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Meteorological Drought Prediction Based on Evaluating the Efficacy of Several Prediction Models

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Abstract
The prediction of drought is critically important for early warning and mitigation of its impacts. Selecting the most appropriate prediction model provides opportunities for reducing the drought's adverse effects on different sectors. So, in this study, the capability of several prediction models to predict drought (based on the Reconnaissance Drought Index (RDI) in 1 and 3-month time scales) was compared. The models included stationary time series models (ST), cyclostationary time series (CST) models, autoregressive fractionally integrated moving average (ARFIMA), periodic autoregressive fractionally integrated moving average (PARFIMA), first-order Markov chain (FOMC), and second-order Markov chain (SOMC). For choosing the best-fitted model, the correlation coefficient (R^2) and absolute values of T-Statistics (AVTS) between predicted (using each model) and observed RDI in 1 and 3-month time scales at 15 stations during the period 2017–2021 in Iran were used. For this purpose, the 1967 to 2016 data series was used. Then the best prediction model (with the highest performance level) was used to predict 1 and 3-month RDI in the investigated stations from 2022 to 2031. For this purpose, 1967 to 2021 data series was used. The results showed that CST models with the highest R^2 values (significantly at the 5% level in both time scales in all stations) and the lowest AVTS values (significantly at the 1% level in both time scales in all stations) for the best-fitted models in 1 and 3-month time scales had the best performance in predicting monthly and seasonal RDI. To predict monthly and seasonal RDI in all stations, the PARIMA (24, 0, 0), 12 and PARIMA (20, 0, 0), 4 models were used as the best models, respectively. The predictions indicated that normal (No) and moderately (Mod) dry classes would be more frequent in both time scales. This study demonstrates that CST models can be useful tools for drought prediction and management.

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