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Hillslope Hydrology: Towards Improved Process Understanding Using Modeling and/or Field Observations

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Message from the Guest Editors

The hillslope is a fundamental spatial unit of headwater catchments. It is recognized that hillslopes are of key importance for a reliable description of both catchment runoff generation and biogeochemical processes. However, understanding hillslope processes has been limited by problems posed by the presence of heterogeneity. Quantifying the threshold hydrological responses of hillslopes to rainfall as controlled by soil heterogeneity, preferential flow, and the spatiotemporal connectivity of soils' saturated patches requires distinct and multi-scale monitoring procedures. To advance the current models, heterogeneity should be replaced by the ecosystem function that it performs, instead of characterizing and specifying its exact details. This would allow to move from a micro-scale Newtonian response to a hillslope-scale, functionally based response. Flux partitioning of water and dissolved substances occurring along various flow pathways (e.g., above and on the soil surface, above the soil–bedrock interface, evaporation, and transpiration) with different residence times plays a major role in the overall hillslope water and material balance. The connectivity of hillslope soil water with the riparian zone and the underlying geological structures remain also poorly understood. To address the above challenges, novel monitoring and observation techniques, as well as new modeling approaches, are needed to foster a better quantification of hillslope hydrologically functioning descriptors, including water transit time, residence time, and flow pathways.

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Special Issue

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Message from the Editor-in-Chief

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