

# Interplay of precipitation and catchment response shapes heavy tails of flood distributions

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Large and surprising extremes emerge more often from heavy-tailed distributions compared to the light-tailed distributions. Heavy-tailed distributions are characterized by a right tail which decays slower than the exponential one. Distributions of flood and precipitation records in Germany often show heavy-tail behavior. For sound flood risk management, controls of heavy-tail behavior need to be understood. Based on past records and re-analysis data, we stratify precipitation events into stratiform and convective types. Annual maxima of precipitation records tend to heavy-tail behavior if the tail of the distribution is dominated by convective events. Heavy-tail behavior of flood distributions is primarily controlled by runoff generation processes such as runoff concentration and exceedance of catchment storage. For high return periods, heavy tail of precipitation is dominating the tail of flood distributions when catchment storage is exceeded.

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