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Abstract:

Drought is the most frequent natural disaster in Algeria during the last century, with a severity ranging over the territory and causing enormous damages to agriculture and economy, especially in the north-west region of Algeria. The above issue motivated this study, which is aimed to analyse and predict droughts using the Standardized Precipitation Index (SPI). The analysis is based on monthly rainfall data collected during the period from 1960 to 2010 in seven plains located in the north-western Algeria. While a drought forecast with 2 months lead-time is addressed using an artificial neural network (ANN) model. Based on SPI values at different time scales (3-, 6-, 9-, and 12-months), the seven plains of north-western Algeria are severely affected by drought, conversely of the eastern part of the country, wherein drought phenomena are decreased in both duration and severity. The analysis also shows that the drought frequency changes according to the time scale. Moreover, the temporal analysis, without considering the autocorrelation effect on change point and monotonic trends of SPI series, depicts a negative trend with asynchronous in change-point timing. However, this becomes less significant at 3 and 6 months' time scales if time series are modelled using the corrected and unbiased trend-free-pre-whitening (TFPWcu) approach. As regards the ANN-based drought forecast in the seven plains with 2 months of lead time, the multi-layer perceptron networks architecture with Levenberg–Marquardt calibration algorithm provides satisfactory results with the adjusted coefficient of determination (R2adj$\square$adj2) higher than 0.81 and the root-mean-square-error (RMSE) and the mean absolute error (MAE) less than 0.41 and 0.23, respectively. Therefore, the proposed ANN-based drought forecast model can be conveniently adopted to establish with 2 months ahead adequate irrigation schedules in case of water stress and for optimizing agricultural production.

Key words: Hydro-chemistry ; Management ; Isotopic analysis ; Groundwater ; Upper and Middle Cheliff ; Algeria

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