Research Paper

Hydrogeomorphology, Vol. 9, No. 31, Summer 2022, pp (20-21)

Received: 2022.04.23
Accepted: 2022.05.24

Numerical Modeling of Sediment Transfer and River Erosion in Flood Conditions Case Study: Kashkan Catchment

Ahmad Godarzi [1], Hojatollah Younesi [*2], Babak Shahinejad [3], Hassan Torabi Poudeh [4]

1-Ph.D, student in Hydraulic Structures, Faculty of Agriculture, Lorestan University, Lorestan, Iran
2-Assistant Professor, Department of Water Engineering, Faculty of Agriculture, Lorestan University, Lorestan, Iran
3-Assistant Professor, Department of Water Engineering, Faculty of Agriculture, Lorestan University, Lorestan, Iran
4-Associate Professor, Department of Water Engineering, Faculty of Agriculture, Lorestan University, Lorestan, Iran

1-Introduction

The process of erosion, sediment transport, and sedimentation of sedimentary materials must be thoroughly researched in order to control and reduce the damage caused by floods, sedimentation, and erosion to streams, agricultural areas, and aquatic infrastructure. Erosion and sedimentation alter the appearance and creation of branches, as well as other features of the catchment region, in general. Rivers are one of the examples when this process causes significant alterations. Because there is constantly erosion and sediment transfer in rivers, the study of sediment transport capacity and sediment transport mechanisms in river hydraulics and morphology is extremely important. Because of the importance of sediment transfer, it is critical to be aware of and anticipate the volume of displaced sediments, bed changes, and other factors. Experimental relationships, experimental models, and numerical models that can describe sediment movement and prediction can all be utilized to achieve this.

2-Methodology

Kashkan River is one of the Karkheh catchment's hydrological units, situated in the east. It covers 9534 km^2 and accounts for around 22% of the Karkheh basin's land area and 33% of Lorestan province's land area. The Kashkan River rises in the Green Mountains to the north of Aleshtar city, and it is joined along the way by the rivers Hero, Khorramabad, Chulhol, and Madianrud. This river joins the Seymareh River 25 kilometers south of Poldakhtar city, in the bottom of Chammehr hamlet, to form the Karkheh River.

The HEC-RAS model is a multi-purpose interaction in the environment created as an integrated software system. This program can calculate steady-state and non-steady-state currents in one and two dimensions. This paradigm is also categorized as a process-based model. The fundamental computing method of HEC-RAS is based on a one-dimensional energy equation solution. The model was used by Johnson et al. (1999) to estimate and

* Corresponding author; **E-mail:**yonesi.h@lu.ac.ir

calculate the HEC-RAS limit of wetlands in the US. They calculated the river water level profile using this model, and they believe the technique is valid for quantifying the impacts of diversion on wetlands along rivers.

3-Results and Discussion

The HEC-RAS hydraulic model was used to simulate the hydraulic conditions of the Kashkan River during floods in 2019 with various return times. The findings demonstrate that when the total sediment was simulated using the above equations and the suspended load was separated, the England and Hansen equations had an error of +18.20 percent, Eckers and White had an error of +26.40 percent, Larsen had an error of +13.70 percent, and Young had an error of 11.87 percent more than the measured sediment at the station. Tofalti relationships with a -17.90 percent error, Meyer-Peter and Müller relationships with a -32.32 percent less than the measurement sediment at the station also simulated the suspended load. In comparison to previous relationships, Young and Larsen's relation has the capacity to estimate sediment at Kashkan Poldakhtar station. The Young relation predicts a total sediment of 207.45 million tons per day, and the suspended load with an error of + 11.87 percent is closest to the sediment observed at the Kashkan Poldakhtar hydrometric station, with the Meyer-Peter Müller relationship having the largest error. Because of the low error percentage, Larsen's relationship is justified and utilized to estimate the simulated sediment. The Young relation was chosen for numerical modeling in this study because of its superior accuracy (as measured by the error percentage findings).

The findings also revealed that the volume of suspended sediments in April, when there was a lot of rain, was larger than in previous months, and that this amount was substantially more than the Kashkan River's typical sediment volume. In February and January, the least quantity of transition sediment was simulated.

4-Conclusions

The simulation results for the Kashkan River using the HEC-RAS model revealed that England and Hansen, Tofalti, Eckers and White, Larsen, Young, and Meyer Peter Müller had the greatest total sedimentation performance among the various relationships, with Young calculated at 207.45 tons per day. Field data were also compared to modeling formulas. Larsen's formula came closest to the data, while the equatorial formula was weak, and the other samples yielded lower results than the field values, with minimal convergence in some of these statistically derived results.

Keywords: Sedimentary Load, Suspended Load, Transverse Sections, Kashkan Catchment.