EGU22-11706
https://doi.org/10.5194/egusphere-egu22-11706
EGU General Assembly 2022

Global variations in SSC-Q relationships and the controlling catchment characteristics

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Rivers transport large amounts of fine mineral and organic matter in suspension from their sources to the ocean. Suspended solids, which also bind contaminants and nutrients, therefore, affect river morphodynamics, water quality and ecosystem functioning. A detailed understanding of suspended solid dynamics is urgently needed to improve suspended sediment monitoring and management around the world.

Sediment rating curves ($SSC=aQ^b$) describe the relation between suspended solid concentrations (SSC) and river discharge (Q) and are frequently used to study suspended sediment dynamics at specific location in a river. In this formula, *a* and *b* are regression coefficients that depend on river basin characteristics. The *a*-parameter is an indicator of the erosion severity and the *b*-parameter reflects the erosion reactivity with respect to changing discharge. To date, a few studies have compared the rating parameters (*a* and *b*) to catchment characteristics, however, these studies only focused on specific regions on earth. A global study is required to better understand suspended sediment dynamics along a wide range of catchments characteristics.

In this study, we compiled available SSC and Q data from 176 rivers that are located in various regions around the world. The majority of the SSC and Q data have been collected from the GEMStat and the Global Runoff Data Centre (GRCD) databases, but we also included data from the USGS and SO-HYBAM datasets. The compiled dataset ranges from small basins (~50 km^2) to large basins (~190,000 km^2), with medium-sized river basins (~1000-10,000 km^2) being most dominant. Furthermore, the dataset contains basins that are located in various climate regions, ranging from semi-arid to humid climate, and includes both upland and lowland rivers. We only included river monitoring stations with >50 overlapping SSC and Q data points (i.e., SSC and Q data measured on the same day). We parameterized the rating curve between the SSC and Q data and compared the *a*- and *b*-parameters to topographic, lithologic, climatic and land cover-related catchment characteristics using simple and multiple linear regressions.

The first results reveal that the *b*-exponent and, thus, the suspended solids variability, shows a fairly good relationship with catchment steepness and basin size. The data suggests that climatic and land use parameters play an insignificant role, however, when combining all parameters in a multiple linear model, climate seems to have a secondary effect on top of topographic parameters. The erosion severity (*a*-parameter) is most strongly controlled by climatic and land

cover parameters. The results of this study can be used to infer for suspended sediment dynamics in ungauged catchments, which is relevant for implementing sediment monitoring and management in these regions on earth.