

# Hydrology, sediment transport dynamics and geomorphology of a variable flow river: The Mfolozi River, South Africa

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## Abstract

The co-efficient of variation for inter-annual streamflow of the Mfolozi River is extremely high at 79%. An analysis of flow frequency indicated that streamflow is skewed towards low-flow values, with a number of extremely large flood events occurring as outliers on the histogram. Streamflow variability in the Mfolozi River may be linked to multiple factors including a large catchment size, a seasonal climate of a dry winter and wet summer, evergreen vegetation in the catchment, variable precipitation and the occurrence of regionally pervasive climatic oscillations. This research aimed to address how streamflow variability impacted upon sediment transport and thus, geomorphology. It was found that sediment transport variability occurred at the intra- and inter-annual scale. Analysis of mean monthly sediment concentration and discharge showed a hysteresis effect, such that sediment concentration peaked prior to discharge in the early wet season. During the late wet season, peak discharges often had unexpectedly low sediment concentrations. Furthermore, data suggested the existence of long-term hysteresis that may be related to decadal-scale climatic oscillations that alter sediment availability and stream capacity, resulting in discharge peaking in 2000 and sediment concentration in 2005. However, more data are required to confirm this relationship. Variability in streamflow appears to share a causal relationship with sediment transport variability, as both are linked to variation in precipitation and the resultant impacts on vegetation growth and evapotranspiration rates. The variability of streamflow and sediment transport has implications for stream and floodplain geomorphology, and the hydrology of variable rivers should be considered when interpreting their geomorphology.

**Keywords:** flow variability, sediment transport, hysteresis, turbidity