Reservoir Evaporation Prediction Modeling Based on Artificial Intelligence Methods

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Abstract: The current study explored the impact of climatic conditions on predicting evaporation from a reservoir. Several models have been developed for evaporation prediction under different scenarios, with artificial intelligence (AI) methods being the most popular. However, the existing models rely on several climatic parameters as inputs to achieve an acceptable accuracy level, some of which have been unavailable in certain case studies. In addition, the existing AI-based models for evaporation prediction have paid less attention to the influence of the time increment rate on the prediction accuracy level. This study investigated the ability of the radial basis function neural network (RBF-NN) and support vector regression (SVR) methods to develop an evaporation rate prediction model for a tropical area at the Layang Reservoir, Johor River, Malaysia. Two scenarios for input architecture were explored in order to examine the effectiveness of different input variable patterns on the model prediction accuracy. For the first scenario, the input architecture considered only the historical evaporation rate time series, while the mean temperature and evaporation rate were used as input variables for the second scenario. For both scenarios, three time-increment series (daily, weekly, and monthly) were considered.

Keywords: tropical environmental; evaporation; artificial intelligence models

1. Introduction

1.1. Background

The evaporation rate is a significant hydrological parameter for the survey, control, and management of water resources [1,2]. It is known that the effect of evaporation losses on the water budget of reservoirs or lakes is considerable and, hence, contributes significantly to lowering the water surface level. As a result, water losses by way of evaporation should be considered in the design of irrigation system water requirements and various water resource management programs for dams and reservoirs.

Broadly, there are two types of methods for estimating the evaporation value: direct and indirect. The direct method mainly relies on real measurements via A and U pan classes. Although the direct method gives an accurate estimation of the evaporation rate, it is not reliable due to poor maintenance. In fact, this method results in missing the time-series evaporation data.