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Evaluation of ERA5 Reanalysis Dataset for Simulation of Climatic Variables and Water Harvesting from Humidity (Case Study: Qazvin Province)

S. Koohi, B. Bahman Abadi, F. Safari, Z. Partovi, M. Khajehvand Sas and H. Ramezani Etedali[1*]

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Abstract

Water supply remains a significant challenge in arid and semi-arid regions, and in addressing this concern, unconventional water sources have gained prominence. Notably, the extraction of water from air humidity, classified as an unconventional water source has seen increased adoption. Diverse techniques have been developed to achieve this goal, with the utilization of mesh networks being particularly prevalent. Consequently, this study assesses the evaluation of the performance of the ERA5 dataset in the simulation of atmospheric variables that influence the ability to assess water harvesting from air humidity (including temperature, wind speed, and water vapor pressure). Also, the possibility of water harvesting from air humidity was investigated in Qazvin Province. The outcomes demonstrated the benefit of incorporating adjustment coefficients in estimating temperature and wind speed using the ERA5 dataset. Based on these findings, the northwestern and southern regions of the province (Kuhin and Takestan) exhibit notable potential during spring and summer for water harvesting from the atmosphere. The peak water harvesting for these stations in the summer is estimated at 10.2 and 9.7 l/day.m^2, respectively. Using the ERA5 reanalysis dataset, the annual average potential for water harvesting in the stations was evaluated at 7.9 and 4.6 l/day.m^2, respectively. Notably, the minimum water harvesting capacity during the summer season recorded in Qazvin is equal to 3.39 l/day.m2, which can be planned for use in irrigation requirements of green spaces, fields, or gardens.

Keywords: Unconventional water, Mesh networks, Water crisis, Remote sensing

1. Department of Water engineering, Faculty of Agriculture, University of Imam Khomeini International, Qazvin, Iran.

*: Corresponding author, Email: Ramezani@eng.ikiu.ac.ir