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What drives flood trends along the Rhine River: climate or river training?

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Over the past decades increasing flood flows were detected for several gauges along the Rhine River by different studies. It remains, however, unresolved which factors are responsible for observed changes. Particularly, in the heavily trained Rhine catchment, the role of the constructed weir cascade and a series of detention basins is poorly understood and quantified. The presented study addresses the question to what extent the changes in annual maximum daily flows at Rhine gauges starting from Maxau down to Lobith in the period from 1952 to 2009 are controlled by river training and to what extent other drivers such as climate variability/change are in play. Applying multiple trend analysis to the original records and homogenised flood flow series – flows that would have occurred if river training measures had not been in place – reveals a relative increase in flood flows up to about 20 % points at some gauges caused by river training. This increase is partly caused by the enhanced superposition of flood waves in the Rhine and Neckar Rivers, but to large extent is a result of large-scale increase of main channel and tributary flows. This suggests that the river training measures fell in a period with increasing flood trends driven by factors other than river training in the Rhine main channel.