The application of ANNs and multivariate statistical techniques to characterize a relationship between total dissolved solids and pressure indicators: a case study of the Saf-Saf river basin, Algeria

Bachir Sakaa[a,b,*], Saifi Merdas[a], Toufik Mostephaoui[a], Hicham Chaffai[b], Azzedine Hani[b], Larbi Djabri[b]

[a]Scientific and Technical Research Center on Arid Regions CRSTRA, Omar El Bernaoui. BP 1682 RP Biskra 07000, Algeria, Tel. +213 670 16 83 50; email: sakaabachir@yahoo.fr (B. Sakaa), Tel. +213559 09 26 56; emails: saifieco@gmail.com (S. Merdas), mostephaoui66@gmail.com (T. Mostephaoui)
[b]Faculty of Earth Sciences, Laboratory of Water Resource and Sustainable Development (REED), Annaba University, BP 12 23000, Algeria, Tel. +213 772 34 65 62; email: hichamchaffai@yahoo.fr (H. Chaffai), Tel. +213 775 17 34 96; email: haniazzedine@yahoo.fr (A. Hani), Tel. +213 661 32 22 02; email: djabri_Larbi@yahoo.fr (L. Djabri)

ABSTRACT

With fast social and economic growth, stream water pollution in Saf-Saf river basin must consider appropriate control measures of the pollution sources. Hence, there is a need for a better knowledge and understanding of the pressure variables influencing the total dissolved solids of stream water. Saf-Saf river basin was chosen as the study area, and the data set included data on 9 variables for thirty different municipalities in the Saf-Saf river basin for monitoring year 2012. In this study, the effective variables have been characterized and prioritized using multi-criteria analysis with artificial neural networks (ANNs), and expert opinion and judgment. The selected variables were classified and organized using the multivariate techniques of principal components analysis (PCA) and factor analysis (FA). The results of ANN analysis indicate that domestic wastewater and industrial wastewater are the most pressing pollution sources, which is in contrast with the results of expert opinion in terms of ranking and prioritizing of pressure variables. The PCA/FA grouped the 30 municipalities into four groups based on their similarities, corresponding to municipalities of urban pollution (group I), very low pollution (group II), rural pollution (group III), and industrial pollution (group IV). Therefore, the identification of the main potential pollution sources in different municipalities by this study will help managers make better and more informed decisions about how to improve stream water quality degradation.

Keywords: Saf-Saf river basin; Total dissolved solids; Pressure indicators; Artificial neural networks; Principal component analysis; Factor analysis

*Corresponding author.