



Spatial and temporal variations in suspended sediment rating curves in the middle Yellow River basin, China

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The middle Yellow River basin is known for its extremely high rate of erosion and sediment delivery and for the dramatic decrease in sediment yield over the last 20-30 years. A suspended sediment rating curve (SRC, assumed to be $Q_s = aQ^b$) describes the relationship between water discharge (Q) and suspended sediment discharge (Q_s) in a river, and these relationships and their spatial and temporal variations could be used to interpret and indicate the effect of climate change and human activities on sediment yield. The purpose of this study was to examine how parameter values characterizing SRC, i.e. the exponent (b) and coefficient (a), were related to river basin characteristics, and to find out how these SRC parameters varied from a period of poor vegetation cover prior to 1970 to a period with much improved vegetation cover since 2000. The SRC parameters were firstly estimated with the least square technique using log-transformed daily data for 70 hydrologic gauging stations in the middle Yellow River basin. Precipitation, temperature, flow duration (the percentage of the number of days with the flows above 25% of the mean discharge), flow peakedness (the ratio of average annual peak discharges to the mean discharge), drainage area, basin relief, and the percentage of area with a slope $> 15^\circ$ were used to characterize each of the 70 river basins. The exponent b for the middle Yellow River basin ranged from 1.5 and 3.3 for the 70 stream gauging stations. Correlation analysis showed that the coefficient a was mainly negatively correlated with the long-term mean Q , basin relief, drainage area, the annual mean precipitation and temperature, while a was positively correlated with the flow peakedness, and the exponent b was most strongly correlated with flow duration. The SRC exponent b has significantly decreased from the period before 1970 with poor vegetation cover to the period since 2000 with much improved vegetation cover, while the SRC coefficient a has not changed much between the two contrasting periods, this indicated the erosive power of streams have decreased generally in the middle Yellow River region since 2000. The impact of human activities on SRC parameters needed to be analyzed for further research.