Hydrogeomorphology influence on pan-tropical water transit times

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Abstract

The tropics represent one of Earth's most diverse and dynamic regions. Despite their significance, our comprehension of tropical hydrological processes remains a formidable challenge, largely due to limited monitoring. In this study, we harnessed high-resolution daily input-output isotope data from seven tropical catchments, situated around the pantropical band (±20°North,South). Our aim was to estimate and compare streamflow transit times employing a simple lumped convolution integral model with a Gamma distribution as the transfer function (yielding best-fit Kling Gupta efficiencies up to 0.9), our extensive and unique pan-tropical dataset revealed relatively Transit Times (TTs) up to 2 years. The relative importance test highlighted geomorphological factors such as soils and precipitation that influence TTs. Moreover, the TT distribution, as was indicated by the alpha parameter, was influenced by geological and topographic variables. These findings provide more insights into controls on TT and its distribution in rapidly responding tropical catchments compared to other climate and geomorphic zones, underscoring the significance of TT as a coherent descriptor about flow pathways, source of water and storage.