Desalination and Water Treatment
www.deswater.com
doi: 10.5004/dwt.2023.29531

293 (2023) 67–81
May

Linear and non-linear ensemble concepts for pan evaporation modeling

Jazuli Abdullahi[a,*], Gözen Elkiran[b], Fidan Aslanova[c], Derin Orhon[d]

[a]*Center for Clean Energy and Climate Change, Baze University, Plot 686 Cadastral Zone COO, Abuja, Nigeria, email: jazuli.abdullahi@bazeuniversity.edu.ng*
[b]*Department of Civil Engineering, Faculty of Civil and Environmental Engineering, Near East University, Nicosia, Mersin 10, Turkey, email: gozen.elkiran@neu.edu.tr*
[c]*Department of Environmental Sciences and Engineering, Faculty of Civil and Environmental Engineering, Near East University, Nicosia, Mersin 10, Turkey, email: fidan.aslanova@neu.edu.tr*
[d]*Department of Environmental Engineering, Faculty of Civil Engineering, Istanbul Technical University, The Science Academy, Istanbul, Turkey, email: orhon@itu.edu.tr*

Received 1 December 2022; Accepted 3 April 2023

ABSTRACT

Modeling of pan evaporation (Ep) is of paramount importance in the evaluation of drinking water supplies, planning of regional water resources and reservoir management. The main aim of this study is to investigate the accuracy of linear and non-linear ensemble approaches for monthly Ep modeling in Erbil and Salahaddin meteorological stations of Iraq. For this purpose, sensitivity analysis was performed to determine the dominant input parameters. The results showed that T_{mean}, T_{max} and T_{min} are the most effective parameters. Thereafter, two scenarios were involved for the Ep modeling. In scenario 1, the ability of artificial neural network, least-squares support-vector machine and multiple linear regression models was examined for the estimation of Ep. The results demonstrated that different input combinations led to different performance, model 3 (which has T_{mean}, T_{max}, T_{min}, R_H) for Erbil station and model 2 (which has T_{mean}, T_{max}, T_{min}) for Salahaddin station provided the best performance among several models developed. In scenario 2, linear and non-linear ensemble approaches were employed as simple linear average, weighted linear average and non-linear ensemble (NLE) models to improve predictions of the single models. The results reported that ensemble modeling could improve performance of single models and NLE model provided the best results due to its non-linear nature. The general results demonstrated that the proposed ensemble models could improve predictions of single models up to 5% and 16% for Erbil and Salahaddin stations, respectively.

Keywords: Pan evaporation; Artificial neural network; Ensemble modeling; Erbil; station

* Corresponding author.