

Assessment of the precipitation and temperature changes over South East of Iran using downscaling of General Circulation Models' outputs

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Abstract

Introduction

Numerous studies have proved the relationship between the amount of CO₂ in the atmosphere and climate change. In this respect, developed countries have a undeniable role and they cause serious damages in the throughout the world. IPCC' forth evaluation report implies that adding greenhouse gases to the atmosphere during recent decades prevents the heat rays to emit which, in turn, cause atmospheric temperature to increase. During the past centuries, the temperature has increased by 3 to 6 Degrees Centigrade, with a rapid speed in recent decades. It is believed that if greenhouse gases continue to increase at the present rate, an average increase in temperature, from 1c to 3.5c is expected by the year 2100. Therefore, it is necessary to study and evaluate climate changes in the future decades so as to plan a proper environmental program corresponding to future climate conditions, consequently reduce its unfavorable effects. The uncertainty in Atmospheric Circulation Models being taken into account, the present study investigates the temperature and precipitation changes in Eastern South of Iran during the following periods: 2011-30, 2044-65, and 2080-99.

Material and methods

Two datum groups; namely, observed data and model data, including maximum and minimum temperature, precipitation and solar radiation were used. The period, 1983-2007, was chosen as the observed period; data from weather synoptic stations were gathered. The required data for General Circulation Models including IPCM4, NCCCM3, HADCH3, and INCM3 with three scenario A1B, A2, B1 were gathered from the two Reference Networks, Canada Climate Change Reference and data bank of LARS-WG5.1. The most upgraded version of LARS-WG5.1 was used to evaluate climate change in Eastern South of Iran. This version observes the forth report on IPCC. Therefore, it uses the outputs of 15 General Circulation Models with A1B, A2, and B1 Scenarios. Four climate models having three shared Scenarios were used in this study. Time series of observed data from synoptic stations in Eastern South of Iran were compared with those of IPCM4, NCCCM3, HADCH3, and INCM3 in similar periods with A1B, A2, and B1scenarios. To do so, first, average time series of each station were computed using temperature and precipitation data from synoptic stations, then , monthly

thermal data and those of GCM fall amount during the study period from CCCSN (Canada) were received. Finally the mentioned data were compared with the average temperature and precipitation during the study period. And to investigate the uncertainty resulted from employing various GCM models, weighting method of averages of observed temperature and precipitation was used.

Results and Discussions

General circulating models don't have equal results in estimating long – term temperature and precipitation which indicate the existing uncertainty in their outputs. Analyzing using T-test and K square statics result for all stations, revealed no significant difference between modeled and observed values at $P < 0.05$. In general, the results show that LARS-WG Model is capable of modeling the climate in previous periods of the studied stations. The average precipitation and temperature of the stations were compared using LARS-WG Model. The results revealed an increasing trend in the temperature of all the studied regional stations in future. The 90 year thermal increases in the following stations are: 0.44-3.53 in Bam, 0.52-3.30 in Bandar Abbas, 0.39-2.64 in Chabahar, 0.85-3.41 in Iranshahr, 0.38-2.27 in Jusk, 0.76-3.82 in Kerman, 0.55-3.47 in Zabol, and 0.54-3.57 in Zahedan. The above values are in Degree Centigrade. The most distinctive feature of modeling, in regard to precipitation, is lack of harmony in its increase or decrease trends in future. In other words, it cannot be concluded that precipitation, like temperature, has an increasing trend; rather it has fluctuations. As modeled values show; precipitation increases in all the stations during spring, although it is relatively more in such dry stations as Bam, Kerman, Zahedan, Zabol, and Iranshahr. This, in turn, causes spring floods.

Conclusion

This study investigated the effects of climate change on the two weather parameters, temperature and precipitation, using the data gathered by Atmospheric General Circulation from synoptic stations located in Eastern South of Iran. The obtained results showed that LAR-WG Model is capable of modeling precipitation and temperature values. According to the results, it was shown that NCCCM3, HADCH3, IPSLM4, and INCM3 models have a good performance in simulating precipitation. Regarding temperature, HADCH3 Model proved a good capability in most months. The obtained weights having been applied on model values, an increasing temperature trend was shown in all the stations. Furthermore, it was shown that thermal increasing amount in coastal stations is higher than that of dry ones, the most amount of increase in temperature belongs to Kerman, Zahedan, Bam, Zabol, and Iranshahr, respectively. Accordingly all coastal stations would experience a thermal increase less than 3c, while the value for dry stations would exceed 3c. It seems that temperature follows a steady increasing trend, whereas precipitation in various stations fluctuates during different seasons.

Key words: Climate Change - General Circulation Model- Downscaling - South East of Iran.

Keywords

[Climate Change](#); [General Circulation Model](#); [Downscaling](#); [South East of Iran](#)

Main Subjects

[Climatology](#)

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