Abstract

Precision measurements of rainfall have many applications in climate research, agriculture, drought, natural disasters and hydrology. Since precipitation metering stations are scattered and access to them are usually delayed, there are other ways to estimate rainfall. The prediction of rainfall is very important for developing countries whose economies are based on agriculture. This research has been designed to estimate rainfall in Guilan province using artificial intelligence methods including artificial neural networks and comparative neuro-fuzzy inference system. The study area includes the northwestern areas of the Alborz Mountains and the western part of the southern shores of the Caspian Sea. The average rainfall in the province is about 1506 mm per year. In the highlands of the province, about 8.4 billion cubic meters (52.5%) of the rain falls out of reach of evapotranspiration. In artificial intelligence techniques that include artificial neural networks, the most important issue in these models is to select appropriate inputs to the model to achieve desired outputs. The neuro-fuzzy comparative inference system and the classical statistical theory are used to examine patterns and systems including statistical uncertainty (associated with random events). According to the results, artificial neural networks have been superior to fuzzy neural networks in mountainous, semi-humid and cold regions. The superiority of the neuro-fuzzy adaptive inference system is in the temperate and humid region. Rasht station with values of R2, RMSE, NS and MAD coefficients was 0.62, 0.61, 0.62, and 13.41 and Lahijan stations with values of 0.73, 57.77, 0.70, 87/12 respectively, are considered as mountainous regions. Talesh station with coefficients R2, RMSE, NS and MAD with values of 0.42, 59.59, 0.49, 13.23 and Astara station with values of 0.55, 10.39, 0.43, 46 / 24 are considered as semi-humid and cold areas. These results show that neural networks have the lowest error, the highest Nash coefficient and the highest determination coefficient. At Anzali station, the coefficients R2, RMSE, NS and MAD were 0.77, 69.86, 0.78 and 15.62 respectively, which are considered as moderate and humid areas and has had the best performance in the neuro-fuzzy comparative inference system estimates.

Keywords: Neuro-Fuzzy Adaptive Inference System, Artificial Neural Network, Estimation of Rainfall, Weather Areas of Guilan Province.

University of Zabol
Graduate school
Faculty of Water and Soil

Department of Watershed Engineering
The Thesis Submitted for the Degree of M.Sc
(in the Field of Water Resource Engineering)

Efficieny of Artificial Neural Network and Neuro-Fuzzy Comparative Inference Models on Rainfall Prediction in Gilan Weather Condition

Supervisors:
Dr. M. Nohtani

Advisors:
Dr. M. R. Dahmardeh
O. Norouzi engenayi

By:
M. J. Khalafi Khotbehsara

Spring 2018