

Abstract

The risk of flood is affected by factors such as land use, meteorological events, hydrology and the topology of the land. In South Africa, the geography of apartheid, as another example, is also a key factor affecting flood vulnerability since it influenced the geographic location of population sectors. Poverty encouraged settlement patterns that neglected flood risk in certain areas, especially in rural areas. The Msundusi area is one such region which has been vulnerable to flood disasters. This research explores the use of artificial neural network models to predict the onset of floods. Rainfall is considered as the primary factor influencing the likelihood of flood, and a number of artificial neural network architectures were evaluated as flood prediction models. The mean percentage accuracy and correlation coefficient were used to evaluate the performance of trained neural networks. Training simulation results indicate that a feed-forward model with six input neuronal units, four hidden units and one output unit produced the best predictive results for this type of neural network. However, recurrent network models are shown to perform better than feed-forward models. The best flood prediction result was obtained for the recurrent Elman network, with a mean prediction percentage of 58.8%.

While the results obtained are not as good as some published results, those techniques involved a number of predictive variables, and in some cases required in-depth knowledge of the characteristics (for example hydrological, topographic or land use properties) of the region and physics of these processes. A key advantage of this approach is that no such knowledge is required. Moreover, the method used is parsimonious in that only a single predictive variable, namely precipitation is needed to model flood prediction. Under these conditions, this approach produced acceptable results for the neural network architectures that were studied.