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Spatiotemporal features and delineation of water quality control zones for Taipei Water Resources District with multivariate manners

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ABSTRACT

This research adopts two methods of multivariate statistical analysis (MSA), principal component analysis (PCA) and cluster analysis (CA), to analyze the water quality parameters (WQPs) monitoring results for evaluating the dominant factors on the rivers water quality and the areas which should be protected carefully. The combination of PCA and CA provides a better technique to classify the water quality control zones. Although PCA is an effective tool to categorize the monitoring stations, it cannot conduct complex dimensional classification on all of the monitoring stations and parameters; whereas, CA can help to determine the correlations between different monitoring stations via the WQPs monitoring results and then provides a more reasonable classification numbers for further watershed management. In this research, 23 monitoring stations were classified into four water quality control zones by using PCA and CA methods. The results from PCA in various water quality control zones indicate that the amounts of total coliform (TC) can lead to various correlation with various WQPs based on the characteristics of regions and pollutant sources. By applying CA to further classify the WQPs of the monitoring station for midstream of Nanshi River, analysis of variance (ANOVA) tests found only the mean values of monitoring WQPs indices for TC and dissolved oxygen (DO) have significant differences. In terms of the water quality in this area, the wastewater from hot springs usages might cause 17% of the midstream of Nanshi River monitoring stations (Cluster A) to rise their TC values and slightly decrease both DO and pH values. In this region, TC is the WQPs indicator with the highest impact resulted from hot spring wastewater. Additionally, by applying PCA and CA, the correlation of WQPs and the effects that hot spring wastewater have on water quality can be further investigated.

Keywords: Principal component analysis; Cluster analysis; River water quality parameters

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