Application of QUAL2K for Water Quality Modeling and Management for the Euphrates River in Fallujah City as a Case Study

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Abstract

The main objective of this research is an examination of the applicability of the QUAL2K mathematical model on large rivers like the Euphrates, and it is the first study of its kind conducted on this important section within Fallujah Euphrates Reach (FER), using this model for the purpose of evaluating the quality of water and creating a database to predict the quality of river. The tests were conducted during January and April of 2022, where they were calibrated and verified for DO and CBOD5 at a distance of 12.86 km. Google Earth pro and Arc-GIS were utilized to provide certain data as input into the QUAL2K model. The model was calibrated in January using the trial-and-error technique, and the verification was completed in April using the model calibration parameters. For the purposes of evaluating the model's performance, statistical measures such as mean absolute error (MAE), root mean square error (RMSE), and relative error (RE) were used. In addition, three different scenarios were applied (pollution load modification, flow augmentation for point sources, and flow augmentation for headwater) to improve the water quality of Euphrates river. The results show that the difference between observed and anticipated values had a relatively small error percentage, which means that this mathematical model can be applied to this important section of the river. While the concentration of DO was within the permissible limits to perpetuate aquatic life and maintain the ecological health of the river, the concentration of CBOD5 was also within the limits in some locations. In addition, the scenario represented by modifying the pollution loads represented by BOD5 for sewage water were effective in raising the concentration of DO in the river, while increasing point sources discharge and headwater flow does not yield meaningful results.