Using four different approaches to separate the effects of climate change and human activities on sediment discharge in karst watersheds

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Quantifying the relative contributions of climate and human activities to changes in sediment discharge is closely related to regional water resources, soil management and even the healthy operation of ecosystems. However, few studies used different methods to decompose influences of climatic variability and human activities on sediment discharge change, especially in karst regions of southwest China where experiencing severe soil erosion. This study systematically reviewed four different methods including simple linear regression method, double mass curve method, sediment identify factor analysis, and elastic coefficient method to separate the contribution of climate change and human activities to sediment discharge variation in four karst watersheds of southwest during 1955 to 2015. The trend and abrupt change year of sediment discharge in four watersheds were obtained by nonparametric Mann-Kendall test. Result showed that the sediment discharge in four watersheds all decreased significantly (P<0.05), and the abrupt change years were 2003, 2003, 2004 and 2004 for Wujiang, Yujiang, Hongshui, and Xijiang watersheds, respectively. The simple linear regression method, double mass curve method and elastic coefficient method all indicated that the sediment discharge was mainly influenced by human activities, with the contribution rate ranging from 73% to 101%. For the sediment identify factor analysis method, the sediment concentration is the principal factor influencing sediment discharge variation, and the contribution rate of sediment discharge varied from 100% to 154%. The results can provide good reference value for evaluating the influence of the climate and human activities on sediment discharge, and is significance for proper formulation of regional soil conservation policy in karst watersheds.