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Water Quality Prediction of a High Fluctuate River Under Climate Change Scenarios

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Extended Abstract

The impact of climate change on water quality is important to know; however, the prediction of future water quality is more difficult than water flow. Water quality is influenced by climate factors and pollution sources. The conventional method of water quality prediction is using validated water quality models. The utilization of water quality models needs professional training and well knowledge of the underlying mechanisms. The validated water quality model is then, particularly for the case study, and the model cannot be used directly in different cases. This study applies the machine learning technique, which relies on collected data and computation methods. Although machine learning skips the water quality mechanisms, its prediction can show the trend for the future and help policy-making. In this study, the random forest was used in Jishui River, Taiwan. This river is located in southern Taiwan, and the flow has high seasonal variability. The rainfall in wet and dry seasons is 9 to 1. The current water quality is discussed, and the future water quality is predicted. The climate change data is accessed from a national database, which releases the downscale temperature and rainfall data of different AR6 scenarios. Among the climate change scenarios, SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5 were used in this study. For water quality, BOD, NH_3-N, DO, and SS were analyzed. The results show that the prediction of the four water qualities is satisfied, and the R^2 is higher than 0.6. In this case, the air temperature in 2100 is increasing by 1-4 ℃. The monthly rainfall could be up to 800 mm and low to 0 mm. If only the climate factors were considered, the water quality at midstream, where the current water quality is worse, would be impacted more than the other potions of the river. It implied that the impacts of climate change on different rivers are different. For polluted rivers, the impacts are larger than for clean rivers. Compared to the low concentration, the future BOD, NH_3-N, DO, and SS at midstream would be larger at 68%, 176%, 38%, and 30% than the current level, respectively. However, it showed that future high concentrations are lower than current. It is interesting to find that the river's highly fluctuating water quality will become more consistent in the future. High rainfall dilutes the pollution, and low flow is the same as before, so the concentration variability becomes less than before. If the point pollution loads are added and assigned based on the different scenarios, the future water quality will be variable in upstream and downstream, meaning that the relatively clean water bodies are damaged more than polluted water. The results also presented that the impacts of climate factors are larger than the pollution loads. Although the results show that the high concentrations will decrease in the future, the low and average concentrations will increase in the future.