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EXTENDED ABSTRACT

Extraction of Intensity-Duration-Frequency Curves Using Fractal Theory and Evaluation of Climate Change on it (Case Study: Bushehr)

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Climate change, Global warming, Intensity-Duration-Frequency curves, IDF curves, Fractal theory, Mono-fractal.

1. Introduction

Climate change has caused changes in the frequency and magnitude of heavy rainfall, which affects the design standards of some hydrological structures (Yousef and Taha, 2015). Rainfall intensity-duration-frequency (IDF) curves are a standard tool for hydrological risk analysis and design (Mohymont, 2004; Veneziano, 2002). IDF curves show useful information about the occurrence of floods in an area and that in the future a certain amount of rainfall or a certain volume of flow will return again (Basumatary and Sil, 2018). Because the trend of severe rainfall events is expected to change in the future, this affects IDF curves, so these curves need to be updated (Srivastav et al. 2014). The need for such an understanding stems from the fact that existing drainage systems are designed to deal with past rainfall events and may not be sufficient to compensate for future rainfall characteristics (Shrestha et al. 2017). In developing countries such as Iran, the large country area as well as the shortage of rain gauge stations and/or the statistical period of the recorded data, makes it difficult to estimate IDF curves (Zamani Nouri, 2011).

2. Methodology

The fractal theory is a new method that enables us to generate IDF curves for a desired duration and return period based on a few number of required parameters (i.e. maximum annual rainfall data in daily duration) (Nouri Gheidari, 2012).

3. Results and discussion

To detect changes in rainfall intensity at different continuities in the past (1982 to 2019) and the future (2021 to 2058), all return periods were compared. Fig. 1 and 2 show a comparison of the curves. According to Fig. 1, under the RCP4.5 scenario, the maximum rainfall intensity has increased in all return periods; That is, the curves are shifted upwards. Under the RCP8.5 scenario (Fig. 2), except for the return period of 2 years, when the maximum precipitation intensity decreased, it increased in the rest of the return period.

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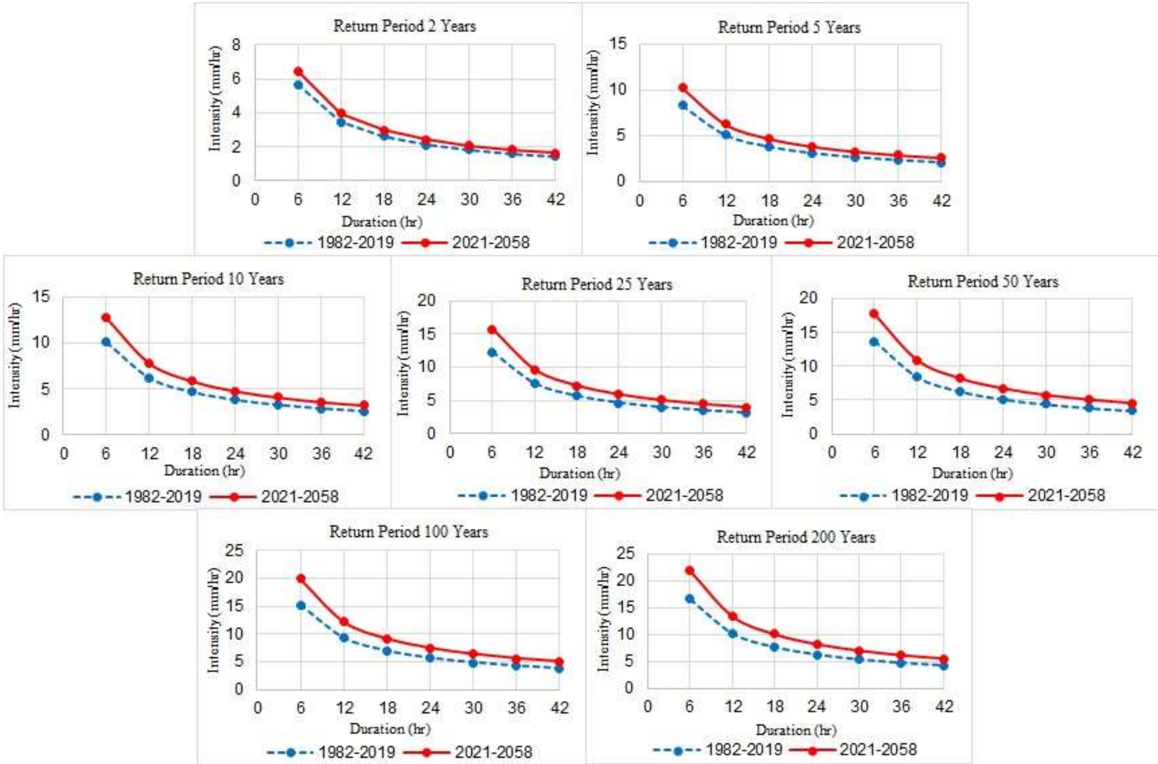

Fig. 1. Comparison of IDF curves related to historical and future period (generating future data with LARS-WG model under RCP4.5 scenario) in different return periods, Bushehr station

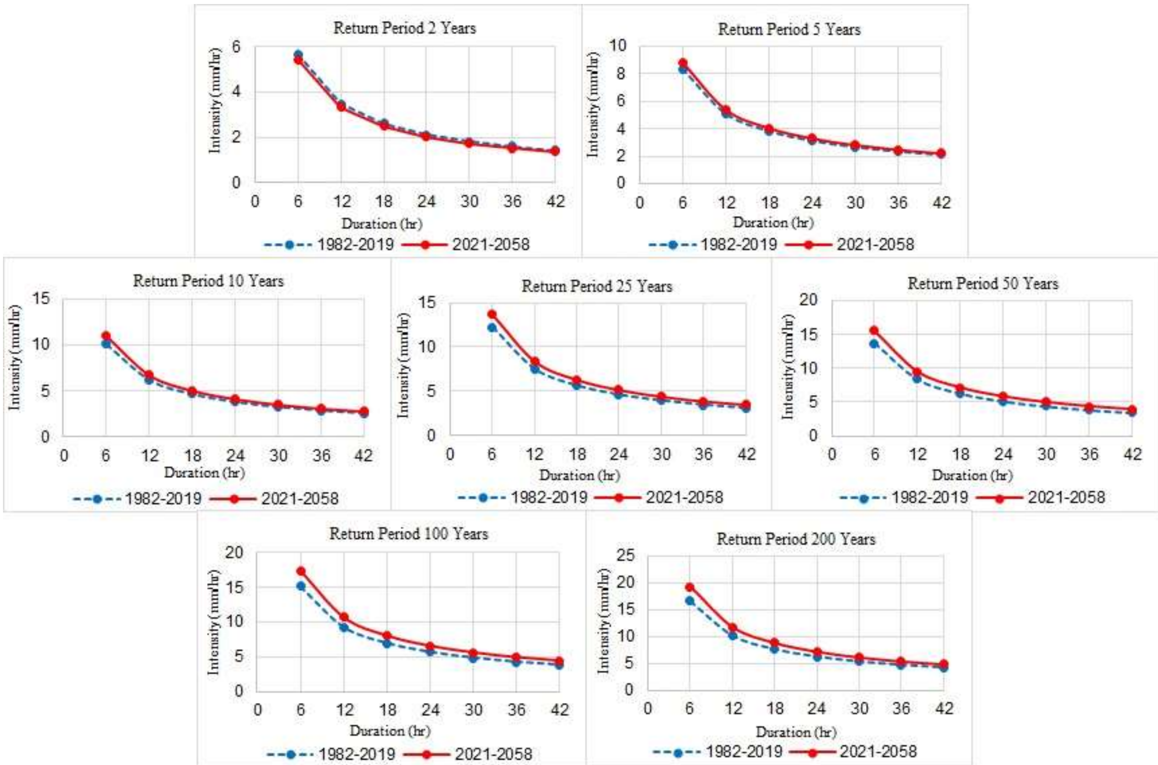

Fig. 2. Comparison of IDF curves related to historical and future period (generating future data with LARS-WG model under RCP8.5 scenario) in different return periods, Bushehr station

4. Conclusions

In total, the mean curves increased by 26.20% under the RCP4.5 scenario and 9.48% under the RCP8.5 scenario (Table 1). Due to the increasing intensity of the curves in the future, structural flood management at Bushehr station could be considered. Also, the results of this study may be used to plan Bushehr regional water management and investigate the adaptation options to the consequences of climate change in the future.

Table 1. Percentage of changes in IDF curves in the future compared to the past

Model	LARS-WG	
Station/ Scenario	RCP4.5	RCP8.5
Bushehr	+ % 26.20	+ % 9.48

5. References

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