Geophysical Research Abstracts
Vol. 18, EGU2016-7051, 2016
EGU General Assembly 2016

Hysteresis effects in suspended sediment concentration of an allogenic river channel in a very arid environment

Guo-An Yu (1,2), Markus Disse (2), and Yang Yu (2)

(1) Key Laboratory of Water Cycle and Related Land Surface Processes, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, China, (2) Chair of Hydrology and River Basin Management, Technical University of Munich (TUM), Munich, Germany

Suspended sediment dynamics of the Tarim River, an allogenic and perennial river flowing in a very arid environment in China, are analyzed to examine the hysteresis effects based on data of flow discharge (Q) and suspended sediment concentration (SSC) from two hydrologic gauging stations in the river in the last five decades (1960-2011). Strong hysteresis effects existed in the sediment rating curves of the Tarim River. Under similar flow conditions, the first flood event in a year quite often causes higher suspended sediment concentration (SSC value), and form a rating curve visibly different from later flood processes. The successive flood events often form rating curves gradually from left to right progressively with time on the SSC-Q plot, indicating that higher flow intensity is needed for later flood events to reach the same SSC value of the earlier flood events. Three hysteresis loop forms, i.e. clockwise, anti-clockwise and Figure-eight existed with occurrence frequency of 57%, 27.3% and 15.6% respectively, showing that clockwise loop is the major hysteresis form and sediment load is generally derived from the channel bed. The very weak banks due to composition of quite homogeneous noncohesive particles (fine sand, silt and almost no clay content) often induce bank failure, which complicates suspended sediment dynamics and causes to shape different hysteresis loops. Somehow random but occurrence of bank collapse with higher possibility near the peak and at the falling limb of a flood hydrograph is probably the major reason causing anti-clockwise and figure-eight hysteresis loops.