

Impact of Climate Change on the Residents of Islamabad City

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ABSTRACT

Climate change negatively affects the nature and other anthropogenic activities. And inversely anthropogenic activities are also effects the climate. Climate change effects on urban area more severe than the rural areas. The aims of this study are to analysis the climate change and its impact on the residences of the Islamabad City. The datasets used for the research includes ninety year weather data that includes of daily maximum and minimum daily air temperature (°C), daily total rainfall (mm), and daily values of incoming solar radiation using B1 scenario Projected temperature changes in Pakistan over the 21st Century under IPCC, SRES. The data were analyses through ArcGIS10.2 Statistical tool and results represented through graphs and maps. The results of this research 2.84mm rainfall in 2011 and 2.56mm in 2090 of the Islamabad City, solar radiation in 2011 is 16.59MJ/m² and 17.09 MJ/m² in 2090. Climate change create many threats and to face these threats, it is necessary to develop mitigation and adaptation measures as well as the appropriate implementation especially in at risk areas; if these threats will multiply in the coming decades. The present study suggests that control the deforestation, less use of motor vehicle, government should launch a media campaign to raise awareness on the climate change.

Keywords: Climate change, temperature, greenhouse gas, urban area, adaptation

INTRODUCTION

Today's climate change is the most emerging issues for the agriculture production in Pakistan and all over the world. Basically climate change is due to increase in anthropogenic activities and concentration of greenhouse gases (GHGs) like methane (CH₄), nitrous oxide (N₂O), carbon dioxide (CO₂) and water vapors. GHGs trap the sunlight and increase overall earth's temperature. This high temperature may negatively affect the wheat growth process because increase in temperature shortens the growing period.

Climate change will increase temperature and impacts on precipitation are both less predictable and dependent on regional variations in climatic patterns. Urban dwellings will encounter many severe impacts from climate change such as flooding, air and water pollution consequences of the increased spread of disease. Here we provide the major comparative impacts of climate on cities of Pothohar region According to the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) B1 Scenario.

Pakistan stands between the groups of developing countries which are intensely susceptible to the impacts of climate change. Pakistan's most serious issues of in the result of climate change to its food, energy security, water and its coastal areas. Other climate change related particular concerns include increased risks of extreme events (floods, droughts and cyclones) and adverse impacts on forests, biodiversity, human health and vulnerable regions

(mountainous areas, rangelands, arid regions and coastal areas etc) (Shamas, 2010). Climate change represents an additional stress over already resource stressed country like Pakistan (Farooqi and Mir, 2005).

Greenhouse gas (GHG) emissions are low in Pakistan as it compared to international standards. In 2008 the total GHG emissions in Pakistan were 310 million tons of CO₂ equivalents. These comprised: CO₂ 54%, Nitrous Oxide (NO₂) 9%, Methane (CH₄) 36%, Carbon Monoxide (CO) 0.7%, and non-methane volatile organic compounds 0.3%. (National GHG inventory 2008)

The future impacts of climate change will be lead to wide range impacts on different regions of the world. The wide range of impacts of climate change (IPCC, 2007b) include effects on fisheries, agriculture, desertification, water resources, coastal zones ,biodiversity, heat and cold related mortality, and floods. These impacts are increasingly linked with the significant economic loss, and consideration of these costs is increasingly helping to inform the policy debate (e.g. as with the Stern Review, 2006).

Climate change negatively affects the nature and other anthropogenic activities. And inversely anthropogenic activities are also effects the climate. Climate change effects on urban area more severe than the rural areas. Rural areas are less populated as compare to urban areas but agriculture field is highly effected due to change in climatic conditions. This research shows the impact of climate changes on Islamabad. Islamabad is capital of Pakistan and it is a famous tourist place.

Islamabad has attracted people from all over Pakistan, making it one of the most cosmopolitan and urbanized cities of Pakistan. Islamabad is a planned, modern and maintained city located in the Pothohar Plateau in the northeastern part of the country, within the Islamabad Capital Territory.

OBJECTIVES

Objectives of the current study are:

1. Statistical analysis of climate change in Islamabad.
2. To find the impact of climate change on the urban area of Islamabad city.
3. To provide information on adaptation responses and the difference that these can make in reducing impacts.

STUDY AREA

The study area selected for research is Islamabad. Islamabad is the capital city of Pakistan located on 33.7167° N Latitude, 73.0667° E Longitude and altitude 490 m and a famous tourist place. According to a 2012 estimate by the Census Department, the population of Islamabad including its surrounding territory has increased to 2 million. The total area of Islamabad City is 906 square kilometers. A further 2,717 square kilometers area is known as the Specified Area, with the Margala Hills in the north and northeast.

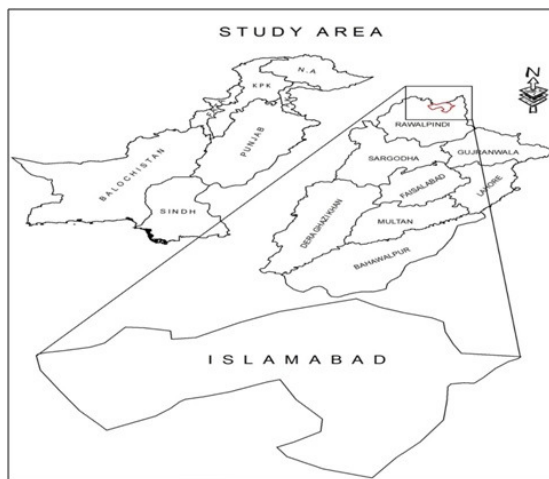


Figure 1: Study Area Map

The southern portion of the city is an undulating plain. It is drained by the Kurang River, on which the Rawal Dam is located.

MATERIALS & METHODS

The following datasets are used to find the impact of climate change on Islamabad.

1. Maximum Temperature (°C)
2. Minimum Temperature (°C)
3. Solar radiation (MJ/m²)
4. Rainfall (mm)

The datasets used for the research includes ninety year weather data that includes of daily maximum and minimum daily air temperature (°C), daily total rainfall (mm), and daily values of incoming solar radiation downloaded from website at <http://gismap.ciat.cgiar.org/MarkSimGCM/> using B1 scenario Projected temperature changes in Pakistan over the 21st Century under IPCC, SRES (Special Report on Emissions Scenarios). Trend lines and Graphs drawn of minimum and maximum temperature, solar radiation, and rainfall for analysis are climate change impacts on urban areas of Pothohar Region. Maps of minimum temperature, maximum temperature, solar radiation, rainfall generates for the visualization of climatic changes in Islamabad.

RESULTS AND DISCUSSION

Climate change is the major problem that affects more severely the whole world and Pakistan as well. Climate of Pakistan consistently increasing day by day that will effect all sectors like urban areas, agriculture, tourism and forestry etc. Rise in temperature from 2011-2090 is approximately 3 (°C). Islamabad is the most famous tourist place and it is also capital city of Pakistan. Islamabad is basically an urban area with the population of 2 million.

Climate change is increase the risk those are associated communities exposure to hunger, poverty, displacement, mortality and disease. Islamabad is a capital city of Pakistan and that’s why more populated and day by day increase population. Because there are more opportunities for the people to live better life and get better jobs. With the increase in population GHG emissions are also increase. And these GHG emissions caused global climate change. These climate change risks are more disastrous for the communities.

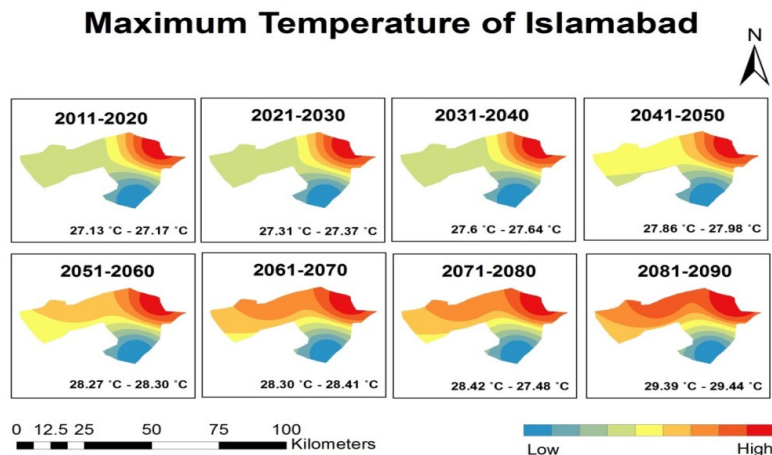


Figure 3. Maximum Temperature of Islamabad City

Figure 2 shows the maximum temperature of Islamabad city. Maximum temperatures rise in each decade and approximate 3°C increase from 2011-2090. North east portion of Islamabad city has high temperature increase rate as compare to other areas.

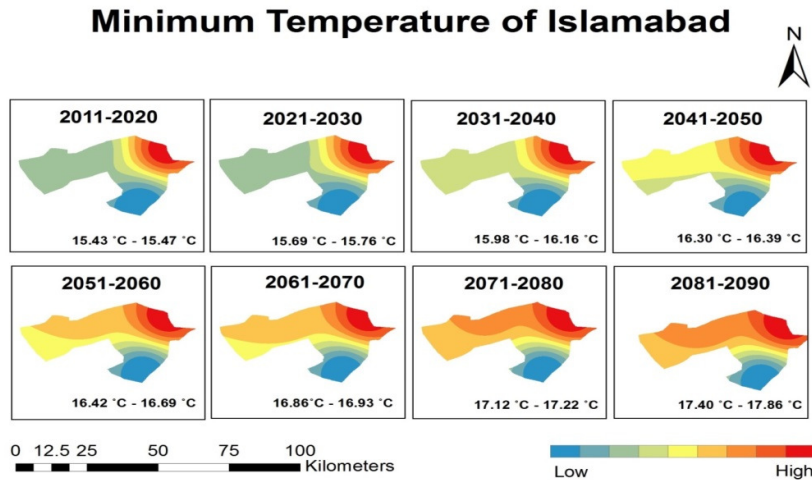


Figure 4. Minimum Temperature of Islamabad City

Figure 3 map shows the minimum temperature of Islamabad city from 2011-2090. Minimum temperature are rise situation same as show in the maximum temperature maps. The north-east portion of the city is highly affected than the other areas.

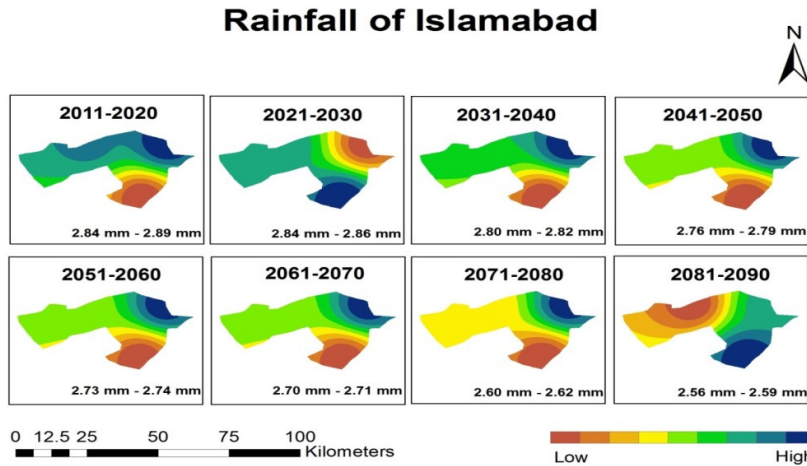


Figure 5. Rainfall of Islamabad City

Figure 4 rainfall map of Islamabad shows the decreasing trend in Islamabad from 2011-2090. North-west part of Islamabad shows the high decreasing trend of rainfall as compare to other areas.

Figure 5 shows the minimum temperature (°C), maximum temperature (°C), solar radiation (MJ/m²) and rainfall (mm) from 2011 to 2090 of Islamabad. Above graph shows the gradually rise both in maximum and minimum temperature. The rise in temperature is up to 3°C from 2011-2090. In 2011-2020 the minimum temperature of Islamabad is 15.46 (°C), maximum temperature is 27.15 (°C), solar radiation is 16.62 MJ/m² and rainfall is 2.75 mm. In 2021-2030 minimum temperature is 15.75 (°C), maximum temperature is 27.15 (°C), solar radiation is 16.70 MJ/m² and rainfall is 2.81mm.

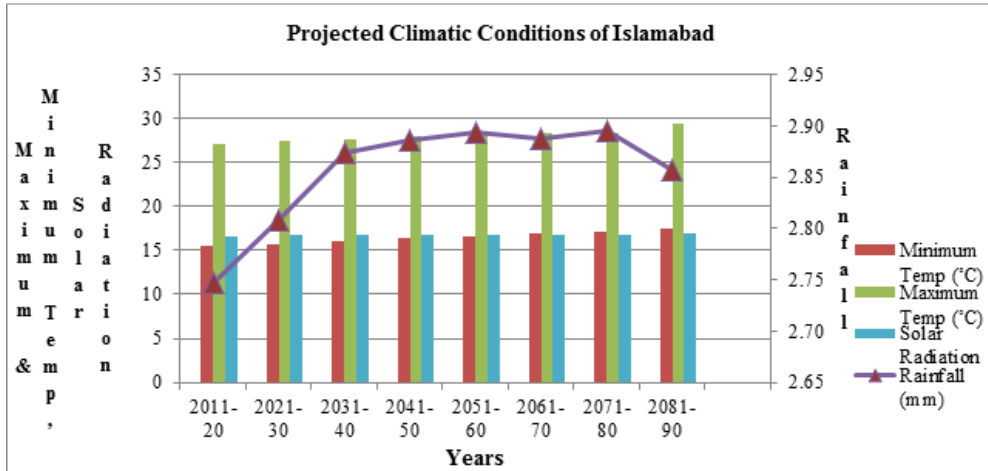


Figure 6. Projected Climatic Condition of Islamabad City

In 2031-2040 minimum temperature is 16.04 (°C), maximum temperature is 27.62 (°C), solar radiation is 16.74 MJ/m² and rainfall is 2.87 mm. In 2041-2050 minimum temperature is 16.33 (°C), maximum temperature is 27.99 (°C), solar radiation is 16.79 MJ/m² and rainfall is 2.89 mm. In 2051-2060 minimum temperature is 16.62 (°C), maximum temperature is 28.27 (°C), solar radiation is 16.80 MJ/m² and rainfall is 2.89 mm. In 2061-2070 minimum temperature is 16.91 (°C), maximum temperature 28.30 (°C), solar radiation is 16.84 MJ/m² and rainfall is 2.89 mm. in 2071-2080 minimum temperature is 17.17 (°C), maximum temperature is 28.36 (°C), solar radiation is 16.84 MJ/m² and rainfall is 2.89 mm. In 2081-2090 minimum temperature is 17.40 (°C), maximum temperature is 29.36 (°C), solar radiation 16.93 MJ/m² and rainfall is 2.86mm. Solar radiation of Islamabad is also continuously increasing as above graph shows.

Solar Radiation of Islamabad

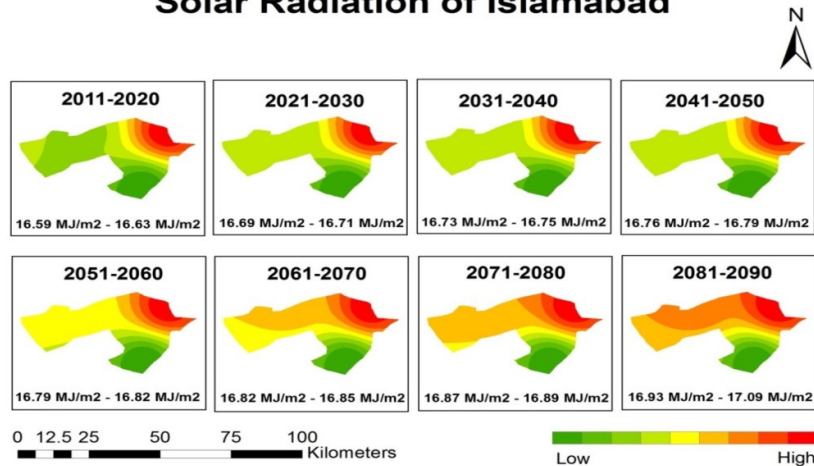


Figure 7. Projected Solar Radiation of Islamabad City

Figure 6 map shows the increasing trend of solar radiation of Islamabad city. North-east and North-West portion of the city shoes the high increasing trend of solar radiation. Arid areas are more severely effect by the maximum precipitation decreases due to change in climate (Arab Water Council). They may also be less direct as climate change negatively affects livelihoods or food supplies (and prices) or access to water needed for domestic consumption or livelihoods. Certain groups may face increased risks from measures taken elsewhere in

response to climate change. The urban areas are more risky than rural areas. It is expected that the intensity and frequency of extremes events will increase. Increase in mean temperatures and precipitation levels that lead to adverse impacts on reduction of drainage capacity of sewage systems and energy demand.

Projected Impacts of Climatic conditions in Islamabad

Table 3. Climatic Conditions

<i>Climatic Conditions</i>	<i>Major projected Impacts of Climatic Condition in Islamabad</i>
More warmer days and Fewer cold days and nights,	Reduction of energy demand used for heating Cooling demand increased Decreasing air quality Effects on tourism because of severe climatic events
Increasing frequency of heat waves	Reducing quality of life Impacts on very young child, poor and elder people are more severe
Shortage of rainfall and extreme precipitation events	Shortage of water for drinking, industries and house holds Declining potential of hydropower generation

Islamabad imported fresh water from different lakes because ground water does not meet the requirement of all peoples. Under the severe climatic conditions particularly drought affects the water supplies in Islamabad. Air quality decreases due to high change in Temperature. Change in temperature, precipitation, and humidity will result water and vector-borne diseases. Islamabad will experience increase heat wave in summer and reduced cold-weather stresses in winter. Extreme weather events might be create new health hazards like dengue fever, malaria, cholera, diarrhea and this will show significant increases in hospitalization. Extreme events increase in temperature threatening linkage infrastructures such as bridges, roads, pipelines, or transmission networks and government can experience substantial economic losses. Islamabad temperature increased due to climate change. Commercial, industrial, and residential building will increase the demand of cooling and this will lead to the high demand of electricity. The main source of energy for cooling is electricity and electricity produced by using water in Pakistan. Demand for electricity production will lead to the increase water demand but due to shortage of rainfall water level decrease and that will affect the quality of life.

CONCLUSION AND RECOMMENDATIONS

This study reveals that the climate of the Islamabad city is rapidly changed, this climate change has direct or indirect impact on the residence of the Islamabad City. According to this research 2.84mm rainfall in 2011 and 2.56mm in 2090 of the Islamabad City, solar radiation in 2011 is 16.59MJ/m² and 17.09 MJ/m² in 2090. Similarly this climate change create many threats includes; floods, heat waves, cool weather stress, droughts, cyclone and rise in sea level. These threats not give only economical loss but also effect on urban environment, infrastructure, water quality, air quality and life quality of the residence of the urban areas. To face these challenges, it is necessary to develop mitigation and adaptation measures as well as the appropriate implementation especially in at risk areas; if these threats will multiply in the coming decades. The present study suggests that increase the green space, control the deforestation, less use of motor vehicle, government should built the dam and proper water storage system for agriculture and domestic used, government should launch a media campaign to raise awareness on the climate change.

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