Hydrochemistry of groundwater in Plateau of Kasserine in Central Tunisia and its suitability for agriculture use by statistical analyses and geochemical investigations

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The plateau of Kasserine is located in Central Tunisia in an arid climate. Groundwater exploited for Miocene aquifer is the main water resource for the region. In downstream, the system is composed of unconfined Miocene sandstone with a variable thickness from 10 to 200 m. In upstream, the aquifer is overlain by a layer of marl exceeding the thickness of 200 m. Concentration of 38 parameters (major and minor elements) in 18 samples collected during February 2014, were considered to determine the origin of mineralization and the suitability of groundwater for irrigation. The understanding of the geochemical behavior was achieved by using conventional classification techniques, correlations and statistical analyses. Water mineralization is dominated by precipitation of calcite and dolomite and dissolution of halite, gypsum and anhydrite. Interpretation of analytical data showed that the water facies gradually change from Ca-HCO_3 type to Ca-SO_4 type and are controlled by rock-water interaction. This classification has been verified by cluster analyses which show that the wells are divided into two groups based on similar groundwater characteristics. Application of Principal Component Analysis helped to delineate the variables responsible for water quality that are mostly related to Na^+, Cl^-, K^+, Ca^{2+} Mg^{2+}et SO_4^{2-}. Sustainability of groundwater for irrigation, based on the Richards diagram, suggests that groundwater serves good irrigation quality in the area. Data points used in this study fall within the medium salinity-low sodicity (C2-S1) and high salinity-low sodicity (C3-S1) fields, which ascribe good irrigation quality to groundwater from this aquifer.

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Climate predictions for urban areas using remote sensing and dynamic modeling: A case study of Hong Kong

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Temperature projections for Hong Kong have been carried out by the Hong Kong Observatory (HKO) in recent years. These projections have largely been based on the local climate data collected at the HKO Headquarters and data obtained from the Intergovernmental Panel on Climate Change (IPCC). These projections have only been able to reflect the expected temperature change at the HKO Headquarters according to global warming predictions but have paid little attention to the effects of global warming and urbanisation at local scale across the whole of Hong Kong. This research has examined temperature changes due to both global warming and urbanisation effects independently and applied them differentially over the whole of Hong Kong. The effect of global warming on temperature was estimated by regressing the IPCC data against the background temperature recorded at the Ta Kwu Ling (TKL) climate station which is assumed to be free from urbanisation. Results suggest a background temperature increase of between 0.10°C and 1.29°C (with an ensemble of 0.67°C) over the next three decades to 2039 depending on different emission scenarios. Long-term temperature data and a measureable urbanisation parameter (plot ratio) surrounding different automatic weather stations (AWS) were used to model the temperature changes for different degrees of urbanisation. Models representing daytime and nighttime respectively were developed based on these data and the results suggested a logarithmic relationship between the rate of temperature change and plot ratio (degree of urbanization). When the effects of global warming and present and future urbanisation are known the actual rate of temperature increase at different locations across Hong Kong can be calculated. Future temperature maps can therefore be produced by applying the rate of increases to current temperature maps. The current temperature patterns over the whole of Hong Kong were derived from two ASTER thermal images for summer daytime and night time respectively. By a method of dynamic raster modeling, the temperatures are projected towards 2039 in 10-year intervals on a per-pixel basis according to the degree of urbanization predicted. The projections were validated by projecting the temperature trends from 2039 backwards to past decades at different AWS and calculating the RMS errors between the actual and projected changes for the stations. The average RMS errors based on eight AWS were found to be 0.19° C for daytime and 0.14°C for night time.

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