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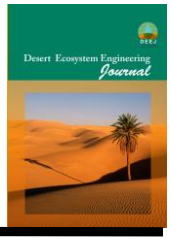

Optimizing Intensity-Duration-Frequency Curves in Consistency with Genetic and Particle Swarm Algorithms: A Case Study of Urmia Lake's Basin

Emad Fahim[1], Reza Ghazavi[2], Hoda Qasemieh[3], Ebrahim Omidvar[4]

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Extended Abstract

Introduction: Collected from sixty-six meteorological stations, the most recent data concerning the intensity-duration-frequency curve in Iran have been recorded in 1374. While rain gauges are required for physically obtaining such data, the collected data may be fraught with inaccuracies, considering the fact that the meteorological data of the extremely remote areas may be impossible to be gauged. Therefore, intensity-duration-frequency formulas are used to reduce the rate of such inaccuracies. While many formulas have so far been developed to be used for obtaining the required data regarding intensity-duration-frequency curves, they could only be applied to those areas whose regional rates have been estimated.

This study sought to identify and optimize such formulas' rates together with the computational algorithms in the Urmia Lake's basin. Then, the efficiency of the mass-fine computational algorithm and the genetic algorithm was measured and compared. Finally, the influence of climate change on intensity-duration-frequency diagrams in the basin was investigated using the nearest neighbor algorithm.

Materials and Methods: Considering the precipitation intensity data collected from Western Azerbaijan Province's Regional Water Organization, first, the method for selecting the function of the precipitation's intensity-duration-frequency was determined. Then, the fitting methods for the different return years' functions of the intensity-duration were presented.

As for the extraction of IDF curves, the required data regarding the highest annual precipitation rates in 30-, 45-, and 60-minute durations were obtained from the statistics published by the Iranian Meteorological Organization. Then, the precipitation rate was investigated in twenty-seven meteorological stations of the Urmia Lake, and the intensity-duration-frequency curves were made accordingly. Taking the extracted curves into account, the regional coefficients of Abkhezr's equation were measured and optimized based on the Genetic and Particles Swarm algorithms. Then, to determine the measurement accuracy, the daily precipitation rates were extracted from five sample meteorological stations in terms of 2-200 return years and millimeters per hour unit using the SMADA software. Finally, the IDF curves were made based on the optimized rates and Abkhezr formulas.

Results: The average rates of optimizing the coefficients of the Abkhezr formula with both algorithms mentioned above were found to be the same, bearing a very close prediction. Taking into account the average intensity and continuity rates of the IDF curves in terms of an integral diagram, the study undertook to compare the measurement of pre- and post-optimization IDF curves in five sample stations. Generally, the findings of this study indicated the accuracy of the Abkhezr Formula's rates (with an acceptable closeness) in all meteorological

1. PhD. Student, Department of Nature Engineering, Faculty of Natural Resources and Earth Sciences, University of Kashan, Kashan, Iran

2. Professor, Department of Nature Engineering, Faculty of Natural Resources and Earth Sciences, University of Kashan, Kashan, Iran, Corresponding Author; Ghazavi@kashanu.ac.ir

3. Associate Professor, Department of Nature Engineering, Faculty of Natural Resources and Earth Sciences, University of Kashan, Kashan, Iran

4. Associate Professor, Department of Nature Engineering, Faculty of Natural Resources and Earth Sciences, University of Kashan, Kashan, Iran

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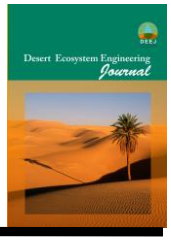

stations of the Urmia Lake except for the Mahabad camp. It could therefore be argued that the average optimized regional rate are hundred percent fitted with the obtained rates.

Discussion and conclusion: The findings of the study suggested a high accuracy of the Abkhezr formula's coefficients in all Urmia Lake's meteorological stations (with acceptable closeness) except for the Mahabad camp, with the Siyah-Ceshmeh station having the best fitting rate. In this regard, the fitting rate of the coefficients in the above-mentioned stations differed merely at thousandth and ten-thousandth decimal rates. On the other hand, the pre-and post-optimization IDF curves were found to have slight differences, bearing an acceptable fitting. Moreover, the comparison of the integral curves of the IDF parameters indicates the great consistency between the results of this study and the formulas developed by Abkhezr and Bell. Furthermore, a good correlation was found between the results of this study and the research findings of Aghajani and Kerami, which were based on Sherman and Bernahu's formulas. As t and T in Bell's formula can have a local dependence in each area, such a dependence has been included in Abkheder's formula based on regional coefficients.

The results also showed that the PSO algorithm performed more efficiently in terms of optimization and its intended function is closer to zero, as it measures each particle with other neighboring particles, putting it in numerous cycles. However, the sensitivity analysis revealed a very slight difference between the two algorithms used in this study, suggesting that both algorithms could be applied.

Keywords: Optimization, Meteorological Stations, Formula, Precipitation Patterns, Regional Coefficients.