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Statistical and hydrogeochemical approach to study processes that affect groundwater composition in the Ferrara province (Italy)

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The ground water should not be seen only as a reserve for the water supply, but also be protected for its environmental value. Groundwater plays an essential role in the hydrological cycle for which the characterization, pollution prevention, monitoring and restoration are essential in view of the recovery and identification of the water bodies to be submitted to recharge for the adaptation to DM n. 100/2016.
Groundwater of Ferrara province presents salinisation problems and pollution of noxious metals that can be mitigated through recharge processes evaluated based on the specific site characteristics. It is essential to know the hydrogeochemical characteristics of different aquifer levels. To do this have been discuss analytical results of groundwater (2014-2015 monitoring phreatic ground water and temporal series from 2003-2015 A1-A2-A3 samples from Emilia Romagna databases). Results showed that in the territory analyzed insist both salinization and refreshening processes.
Factor analysis(FA) conducted on samples has divided them into three groups. 1: samples affected by ionic exchange, 2: pH reaction on heavy metal, 3: samples affected by mineralization.
The geochemical groundwater facies changed from Ca-HCO_3, and $NaHCO_3$ with a small samples group of CaSO4 and through geochemical investigations were observed the reactions that take place in the waters mixing of different composition. The Na excesses are explained by ionic exchange processes.
A determinant role is played by ionic exchange between Ca and Na. In this territory is important also the role of CH4 presence which typically rises towards the surface along faults and fractures and influence rise of deep water with different composition. On samples selected from FA Group 1 has been observed an increase of the CEC (Cation exchange capacity). Adsorption–desorption exchanges take place between water and the fine fraction sediment rich in clay minerals. Higher CEC values are found in rich organic substance areas which is noticeably water sediment interaction contributing to the increase of some elements (Ca, Na, Mg, K). The salinization processes are attributable to a change in the weather conditions, with increased evapotranspiration and change in pH that leads to the decomposition of organic matter resulting in an increase of Na in the waters. The refreshening processes involving deepwater characterized by a marked increase in HCO_3. Overall, mixing, cation exchange and oxidation of organic matter are identified as the major processes determining the general groundwater quality. This approach represents a new method of identification and classification of phreatic and deep groundwater and identifies areas on which it would be interesting to intensify monitoring to see which water bodies may be intended for regeneretion through innovative processes.