How Darcy's equation is linked to the linear reservoir at catchment scale

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In groundwater hydrology two simple linear equations exist that describe the relation between groundwater flow and the gradient that drives it: Darcy's equation and the linear reservoir. Both equations are empirical at heart: Darcy's equation at the laboratory scale and the linear reservoir at the watershed scale. Although at first sight they show similarity, without having detailed knowledge of the structure of the underlying aquifers it is not trivial to upscale Darcy's equation to the watershed scale. In this paper, a relatively simple connection is provided between the two, based on the assumption that the groundwater system is organized by an efficient drainage network, a mostly invisible pattern that has evolved over geological time scales. This drainage network provides equally distributed resistance to flow along the streamlines that connect the active groundwater body to the stream, much like a leaf is organized to provide all stomata access to moisture at equal resistance.