



Long-term temporal trend analysis of climatic parameters using polynomial regression analysis over the Fasa Plain, southern Iran

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Abstract

The climate conditions of Iran vary from extremely arid in south parts to very humid in the northern parts. In the past two decades, severe droughts and population growth as well as inappropriate management of water resources have intensified Iran's water shortage problems. In this study, we used the Polynomial Regression Analysis (PRA) to investigate the trend of climatic parameters, including minimum and maximum air temperature, total monthly rainfall, average monthly relative humidity, sunshine hours, and average monthly wind speed at Fasa Plain, southern Iran with semi-arid climate during 1967–2019. For each parameter, a significant trend in each month was determined by the model contained a linear effect (t), quadratic effect (t^2), cubic effect (t^3), and so on. Results indicated that the temporal trend of minimum and maximum temperature was significantly increasing (maximum values of 0.358 and 0.316 °C year⁻¹ in March and April, respectively) during 1967–2014. While the trend of rainfall has fluctuated and almost significantly decreased (maximum decrement of -3.367 mm year⁻¹ in March). Sunshine hours had an increasing trend in recent decades (maximum of 3.220 h year⁻¹ in December), wind speed had a quite negative trend (maximum reduction of -0.194 m/s year⁻¹ in January), and relative humidity had a more decreasing trend (maximum decline of -1.284% year⁻¹ in November) in the studied duration. Total changes in the studied meteorological parameters are indicative of more warmth and dryness of the region. Rainfall reduction in March and April is in agreement with warming and drying, during 1967–2014. Then, the validation of the obtained equations was assessed using meteorological data of the study area during 2015–2019. The forecasted results showed the acceptable values of coefficient of determination (R^2) between forecasted and actual data. In general, the results of this study indicate a serious warning about warming and climate change in the studied region.

1 Introduction

The influence of climatic parameters variation on crop water requirement is a matter of great concern for countries like Iran, where the temporal variability in rainfall often influences the water supply (Bahrami et al. 2018, 2019b; Zarei et al. 2019). By experiencing historical and sudden changes in weather, it is expected that most areas of Iran

including southern areas will be affected by a changing climate (Zarei et al. 2016, 2017; Bahrami et al. 2017, 2019a). The expected ascending trend of global temperature due to the likely continuous release of greenhouse gases in the next decades can potentially affect the hydrological cycle from global to regional scales (Seager et al. 2013; Yang et al. 2014; Kouhestani et al. 2016; Shen et al. 2018). It has been realized that global or continental scale observations of historical climate are less valuable for local or regional scale planning (Taxak et al. 2014). The climate of an area is commonly expressed in terms of climatic parameters such as temperature, relative humidity, wind speed, solar radiation, rainfall, and sunshine hours (Bahrami and Mahmoudi 2020). Besides the application of climate models, temporal variability of climatic parameters can also be investigated using the analysis of long-term climatic data. In this regard, various statistical and mathematical approaches have been applied recently to assess the variability of the climatic parameters

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