

**PAST TRENDS OF ATMOSPHERIC VARIABLES USING
ERA INTERIM AND FUTURE PROJECTIONS OF
TEMPERATURE AND PRECIPITATION USING
STATISTICALLY DOWNSCALED MODEL CCSM4 ON
MURREE, PAKISTAN**



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2017**

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A thesis submitted to Bahria University, Islamabad in partial fulfilment of
the requirement for the degree of BS in Environmental Sciences

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ABSTRACT

Over the last few decades, climate change had become a major focus for researchers. It has caused damaging effects on human society and the natural environment. In this study, past climate trends using high resolution reanalysis data set and future climate trends of temperature and precipitation over Murree under two different RCP scenarios of a statistically downscaled CMIP5 Coupled General Circulation Model is presented in this study. The analyses are extended to annual, decadal and seasonal scale with a focus on the Summer Monsoon season. There is a positive change in mean temperature of 3.4°C under RCP 4.5 scenario and 4.3 °C under RCP 8.5 scenario till the end of this century. The analysis of decadal and monsoonal mean of temperature under both RCPs, showed a rise in temperature above the mean baseline period. The analysis of decadal and monsoonal mean of precipitation under both RCPs, also showed a slight increase from the baseline period. The seasonal cycle shows that the winters are warming more than summers with an increase in temperature about 9 to 15°C in the 21st century with respect to baseline (1979-2005). Moreover, there is a slight shift of monsoon precipitation towards October and November. The tourism sector of Murree is linked with the monthly mean of temperature, precipitation and snowfall during baseline period. The rise of temperature during the winter season has caused the tourists to delay their visit till the occurrence of snowfall.

ACKNOWLEDGEMENT

To start with, all praise to Allah Almighty who is the supreme power. We would like to show gratitude to our supervisor Dr Humera Farah, Senior Professor, Department of Earth and Environmental Sciences, Bahria University Islamabad for her patient guidance, enthusiastic encouragement and useful critiques of this research work. We would also like to thank Mr. Burhan Ahmed from Research and development section of 'Pakistan Meteorological Department' for his advice and assistance in keeping my progress on schedule. Our grateful thanks are also extended to Sir Muhammad Khubaib Abuzar, Senior Assistant Professor, Earth and Environmental Sciences, Bahria University Islamabad for his valuable advice and help.

Last but not the least, we would like to thank our parents for their encouragement and constant upkeep and our beloved fellow peers with whom we have shared some of the most memorable years of our lives.

ABBREVIATIONS

CO ₂	Carbon dioxide
H ₂ O	Water vapor
CH ₄	Methane
N ₂ O	Nitrous oxide
CFCs	Chlorofluorocarbons
GDP	Gross domestic product
GHG	Greenhouse emission
EDW	Elevation dependent warming
IPCC	Inter panel of climate change
RCPs	Representative concentration pathways
GCM	Global climate model
CMIP5	Coupled model intercomparison project phase 5
SST	Sea surface temperature
AOGCM	Atmosphere-ocean general circulation model
NCEP	National centers for environmental prediction
ERA	European reanalysis
MERRA	Modern-era retrospective analysis for research & application
SRES	Special report on emissions scenarios
IIASA	International institute for applied systems analysis
NIES	National institute for environmental studies
PTDC	Pakistan tourism development corporation
PMD	Pakistan meteorological department
ECMWF	European center for medium-range weather forecasts

TDCP	Tourism development corporation of punjab
TCW	Total column water
SPSS	Statistical package for the social sciences
SLHF	Surface latent heat flux
ANOVA	Analysis of variance

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