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基于希尔伯特-黄变换的非一致性洪水频率计算方法——以西江大湟

Title: Hydrological frequency calculation method of inconsistent flood series based on Hilber-Huang:a case study of Dahuangjiangkou station of Xijiang River

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关键词： 洪水; 频率计算; 非一致性; 希尔伯特-黄变换; 西江大湟江口站

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摘要： 西江流域由于大量兴建堤防工程而导致天然河道洪水槽蓄关系发生了改变,进而使得洪水序列失去了一致性。针对西江洪水归槽问题,提出基于希尔伯特-黄变换的非一致性洪水频率计算方法,该方法假设非一致性年最大流量序列由非一致的确定性成分和相对一致的随机性成分两部分组成。将该方法应用于西江大湟江口站,结果表明:(1)1953-2008年最大流量序列经 Hurst 系数变异分析方法诊断为中变异,说明该序列不满足一致性的要求;(2)同频率同重现期情况下,过去、现状和未来三个时期的最大流量呈增长趋势;(3)C_v在过去(1953年)、现状(2008年)和未来(2015年)三个时期的评价结果为:0.334、0.257、0.25,呈减小趋势,说明年最大流量在多年情况下变化浮动减弱,洪峰流量趋于稳定波动。(4)浔江堤防大湟江口站现有堤坝的防洪标准在过去能达到 $10^年$ 一遇的防洪标准,但现状和未来达不到10 a一遇的要求;(5)典型洪水重现期呈逐年缩短的趋势;(6)相同区间范围内的洪水,过去、现状和未来条件下的洪水发生的概率呈增加趋势。

Abstract: The projects of constructing embankments massively on Xijiang River Basin not only lead to flood returning to main channel, but also change the flood channel storage relationship of the original natural river, so that the flood sequences lose their consistency. This study proposed a frequency analysis method of inconsistent flood based on Hilbert-Huang transformation to inquire into the flood frequency distribution of the river. This method assumes that inconsistent annual maximum discharge series is composed of relatively consistent random component and inconsistent deterministic component. This method was applied to the Dahuangjiangkou Station of the Xijiang River. Results showed that (1) the maximum discharge sequence is in middle variation by the Hurst coefficient variation analysis method, which explained that this sequence not meet the requirements of consistency during the years 1953-2008;(2) in case of the same frequency and return period, the floods at different times present an increasing trend; (3) C_v in the past(the year 1953), now (the year 2008) and future(the year 2015) are 0.334, 0.257, 0.25, respectively, presenting a reducing tendency, which explained that the rate of annual maximum flow change is weakening and the peak flow fluctuation tends to steady;(4) the flood control standard met 10 year's period in the past, but at the present and in the future, the control standard will not meet 10 year's period in the study area;(5) typical flood return period presents a gradually decreasing trend in the future; (6)the probability of occurrence of flood presents a gradually increasing trend within the same interval.

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