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Analysis of river training in Qareaqaj River in Iran: Application of RiMARS

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Erosion and sedimentation play a significant role in river morphology and are among the most important issues in river engineering. Riverbank protection is one of the common efforts in river engineering to stop or reduce the rate of side erosion in rivers. Riprap is one of the simplest and most economical river protection methods due to construction material availability, operation simplicity, flexibility, easiness to construct and repair. Anthropogenic disturbances could have several side effects in rivers and subsequently induce a change in river morphology. Hence, morphological analysis is needed to trace the history of channel formation and forecast future changes. Riprap is widely used in the Southern parts of Iran to save the rural and agricultural areas located along the river. The Qareaqaj River is one of the major rivers in the South of Iran that is affected by side erosion in many places due to its high meandering morphology. Hence, a riprap structure was constructed in 2006 to protect the Qasr Ahmad village located in the right bank of the Qareaqaj River. The objective of this study is to evaluate how the river training has affected the channel morphology for 18 years in a 10 Km stretch (5 km above and 5 km below the riprap structure). Five Landsat multispectral images captured in 1995, 1999, 2003, 2010, and 2013 were used as input in the RiMARS (River Morphodynamics Analysis method based on Remote Sensing data) for morphological analysis. The Sinuosity Index (SI) has been estimated for meanders for 18 years and the results indicated that most meanders along the stretch are classified as *twisty* (about 36%), *meandering* (22%) and *winding* (18%). Furthermore, the river is divided into ten sections along the flow path and temporal migration of each section is separately analyzed. The river in its halfway (where the riprap was constructed) has migrated on average by 12.5 m, 2.2 m, 5.5 m, and 9 m in 1999, 2003, 2010, 2013, respectively, when compared to the year 1995. The maximum rate of river migration was observed (6.5 m per year) during 2010-2013 at the 7th decile of the stretch, which is about 2000 m below the protected area. The results clearly indicated that the migration rates increased in the downstream of the riprap protected area after the construction date.