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LETTER TO THE EDITOR

Modeling and Analysis of the Negative Impact of Stream Tracking on Canyon Water Quality

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It is of great significance for real-time monitoring and protection of the ecological environment of the canyon to study the influence of the traceability movement on the water quality of the canyon, and at the same time, it can make the traceability movement continue. For this reason, a method of modeling and analyzing the negative influence of stream tracing movement on water quality in canyons is proposed. Based on the analysis of risk and hazard of traceability, the seasonal variation characteristics of water quality in canyons are summarized through the time of traceability. According to the data of the variation characteristics of water quality in canyons, the water temperature model of Canyon reservoirs is constructed to realize the determination of water quality in canyons. The experimental results show that the simulated values of the proposed method are basically consistent with the actual values, and the measured results are more accurate, so as to meet the basic conditions for carrying out traceability movement and protecting the ecological environment of the canyon.
Stream Tracing Movement; Canyon Water Quality; Negative Impact; Modeling; Analysis

1 INTRODUCTION

River Tracing, originally a mountaineering method in the European Alps, has evolved into a relatively independent outdoor sport. It is an expedition from the downstream of the canyon stream to the upstream to overcome the obstacles in the terrain and the source of the poor water to the top of the mountain. Streams are also evolved from modern mountain climbing (Mana et al. 2017). Europeans call them "Canyoing" and Americans call them "Canyoeer". Contrary to the direction of traceability movement, it is from upstream to downstream, jumping down the main edge of the waterfall, or sliding down the water. Valley sport is an outdoor activity which can combine mountain climbing, rock climbing, camping, swimming, rope operation, field survival, positioning sport, bird watching and other comprehensive technologies. The southern part of China is dominated by hills and mountains, with wide distribution of streams and waterfalls. It is an excellent area for carrying out traceability movement. However, due to the lack of systematic survey data and technical support, the sport did not become popular in China until the end of the 1990s. At present, it is attracting more and more outdoor enthusiasts. North China, which was not very qualified, has tried this sport more or less. With the development of the traceability movement in China, it is inevitable that some water quality damage events will occur in the valleys, and the types of damage will vary with the geographical environment, climate, society, economy, culture and personal abilities of different places.

Sinuraya et al. (2019) published an article in the Journal of Ekoloji Issue 107 in 2019 entitled "The Environmental Study on Evaluation of Water Quality at Prafi River, Manokwari, West Papua Using Macrozoobenthos Biotics Index and Physicochemical of Water Parameters" (Sinuraya et al. 2019). This paper studied the Quarriprafi River of West Papua Mano by using biological index of macrozoobenthos, hydrochemical and physical parameters. Based on macrobenthos bio-index and hydrochemical-physical clustering and two-cell analysis method, location grouping was carried out. A purposeful random sampling method was used to sample the upstream (no human activities), artificial forests, dams, irrigation fisheries, oil palm forests, households, livestock, fishing areas and other different river sections. The results showed that the pH value of each part ranged from 7.80 to 8.36, and the biochemical oxygen demand (BOD) ranged from 0.53 to 5.51 mg/L. Macrozoobenthos biological index showed that human activities had a certain impact on water quality, but the classification index was slightly polluted. According to cluster analysis and double-plot analysis, more than half of the lower reaches of the Prafi River are polluted water. From a biological point of view, chironomidae insects along the Yangtze River have a higher degree of pollution to water bodies.

Ahamed (2017) presents a water quality evaluation model based on improved wavelet neural network (Ahamed and Loganathan 2017). The adaptive genetic algorithm is used to optimize the initial weights of the wavelet neural network, and then the network is trained by the wavelet neural network algorithm. Finally, the trained network is tested. The simulation results show that the combination of adaptive genetic algorithm and wavelet neural network improves the training efficiency of the network. The method can be used for water quality evaluation modeling, and the evaluation results have high accuracy and accuracy. According to Xu (2017), based on the actual river data, WASP water quality model was used to model and validate the main chemical parameters of the river, and then the ecological improvement effects of constructed wetlands and aeration reoxygenation on the river water quality were studied. The results show that the WASP water quality simulation results fit well with the measured water quality data, and can predict and analyze different scenarios of ecological restoration (Ding et al. 2018). Reasonable emission reduction, constructed wetland, aeration and reoxygenation can reduce the concentration of pollutants in river water and effectively improve water quality. Adding aeration and reoxygenation devices in constructed wetland system will further improve the ecological restoration efficiency of river water.

On the basis of the above research, this paper makes an in-depth analysis of the negative impact of stream movement on the water quality of the canyon.

2 IDEA DESCRIPTION

Based on the investigation and analysis of the water quality damage in the valley in recent years, this paper summarizes the characteristics of the water quality damage in the valley caused by the traceability movement, in order to put forward effective preventive measures and better promote the traceability movement.

The process of modeling and analyzing the negative effects of stream movement on the water quality of the canyon is as follows:

2.1Risks and hazards of stream tracing activities

Streams have the characteristics of short body, large drop and rapid flow, and the developed valley topographic erosion in its infancy has created a unique V-shaped Canyon landscape. The Canyon topography varies in thousands of ways, with huge stones, waterfalls and deep pools scattered in it. This unique Canyon topography has made more and more canyons become a paradise for tracing streams and made tracing activities develop very rapidly and actively. More and more clubs, associations or associations related to traceability have been established.

From the statistical data, it can be seen that the dissolved oxygen concentration in the inflow water of Canyon runoff, which often carries out traceability activities, is high. When the runoff enters the reservoir, the dissolved oxygen content in the water will be increased and the release of endogenous pollutants will be inhibited (Wang et al. 2015). However, the easily degradable organic matter carried by stream tracing activities will lead to an increase in the rate of water oxygen consumption. When dissolved oxygen in the bottom isotherm is consumed to form anoxic state, it will aggravate the release of pollutants in sediment, deteriorate water quality and increase the cost of water treatment. Reasonable discharge of high turbidity water and selection of appropriate water level are effective measures to solve the problem of high turbidity in flood season. However, at present, there are few studies on the water quality damage caused by traceability. In view of the hazards caused by traceability on the water quality of the canyon, the impact of traceability on the water quality of the canyon is analyzed in depth.

2.2 Seasonal variation characteristics of water quality in canyons

Most of the canyons that often carry out traceability movement belong to the large deep-water reservoirs with seasonal thermal stratification, and show obvious thermal stratification phenomenon in summer. Water temperature is an important water quality index affecting physical, chemical and biological processes of water body. It is helpful to further understand the variation characteristics of traceability movement affecting other water quality indexes, such as the existence of thermocline. The exchange of substances and energy between upper and lower water bodies of Canyon reservoirs will be hindered, which will lead to lower dissolved oxygen content in lower water bodies of Canyon reservoirs. Under long-term hypoxic conditions, the lower water bodies will gradually evolve into anoxic and anaerobic zones due to the oxygen consumption of water bodies and microorganisms in sediments, which will induce bottom sediments to release iron, manganese, ammonia nitrogen and other substances to affect the water of Canyon reservoirs. Therefore, it is necessary to study the variation law of water temperature in Canyon reservoir (Li 2016).

The traceability movement is often carried out in spring and summer. With the gradual rise of temperature and the heat transfer between the outside and the surface water temperature, the upper water temperature of the canyon reservoir rises rapidly, while the bottom water body rises slowly due to the slow heat transfer, forming a distribution pattern of high and low water temperature, and the thermal stratification of the canyon reservoir begins to take shape. From April to June, with the further increase of temperature, the temperature difference between upper and lower water bodies increased from 4.9℃ in early April to 16.7℃ at the end of June, and obvious thermocline and clinocline were formed. This stage is the formation period of thermal stratification of Canyon reservoir (Cheng et al. 2015).

2.3 Establishment of water temperature model for Canyon reservoir

Reasonable use of boundary conditions is an important condition for successful use of MIKE software to establish the water temperature model of Canyon reservoir. The main factors affecting the boundary opening are divided into two groups: (1) grid generation considerations; (2) physical conditions considerations. The physical conditions are mainly the orientation of the mesh and the reasonable selection of the simulated area. At the same time, it is better to make the open boundary parallel to one of the coordinate axes, and at the same time, to make the direction of the flow approximately perpendicular to the open boundary, the ideal results can be obtained.

Boundary conditions: In dynamic cases, the x-direction can be assumed to be:

$$\frac{\partial u}{\partial t} = -\frac{1}{\rho}\frac{\partial P}{\partial x} \tag{1}$$

In the formula, ρ is air density in kg/m3, u is wind speed in m/s, t is friction time in s, x is wind pull coefficient, P is friction point in traceable motion.

The inlet and outlet boundaries of the coefficient model are all set as closed boundary conditions. The boundary conditions of flow (water level), flow direction, flow velocity and water temperature are needed to input the water quality data of the canyon. The equation for calculating the water temperature of the canyon reservoir is obtained as follows:

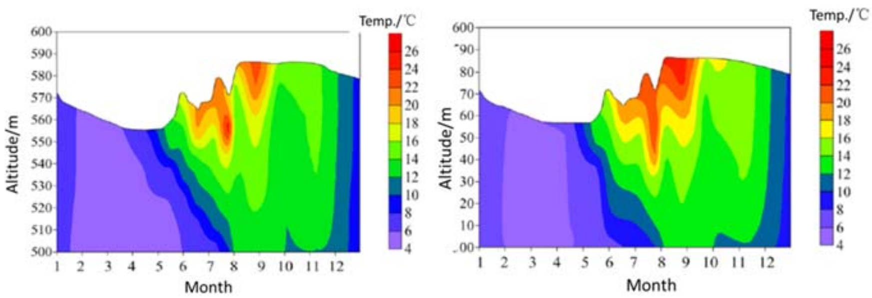
$$C = \frac{\partial u}{\partial t} \cdot \rho \tag{2}$$

Based on the above analysis steps, the change of water quality and water temperature in the canyon can be calculated, and the negative impact of traceability movement on the water quality of the canyon can be modeled and analyzed.

3 RESULTS

In order to verify the performance of this method, a test is carried out. Based on the measured water temperature data of a canyon in 2010, the water temperature of the canyon reservoir is measured by using the water temperature model of the canyon reservoir, and the specific heat of the water quality of the canyon is selected as 4217 J/(kg·°K) in the final model setting. For the solar radiation process, the ratio coefficient of the absorbed light energy on the surface of the water body is determined to be 0.2 and the vertical light energy attenuation coefficient is 0.5 m^{-1}.

The measured and simulated water temperature values of the Canyon Reservoir in 2010 are shown in Fig. 1.



(a)Actual value(b)Analog value

Fig. 1 Comparison of measured and simulated values of water temperature in Canyon Reservoir

From the measured data of the monitoring points in Fig. 1, it can be seen that the monthly variation of water temperature in the main reservoir area of the Canyon Reservoir is remarkable, and the surface water temperature varies relatively large due to the external influence, showing a seasonal variation between 5 and 24℃. The bottom water temperature of the reservoir is less affected by the outside world, and its variation range is relatively small, fluctuating between 4 and 11℃. The seasonal variation of water temperature in the reservoir area is obvious, showing the distribution trend of high summer and low winter. The highest water temperature in the reservoir area is 24℃, which occurs in the late August, and the lowest temperature occurs in the middle of February in winter, which is 4℃. It is basically consistent with the temperature change trend in the reservoir area,

which is delayed by about one month compared with the temperature change.
Therefore, the negative effect of stream tracing movement on the water quality of the canyon can be accurately analyzed by using the water temperature reservoir model of the canyon in this paper.

4 CONCLUSION

In order to promote the traceability movement more environmentally, a method of modeling and analyzing the negative impact of traceability movement on the water quality of canyons is proposed in this paper, aiming at the impact of traceability movement on the water quality of canyons. The water temperature model of Canyon reservoir based on the seasonal variation characteristics of Canyon water quality can accurately measure the change of Canyon water quality. The experimental results show that the method proposed in this paper can accurately analyze the negative impact of traceability movement on the water quality of the canyon, and provide a data basis for the development of traceability movement and the protection of the ecological environment of the canyon.

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