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Classification of Groundwater Quality Data using Hydrochemical Parameters

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ABSTRACT

The Almyros plain is located in the central eastern part of Greece, covering an area about of 110 km2, with a mean altitude of 30 m. The plain is formed of recent unconsolidated materials consisting of sands, pebbles, and fine clay to silty sand deposits. The main aquifer systems are developed in limestone (karst aquifer) and in coarse post alpine deposits.
The area is characterized by intense agriculture, which consumes the major sector of water demands. The aquifer system shows signs of quality deterioration during the last decades. Degradation of groundwater quality is mainly caused by seawater intrusion and nitrate pollution.
In order to classify the groundwater quality data, the following hydrochemical parameters are used: (1) The index of Revelle R=rCl-/(rHCO3-+rCO32-), where r=meq/L, (2) Ionic strength =0,5 , where i is the molar concentration of the i-th ion (mol/L) with charge Zi, (3) Base Exchange Index, BEX= (Na+ + K+ + Mg2+) −1,0716 Cl- (meq/L) and (4)
Seawater Mixing Index (SMI) based on concentrations of Na+, Mg2+, Cl- and SO42-.
For this reason, the results of chemical analyses from 63 samples, collected during the wet and dry periods of the years 2006 and 2007 were used. Based on the values of the aforementioned parameters maps showing their distribution were illustrated. Two main groundwater types may be identified: Ca-HCO3 (freshwater) and Na-Cl (water affected by seawater intrusion). Seawater intrusion phenomena are recorded in both, southern and northern part of the study area, due to overexploitation and low ability of refreshing. In the southern part the seawater intrusion phenomena are more intensive than the northern part, due to the hydraulic communication between alluvial and karstic aquifers. Finally, the results of the above methods are compared and their credibility is controlled.