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Downscaling BQART Model for Sediment Discharge in Subtropical Montane Rivers in Taiwan

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Sediment discharge linked the terrestrial to marine ecosystem is controlled by the climatic, tectonic, and anthropogenic forces. The BQART model which incorporated the three forces explicitly was widely used to estimate the global sediment discharge via collected catchments with the drainage area ranging from 100 to 10,000,000 square kilometre. Recently, the sediment discharge in small mountains rivers (SMRs), drainage area < 10,000 square kilometre, has received great attentions due to its disproportional export compared to the large rivers highlighting the necessity of the downscaling modification. To consider the human impacts, the BQART model has included the parameter, B, which represents the geology and human factors. It was consisted of the glacier erosion factor (I), the average basin-wide lithology factor (L), the trapping efficiency of lake and man-made reservoirs (1-TE,) and the human-influenced soil erosion factor (Eh). Since the most small rivers are located in Oceania, in which the climate is characterized with high precipitate amount and precipitation intensity, and is geologically influenced by tectonic activity (the ring of fire). In order to estimate the sediment discharge better, the earthquake effect should be considered into the model firstly. Secondly, the 1-TE vector focused on the reservoir effect, should be quantitatively determined based upon the reservoir volume and landscape gradient. Thirdly, the Eh factor is originally defined by population density and GNP per capita that could be replaced by the vegetation coverage or greenness, a dominant factor regulating soil erosion.
Here, we focused on the anthropogenic forces, the parameter B in BQART. The model was applied onto 129 catchments in Taiwan with the sediment discharge collected from 1971-2000. The accepted performance NSE = 0.54, and the R square of 0.55 showing the fairly agreement with observation. The largely underestimated stations are attributed to the earthquake effect, whereas the overestimated stations is likely due to the lower values of 1-TE and the Eh, standing for huge impacts from anthropogenic activities. Therefore, the modification of 1-TE and the Eh vector could improve the sediment discharge estimation in SMRs which is important in an era of environmental change with more frequent extreme hydro-climate events and dramatic land cover and land use alterations.

Keywords:
BQART, Sediment Transport, Downscaling, Taiwan