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Use of Multivariate Statistical Techniques for Water Quality Monitoring Network Assessment, Case of Study: Jequetepeque River Basin

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Abstract : A proper water quality management requires the establishment of a monitoring network. Therefore, evaluation of the efficiency of water quality monitoring networks is needed to ensure high-quality data collection of critical quality chemical parameters. Unfortunately, in some Latin American countries water quality monitoring programs are not sustainable in terms of recording historical data or environmentally representative sites wasting time, money and valuable information. In this study, multivariate statistical techniques, such as principal components analysis (PCA) and hierarchical cluster analysis (HCA), are applied for identifying the most significant monitoring sites as well as critical water quality parameters in the monitoring network of the Jequetepeque River basin, in northern Peru. The Jequetepeque River basin, like others in Peru, shows socio-environmental conflicts due to economical activities developed in this area. Water pollution by trace elements in the upper part of the basin is mainly related with mining activity, and agricultural land lost due to salinization is caused by the extensive use of groundwater in the lower part of the basin. Since the 1980s, the water quality in the basin has been non-continuously assessed by public and private organizations, and recently the National Water Authority had established permanent water quality networks in 45 basins in Peru. Despite many countries use multivariate statistical techniques for assessing water quality monitoring networks, those instruments have never been applied for that purpose in Peru. For this reason, the main contribution of this study is to demonstrate that application of the multivariate statistical techniques could serve as an instrument that allows the optimization of monitoring networks using least number of monitoring sites as well as the most significant water quality parameters, which would reduce costs concerns and improve the water quality management in Peru. Main socio-economical activities developed and the principal stakeholders related to the water management in the basin are also identified. Finally, water quality management programs will also be discussed in terms of their efficiency and sustainability.

Keywords : PCA, HCA, Jequetepeque, multivariate statistical
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