地下水補注地點選擇的新型混合框架

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報告者：張睿宇
指導教授：陳瑞昇 老師
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摘要

由於不正確的地點選擇有時會導致人工補注項目的失敗，因此有必要通過采用新技術來提高此類項目的有效性並將其失敗率降至最低。因此，本研究利用決策模型、數值地下水建模和聚類技術的組合，來確定適合實施人工補注項目的地點。該混合方法應用於位於伊朗西南部的 Yasouj 蓄水層。在第一階段，通過採用 AHP 決策模型，從先前研究中使用的 21 個標準中選擇了水力傳導係數、比出水率、坡度、土地利用、地下水深度和蓄水層厚度。然後，將選定的標準輸入到傳統的 k 均值聚類模型中。利用輸出，將蓄水層劃分為七個不同的區域或聚類。然後，將這些聚類與土地利用圖匹配，並從一些廢棄土地區域中選擇最終的選擇來實施人工補注項目。最後，使用 GMS 軟件中的 MODFLOW 代碼來模擬地下水位並對選定的地點進行聚類，以增加地下水位。結果表明，蓄水層北部和西部的 Cluster 2 和 6 的地下水位增加最顯著（分別為 43 和 27 厘米）。因此，此方法可以應用於乾旱和半乾旱地區的其他類似蓄水層，以選擇最佳的人工補注地點，並防止洪水水流的損失。

關鍵字： 定量建模、MODFLOW、人工補注、AHP、K-means、GMS

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Research Paper

A new hybrid framework of site selection for groundwater recharge

Saman Javadi [a,*], Masoud Saatsaz [b], S. Mehdy Hashemy Shahdany [*,a], Aminreza Neshat [d], Sami Ghordoyee Milan [a], Sara Akbari [e]

[a] Department of Water Engineering, College of Aburaihan, University of Tehran, Iran
[b] Center for Research in Climate Change and Global Warming (CRCC), Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran
[d] Department of GIS/RS, Faculty of Natural Resources and Environment, Science and Research Branch, Islamic Azad University, Tehran, Iran
[e] Department of Civil Engineering, Altaha Institute of Higher Education, Tehran, Iran

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ABSTRACT

Since incorrect site selection has sometimes led to the failure of artificial recharge projects, it is necessary to increase the effectiveness of such projects and minimize their failure by employing new techniques. Therefore, the present research used a combination of decision-making models, numerical groundwater modeling and clustering technique to determine suitable sites for implementation of an artificial recharge project. This hybrid approach was employed for the Yasouj aquifer located in southwestern Iran. In the first stage, by employing an AHP decision-making model, hydraulic conductivity, specific yield, slope, land use, depth to groundwater, and aquifer thickness were selected from 21 criteria used in previous research. The selected criteria were then entered as input into the classical k-means clustering model. Using the output, aquifer was divided into seven different regions or clusters. These clusters were then matched with the land use map, and some of the abandoned land areas were selected as the final option for implementing the artificial recharge project. Finally, the MODFLOW code in the GMS software was used to simulate the groundwater level and cluster the sites selected, with regards to increase in groundwater level. Results indicated that the most significant increases in groundwater level (43 and 27 cm) were those of Clusters 2 and 6 in the northern and western parts of the aquifer, respectively. Therefore, this approach can be used in other similar aquifers in arid and semi-arid regions to select the best sites for artificial recharge and to prevent loss of floodwaters.