The climate change, the city of Naein in the period (2011-2100) under scenarios fourth and fifth IPCC report

A. Soltani Mohammadi, M.R. Molaienia, A. Ajamzadeh

[1-] M.Sc. Student, Department of Civil Engineering, University of Zabol, Iran.
[2-] Assistant Professor, Civil Engineering Department, University of Zabol, Iran.
[3-] Graduate of Master of Engineering, Department of Civil Engineering, University of Zabol, Iran.

Abstract: Undoubtedly, climate change and global warming, one of the issues and concerns of today's society. In this paper, the effects of climate change on precipitation and temperature in the city of Naein under scenarios of greenhouse gas emissions and output data General Circulation Models (GCM) were investigated. For this purpose, the global output data models by the end of the 21st century, as change factor method (delta) are down scaled. According to the results, the late 21st century, a maximum temperature rise of 5.34 ° C for Fourth Report and 7.22 ° C for Fifth Report scenarios will be occur. Also, the fourth report scenarios, reduced rainfall predicted until the end of the century addressing. While, the fifth report scenarios, show an increase in precipitation.
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1. Introduction

Climate change means any marked change in the average weather patterns expected, that in the long term in a particular area or for the entire global climate, take place. One important stage in the study of climate change, temperature and precipitation data is analyzed. In this study, data on precipitation and temperature Naein station for years (1971-2000) as a period of observation and years (2011-2100) as the forecast period examined and the results were compared.

Global warming caused by greenhouse gases, and the effects of climate change is to follow the general circulation of the atmosphere, temperature and precipitation are reported. General Circulation Models foundation of all studies on climate change are phenomena (Sun et al., 2016).

Temba and Chung in 2013, the effects of climate change on water resources management in river Geumho South Korea-based general circulation models (GCM) and investigated its effects on temperature, precipitation and runoff were examined. The results of this study showed that climate change is likely to lead to lower water levels in the river basin Geumho to the present time.

Park and colleagues in 2015, South Korea in the drought period (2014-2100) deaths under climate change scenarios predicted RCP. The results showed that called the worst drought in at least 87 years old tub with a return period of drought index -3.54 and duration of 560 days in the period (2039-2040) occur.

Su and colleagues in 2015, precipitation and river flows under different scenarios SRES Air China's Song and RCP examined. The results showed that under scenarios of precipitation RCP, SRES emission scenarios is an increasing trend toward clearer.

2. Study area

Naein is the desert town in the height of 1580 meters above sea level, latitude 32 degrees north and longitude 52 ° East. This city with an area of 35927.8 square kilometers, is the largest city of Isfahan province. According to the 2011 census, its population of 38077 people respectively.

3. Materials and methods

3-1- Downscaling agent of change:In this study, temperature and precipitation data for stations Nain, located in Isfahan province using fine-scale change agent or Delta was. Delta downscaling for temperature and precipitation as follows:

A) Downscaling temperature: For downscaling temperature, the monthly data for the base period (2000-1971), we calculated the average values for each month. Then do the same for future climatic periods and to obtain a change of temperature, mean temperature of the month in the coming period to obtain baseline period in accordance with the following formula:

$$CF_{add} = \overline{GCM_f} - \overline{GCM_b}$$

where in:

CF_{add}: Change Factor Additive

$\overline{GCM_f}$: Average temperature of the future period

$\overline{GCM_b}$: Average temperature of the base period

Then, to obtain fine-scale temperature values, the change agent calculated on the amount of data observations in (local) we add (Anandhi et al. 2011):

$$T_f = T_{obs} + CF_{add}$$

where in:

T_f: Future downscaled temperature

T_{obs}: Observations temperature

B) Downscaling precipitation: For downscaling precipitation, temperature act as downscaling, with the difference that instead of obtaining the difference between the mean, divided by them to obtain and agent of change is calculated according to the following equation:

$$CF_{mul} = \frac{\overline{GCM_f}}{\overline{GCM_b}}$$

Figure 1: Geographic Area of City of Naein

where in:

CF_{mul}: Change factor Multiplicative

$\overline{GCM_f}$: Average precipitation of the future period

$\overline{GCM_b}$: Average precipitation of the base period

To obtain fine-scale rainfall amounts, the agent of change that formula to their My¬Vrbm in the amount of data observations (local) we multiply (Anandhi et al. 2011):

$$Pr_f = Pr_{obs} \times CF_{mul}$$

where in:

Pr_f: Future downscaled precipitation

Pr_{obs}: Observations precipitation

4. Discussion

Downscaling for temperature and precipitation data, the beginning of each of the fourth and fifth reports of the IPCC, have selected three models suitable for the study area. These models include models CGCM3T47, INMCM3 and MIROC3.2-MEDRES of the Fourth Report models and CCSM4, CSIRO-MK36 and HADGEM2ES of the fifth report.

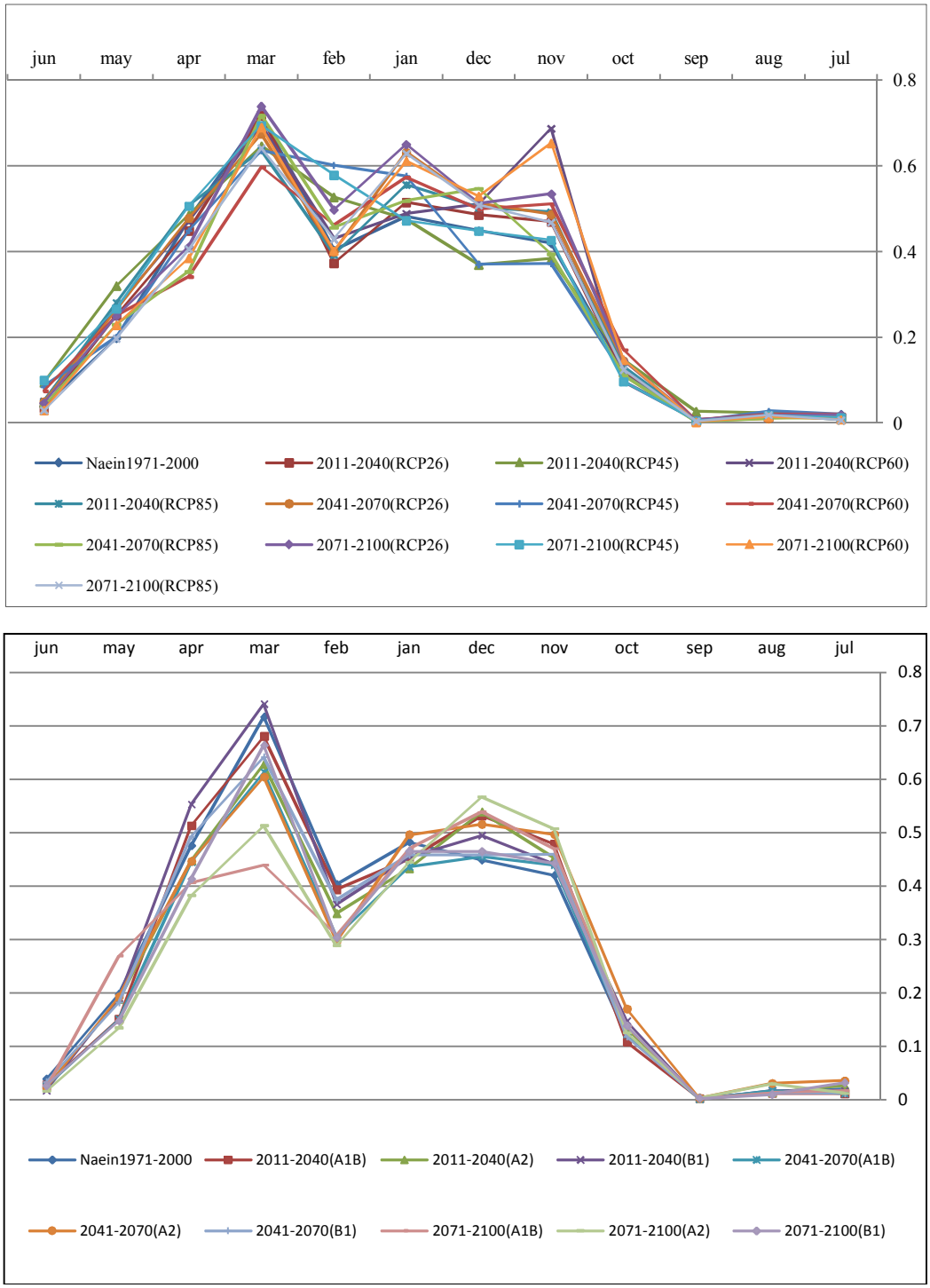

Figure 2: Monthly rainfall scenarios under the Fourth and fifth Report

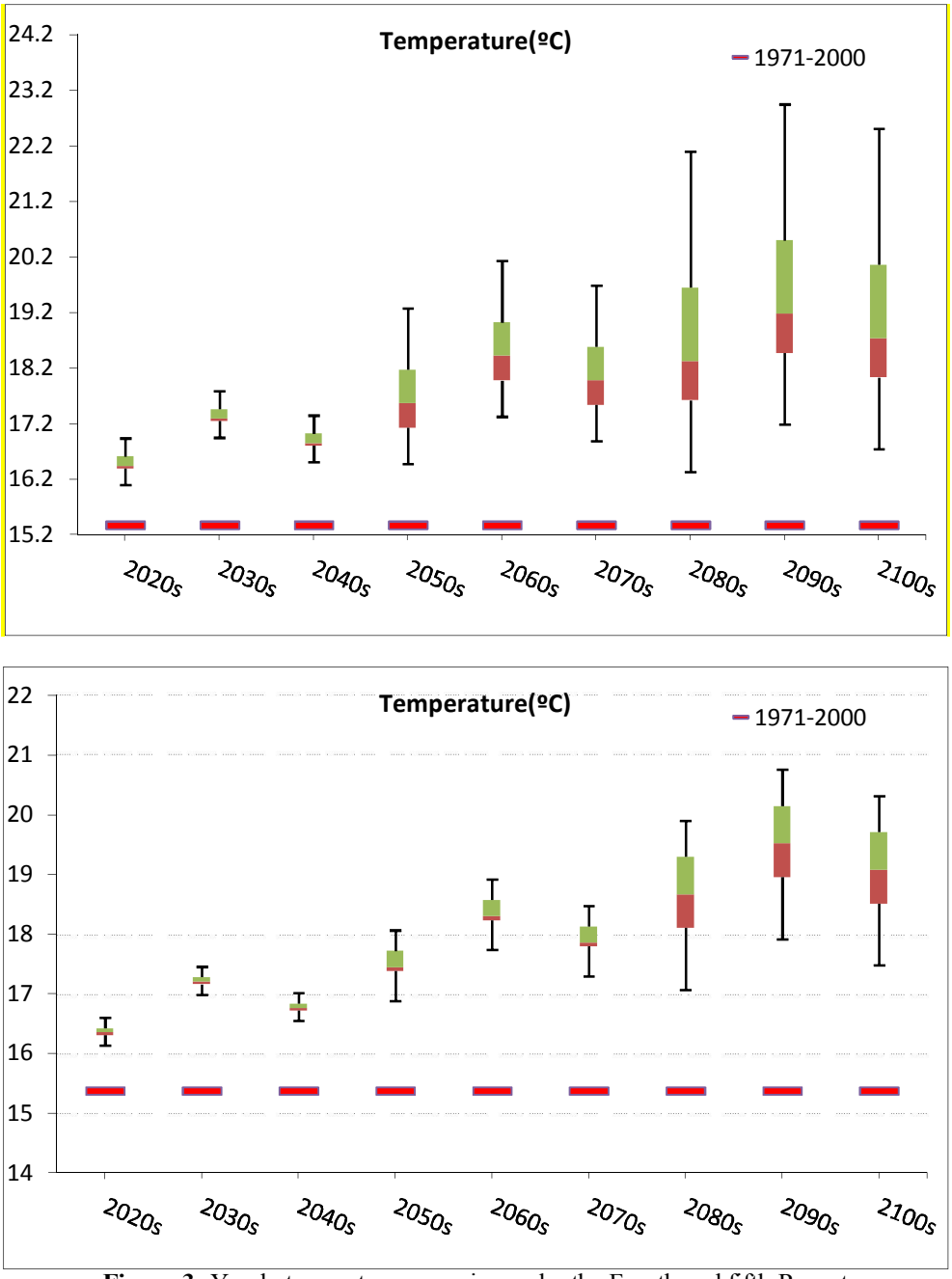

Figure 3: Yearly temprature scenarios under the Fourth and fifth Report

5. Conclusions

In this study, we tried the effects of climate change on precipitation and temperature scenarios for the city of Naein under the fourth and fifth report by the year 2100 and the results of each report separately to compare. The overall findings of this comparison is summarized as follows:

1) Operating method of downscaling change factor (Delta), a variety of methods, depending on the hydrological variables we used them. The most common method is the addition and multiplication, respectively, which are used for fine-scale temperature and precipitation.

2) Models fifth report, the annual temperature increase of more than models predict Fourth Report to this city and this implies the fifth IPCC report on climate change is more severe conditions.

3) According to the fourth report charts precipitation, under the pessimistic scenario A2, the maximum monthly precipitation observations from early spring to late autumn and early winter period returns and pessimistic scenario RCP85 fifth report also similar trend will occur.

4) For scenario A1B mediocrity fourth report, the rainy season from early spring to early winter displacement and the scenario of mediocrity RCP45 and RCP60 fifth report, the shift is toward the end of winter.

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