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Probability Distributions of the Relative Saturation and Saturated Areas of a River Basin

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The present paper introduces an analytical approach for the description of the soil water balance dynamics over a schematic river basin. The model is based on a stochastic differential equation where the rainfall forcing is interpreted as an additive noise in the soil water balance. This equation can be solved assuming known the spatial distribution of the soil moisture over the basin transforming the two dimensional problem in a one dimensional one. This assumption is particularly true in the case of humid and semihumid environments, where spatial redistribution of soil moisture becomes dominant producing a well defined pattern. The model allowed to derive the probability density function of the saturated portion of a basin and of its relative saturation. Furthermore, it was possible to characterize statistically the cumulative probability distribution of the produced runoff. This theory is based on the assumption that the water storage capacity varies across the basin following a parabolic distribution and the basin has homogeneous soil texture and vegetation cover. The methodology outlined the role played by the basin shape in the soil water balance dynamics.