Clustering of groundwaters by Q-mode factor analysis according to their hydrogeochemical origin: A case study of the Cariri Valley (Northern Brazil) wells

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Abstract

Factor analysis was applied to 56 groundwater samples collected from wells located in the Araripe Sedimentary Basin, in the north-east of Brazil. The parameters are a set of 9 physicochemical, chemical, and isotope data, constituted by electrical conductivity (EC), ionic concentrations of Ca^{2+}, Mg^{2+}, Na^+, K^+, Cl^-, SO_4^{2-}, alkalinity and $\delta^{18}O^0/_{00}$. In R-mode factor analysis, the first 3 factors explain 62% of the variance, their loadings allowing the interpretation of hydrogeochemical processes that take place in the area. Q-mode factor analysis on the 56 water samples decreases space dimensionality to 6, explaining 93% of the total database information. With the aid of a scalar and angular measurement method, objects were clustered, resulting in 11 groups classified according to their inherent characteristics, related to their hydrogeological origin.

Keywords: hydrogeochemistry, R-mode factor analysis, Q-mode factor analysis, Araripe sedimentary basin, Cariri valley