A Multidisciplinary Approach for Groundwater Potential Mapping in a Fractured Semi-Arid Terrain (Amezmiz Basin, Western High Atlas, Morocco)

AIT DHMANE Latifa [(1)(*)], AMRAOUI Fouad [(1)], HARROUD Aziz [(2)], MOUSTADRAF Jalal [(3)], BENJMEL Khalid [(1)]

(1) *Laboratoire Géosciences Appliquées à l'Ingénierie de l'Aménagement (GAIA), Université Hassan II Casablanca, Faculté des Sciences Ain Chock, Maroc.*
(2) *BET 4 GEO, 50 A, Massira 3, Marrakech, Maroc.*
(3) *Département de géologie, Faculté des sciences et techniques, Université Cadi Ayyad, Marrakech, Maroc*

(*) aitdhmane.latifa0123@gmail.com

Mots-clés : Amezmiz basin; frequency ratio; Shannon's entropy; AHP model ; GIS; Remote sensing

This study is focused on developing an approach for spatial mapping of groundwater by considering four types of factors (geological, topographical, hydrological, and climatic factors), and by using different bivariate statistical models, such as frequency ratio (FR), Shannon's entropy (SE) and AHP Models. The developed approach was applied in a fractured aquifer basin (Amezmiz Basin, Western High Atlas, Morocco), to map the spatial variation of groundwater potential. Fourteen factors (14) influencing groundwater were considered in this study, including slope degree, slope aspect, elevation, topographic wetness index (TWI), noued density, plane curvature, profile curvature, drainage density, lineament density, faults density distance to rivers and fault network, normalized difference vegetation index (NDVI), and lithology. The potential maps produced were then classified into five classes to illustrate the spatial view of each potential class obtained. The predictive capacity of the frequency ratio, Shannon's entropy and AHP models was determined using two different methods, the first one based on the use of flow data from 58 boreholes drilled in the study area, to test and statistically calibrate the predictive capacity of each model. The results show that the percentage of positive water points corresponds to the most productive areas (high water flow). On the other hand, the low water flows are consistent with the predicted unfavorable areas for hydrogeological prospecting. Additionally, the second validation method involves the integration of 900 Hz apparent resistivity data to identify conductive zones that are groundwater circulation zones. The interpretation of the geophysical results shows that the high-potential zones match with low apparent resistivity zones, and therefore promising targets for hydrogeological investigation. The FR, SE and AHP models have proved very efficient for hydrogeological mapping at a fractured basement area. The results suggest that the proposed approach is very important for hydrogeological mapping of fractured aquifers, and the resulting maps can be helpful to managers and planners to generate groundwater development plans and attenuate the consequences of future drought.