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Dueterim excess of groundwater as a proxy for recharge in an evaporative envrionment

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Groundwater resources in an arid region are stressed due to the lack of sufficient amount of replenishment and high rates of evaporation. Rainfall as the main source of recharge in the United Arab Emirates (UAE), which is located in the southeastern part of the Arabian Peninsula, is scanty as the average annual rainfall is about or below 100 mm. The deuterium excess (*d-excess*) parameter is used to characterize the groundwater and to determine the sources of vapour masses producing rainfall of carbonate aquifer in the southeastern part of the Arabian Peninsula. The deutrium excess is represented by the following equation: *d-excess*= δD – 8δ^{18}O. In order to meet the objectives of this study, 38 groundwater samples were collected from the study area and analzyed for stable isotopes of oxgyen and hydrogen. The results showed that the deuterim excess for groundwater varies signficantly; it ranges from -21.4‰ to 4.51‰. It is noted that the deuterim excess of groundwater has both negative and positive values. Samples that located in the north and south contain negaive values of d-excess suggesting old recharge and greater degree of evaporation. It is also observed that the negative values of deuterim excess assocaited with heavier values of δ^{18}O and δD. However, samples that located in the east are thermal and hosted in carbonate rocks. The d-excess of those samples is charactreirzed by positive values indicating modern recharge and low degree of evaporation. In addition to that, the groundwater in the east has deuterium exces less than Craig's value (+10‰) and there is no shift in the isotopic sigantures of hydrogen revealing that carbonate rocks contain small amount of hydrogen which can exchange with water. The isotopic compositions of groundwater in the east suggests that this water must be of the "juvenile" water with small amounts of meteoric origin. The isotopic signatures of oxygen and hydrogen in groundwater of the east are lighter relative to samples located in the south and north of the study area indicating recharge at elevated mountains.

The results also showed that δ^{18}O is increased with decreasing the d-excess supporting the fact that the evaporation is the main process affecting the isotopic signatures of oxygen and hydrogen.