Impact of climate change and anthropogenic activities on stream flow and sediment discharge in the Wei River Basin, China

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ABSTRACT

Understanding the impacts of climate variation and human activity on hydrological regime and sediment dynamics is useful for developing effective conservation strategies in Yellow River basin. In this paper, we analysed long term trends of water and sediment discharge in flood season in the Wei River basin, China. We analysed data from hydrological stations measuring the sediment and water discharge of two subcatchments and at the middle and downstream of the Wei River from 1932 to 2008. Precipitation data were analysed from corresponding meteorological stations. Furthermore we identified change points or transition years of the trends, and diagnosed whether the trends were caused by precipitation changes or human intervention, or both. We found significant decreasing trends of water and sediment discharge during the flood season as well in the subcatchments as in the Wei River itself. Change-point analyses further revealed that transition years existed and that rapid decline in stream flow began in 1968 ($P<0.01$), and sediment discharge began in 1981 ($P<0.01$) in the main river. In the two subcatchments, the transition year was 1985 ($P<0.01$) and 1994 ($P<0.05$) for water discharge and 1978 and 1979 for sediment discharge ($P<0.05$), respectively. The reduction amount after the transition years impacted by precipitation and human activities were estimated by double mass curves method. For the stream flow and sediment discharge reduction, the impact of human activities contribution rate is 82.80% and 95.56%, respectively, significantly than the contribution rate of precipitation. According to those evidences, in the absence of significantly decreasing precipitation trends, it is concluded that the decreasing trends were very likely caused by human intervention, and human activities occupied a dominant position and played a major role in the stream flow and sediment discharge reduction in the Wei River Basin.