical approaches to characterize infiltration

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Over the past two centuries, studying the infiltration process has received significant efforts resulting in numerous infiltration models being developed. These models depended on specific soil properties, and were influenced by initial and boundary conditions. They were also classified into two major categories: empirical and conceptual models, although the boundaries between those two categories can be debated for several models. The empirical models solved the infiltration problem by curve-fitting measured data into algebraic equations. In contrast, the conceptual approaches built on earlier concepts, mainly derived from the fundamental flow models, and then formulated analytical solutions applied to the infiltration problem. In this review, we create an inclusive survey covering the diverse spectrum of published infiltration modeling to understand the philosophy and evolution of those empirical and conceptual models across the years. After providing a full historical retrospective of infiltration models, we explored the model parameters and their evolution with time. We also reviewed the different methods applied to estimate the basic and common infiltration parameters, as well as the challenges that arise by such methods.