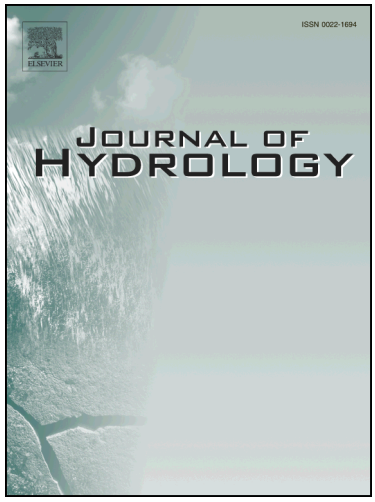

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Assessing changes in extreme river flow regulation from non-stationarity in hydrological scaling laws

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Abstract

Extreme flows are key components of river flow regimes that affect manifold hydrological, geomorphological and ecological processes with societal relevance. One fundamental characteristic of extreme flows in river basins is that they exhibit scaling properties which can be identified through scaling (power) laws. Understanding the physical mechanisms behind such scaling laws is a continuing challenge in hydrology, with potential implications for the prediction of river flow regimes in a changing environment and ungauged basins. After highlighting that the scaling properties are sensitive to environmental change, we develop a physical interpretation of how temporal changes in scaling exponents relate to the capacity of river basins to regulate extreme river flows. Regulation is defined here as the basins' capacity to either dampen high flows or to enhance low flows. Further, we use this framework to infer temporal changes in the regulation capacity of five large basins in tropical South America. Our results

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