Tamil Nadu Climate Change Mission

CLIMATE PROFILE AND PROJECTIONS OF TAMIL NADU

CLIMATE MODELING

Under

CLIMATE STUDIO

REPORT

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Department of Environment and Climate Change
Government of Tamil Nadu

Prepared by
Centre for Climate Change and Disaster Management
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PREFACE

The growing impacts of climate change have become impossible to ignore, particularly in regions with high vulnerability. The need for the comprehensive climate risk assessments has been more important for the State of Tamil Nadu. This report, *Climate Profile and Projections of Tamil Nadu*, serves as a vital resource in understanding the present and future climate conditions across the state of 38 districts.

In the face of rising temperatures, shifting rainfall patterns and increasing climate extremities, the role of scientific data becomes paramount for the formulation of effective adaptation strategies. This report leverages high-resolution downscaled climate projections derived from Global Climate Models (GCMs), particularly under the SSP2-4.5 and SSP5-8.5 scenarios, which provide insights into temperature and rainfall trends for the region. By combining historical climate observations with future projections, the report offers a robust foundation for understanding the potential risks of climate change, such as intense rainfall events and heatwaves.

The downscaled climate projections highlighted here are not just data points. they are tools for decision-making, enabling policymakers, planners and communities to develop strategies that strengthen resilience across critical sectors like water resources, agriculture, coastal management and urban planning. This data-driven approach aligns with Tamil Nadu's broader goals of promoting climate-compatible growth and enhancing the sustainability of its socio-economic systems.

This report is the outcome of extensive collaboration and dedication from experts across various sectors. It reflects the concerted efforts of government institutions, researchers and local stakeholders committed to safeguarding Tamil Nadu future by providing the scientific foundation necessary for informed climate action.

In presenting this document, we aim to equip decision-makers with the knowledge needed to face the challenges ahead and to foster a resilient and adaptive framework for Tamil Nadu development.

(P.Senthilkumar)

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FOREWORD

Climate change is an indisputable truth that poses one of the most critical issues of the present time. Its far-reaching implications affect every element of our life, including the environment and the economy, as well as human health and social welfare. As custodians of governance and progress, we must face this issue with unwavering determination and climate risk-informed action. The Climate Profile and Projections of Tamil Nadu presented in this report marks a significant step forward in our endeavor to understand and address the evolving climate dynamics within the state.

The Intergovernmental Panel on Climate Change (IPCC) stands as a beacon of scientific integrity, collaboration, and knowledge dissemination, particularly for the development and distribution of global climate models (GCMs), crucial for projecting future climate scenarios worldwide. Through meticulous data analysis and scientific evaluation, the Global Climate Models (GCMs) of coarse resolution is downscaled to high resolution, under SSP2-4.5 and SSP5-8.5 scenarios, depicting the climate projections of Temperature and Rainfall for Tamil Nadu. This downscaled high-resolution data is crucial for the climate risk assessment studies on various sectors such as Water, Agriculture, Coastal, Forestry and Sustainable Habitat.

The climate profile and projections for the 38 districts of the state provides an insight into both historical observations, future projections and explores the chance of climate extremities such as intense rainfall events and heatwaves for policymakers, planners and communities to bolster adaptation actions and policies. By harnessing the climate risk informed adaptation strategies, we can forge a path towards a more sustainable and climate-resilient future for Tamil Nadu.

I am extremely thankful to Dr.P. Senthilkumar, I.A.S., Principal Secretary to the Government, Environment, Climate Change and Forests Department for his valuable

guidance and unwavering support in the successful operationalization of the Climate Studio.

I appreciate the efforts of Dr. Kurian Joseph, Professor & Director, Centre for Climate Change and Disaster Management, Dr. A. Ramachandran, Emeritus Professor, Centre for Climate Change and Disaster Management and research team of Climate Studio for collecting, collating and analyzing scientific information from various sectors and compiling the report in the present form.

I would like to extend my appreciation to all the Government line Departments and Institutions for their valuable contributions by providing essential data and information, which played a crucial role in the successful operationalization of the Climate Studio project.

(A.R. Rahul Nadh)

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We humbly acknowledge Prof. Dr. R. Velraj, the former Honourable Vice Chancellor, Anna University, Prof.Dr. K.P. Jaya, Head of the Department, Department of Civil Engineering, Dr. K. Palanivelu, Professor, CCCDM, Dr. R. Saravanan, Professor, CWR and the adjunct faculty of CCCDM, Anna University for their valuable inputs and expertise. Further, we acknowledge the support from the following departments for providing the necessary data for the completion of the Climate Risk Assessment and Adaptation Plan for the key sectors of Tamil Nadu:

- Department of Environment, Climate Change and Forests (DoE&CC), Government of Tamil Nadu
- Indian Meteorological Department (IMD), Ministry of Earth Sciences, Government of India
- Central Ground Water Board (CGWB), SECR, Ministry of Jal Shakthi, Department of Water Resources, River Development and Ganga Rejuvenation, Government of India
- State Planning Commission (SPC), Government of Tamil Nadu
- Tamil Nadu Agricultural University (TNAU)
- Department of Agriculture, Government of Tamil Nadu

- Department of Animal Husbandry, Government of Tamil Nadu
- Department of Fisheries and Fishermen Welfare, Government of Tamil Nadu
- Department of Statistics and Economics, Government of Tamil Nadu
- Department of Water Resources, Government of Tamil Nadu
- National Centre for Coastal Research (NCCR), Government of India
- Tamil Nadu Pollution Control Board (TNPCB), Government of Tamil Nadu
- Institute of Water Studies (IWS), Tharamani
- Institute of Remote Sensing (IRS), Anna University

We sincerely thank other project staff and administrative staff of CCCDM for their continuous support towards the successful execution of the project.

EXECUTIVE SUMMARY

Climate change is one of the significant issues faced globally in this century. It causes irreversible damages to the environment and ecosystem due to the anthropogenic greenhouse gas emissions. Changes in the atmospheric greenhouse concentration altered the climate as well as monsoon rainfall. The intensity of temperature and rainfall frequency, spatial extent and timing of climate extremities are in increasing trend. To understand the major influencer of the climate change, the IPCC releases the assessment report (AR) periodically since 1990 and the latest Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) was released on 2020 based on the socio economic pathways (SSPs) under the Coupled Model Inter-comparison Project 6 (CMIP6).

The Global Climate Models (GCMs) are valuable tools for understanding large-scale climate trends. The GCMs suitable for Indian Climate Scenario with the nominal resolution of 100 x 100 sq.km were selected from the CMIP6 repository based on the literature review. The GCMs are validated with the observations for the period of 1985-2014 and the best model for the impact studies are identified. Since the spatial resolution of selected GCMs are coarse with the resolution of 100x100 sq.km, it is generally unsuitable for simulating local climate which necessitates the model to downscale to obtain high-resolution climate information at regional or local scales.

Tamil Nadu, an important state in India for cultivation, is often affected by extreme events, which requires a prominent need to develop high-resolution climate change information for the state to accomplish the impact studies and enable suitable adaptation strategies.

Climate Studio at CCCDM

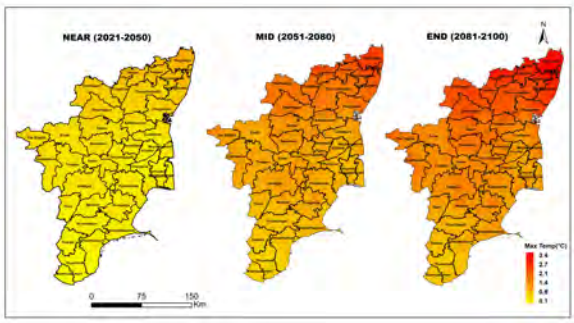
Embracing its commitment to the Nationally Determined Contribution (NDC), Tamil Nadu has emerged as a pioneer in developing adaptation strategies across sectors. Utilising the acclaimed IPCC framework on "Climate Change Risk Assessment," the Government of Tamil Nadu has established the 'Climate Studio' at the Centre for Climate Change

and Disaster Management (CCCDM), Department of Civil Engineering, Anna University. This state-of-the- art facility, funded with Rs. 3.80 crores is equipped with high-performance computational resources and digital learning tools (financially supported by GIZ, Germany) to analyse global climate data at the cadastral level. The Climate Studio aims to provide updated high-resolution regional climate scenarios, assess climate change impacts on natural resources, develop multi-sectoral spatial information, and disseminate knowledge to stakeholders. Through capacity-building programs and workshops, over 250 sectoral officials and thousands of participants have been trained and sensitized, fostering a climate-resilient future for Tamil Nadu.

Downscaling and future projections

Using the robust machine learning system, the GCM is downscaled to the high resolution (25x25 sq. km) regional scale, so as to get the cadastral level climate change projections under SSP2-4.5 and SSP5-8.5 scenarios.

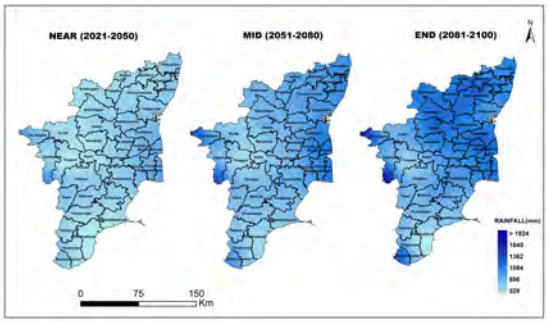
The climate projections for mean maximum temperature and annual average total rainfall have been analyzed for 38 districts of Tamil Nadu during the near-century (2021-2050), mid-century (2051-2080) and end-century (2081-2100). It is observed that the annual mean maximum temperature in the State may rise by **0.4 °C, 1.3 °C and 1.7°C** during near-century, mid-century and end-century, respectively, under SSP2-4.5 scenario and by **0.6 °C, 1.7 °C and 3.5 °C** under SSP5-8.5 scenario respectively. District wise projections indicate that the northern districts such as **Chennai, Thiruvallur, Kancheepuram, Vellore, Chengalpattu and Ranipet** is projected to have maximum increase by the end of the century under both SSP2-4.5 and SSP5-8.5 Scenarios.



Increase in temperature and prolonged dry spells are very conspicuous in the analysis which will lead to heatwaves and discomfort especially in the urban. Heat wave days (above 4.5°C from the normal average of maximum temperature) are projected to increase by **22 days** per year during the

near-century, **40 days** per year during the mid-century and **55 days** per year during the end-century.

The annual average total rainfall in Tamil Nadu is projected to increase marginally, by **4%** towards the near-century, **11 %** in the mid-century and increase by about **16%** towards the end-century under the SSP2-4.5 scenario. Under the SSP5-8.5 scenario, the annual average rainfall is projected to increase by **7%** towards the near-century, **18%** in the mid-century, and **26%** towards the end-century. The districtwise rainfall projection indicate that the coastal districts such as **Cuddalore, Nagapattinam**, **Kanyakumari** and **Mayiladuthurai** is projected to have maximum change in rainfall by the end of the century.



The visible climate change evidence have been noticed that the rainfall pattern changes erratically. The intense rainfall exceeding 64.5 mm per day are expected to increase from **3 days per year** in observation period to **4 days per year** in the near-century, **5 days per year** during the mid-century and **7 days per year** by the end of the Century. The intense rainfall may occur in the coastal districts in a short spell of time without stretching uniformly to the entire monsoon period.

Modeling the regional climate scenario is the keystone to analyse the climate change impacts, hazards, vulnerability and risks on different sectors such as Agriculture, Health, Water Resources, Coastal Forestry ecosystems and sustainable urban habitat. This cadastral level information from the high-resolution climate models will act as a baseline to develop the adaptation strategies for risk-prone districts of Tamil Nadu on different sectors.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ANN	Artificial Neural Network
AR6	Assessment Report Six
CMIP	Coupled Model Intercomparison Project
CNN	Convolutional Neural Network
DQM	Detrended Quantile Mapping
EC	End of Century
GCM	Global Climate Model
HW	Heat wave
IMD	India Meteorological Department
IPCC	Intergovernmental Panel on Climate Change
IPCC	Intergovernmental Panel on Climate Change
LPA	Long Period Average Rainfall
LPA	Long Period Average
MC	Mid-century
ML	Machine Learning
MR	Rating Metrics
NC	Near-century
NE	North-East
OND	October,November,December
PSDM	Parametric Scaled Distribution Mapping
QDM	Quantile Delta Mapping
QM	Quantile Mapping
RCM	Regional Climate Model
RCP	Representative Concentration Pathways
RF	Random Forest
RMSE	Root Mean Square Error
SDMA	State Disaster Management Authority
SHW	Severe Heat wave
SoER	State of Environment Report
SSP	Shared Socioeconomic Pathways
SW	South-West
UNEP	United Nations Environment Programme
WCRP	World Climate Research Programme
WMO	World Meteorological Organization

CLIMATE CHANGE – AN OVERVIEW

CLIMATE MODELING

Climate Studio - CCCDM

1 CLIMATE CHANGE - AN OVERVIEW

Climate change is one of the biggest challenges faced in this century. The global temperature has reached 1.4 °C during 2023 with reference to the pre-industrial baseline of 1850-1900 and the year 2023 is anticipated to be the warmest year ever documented (WMO report, 2023). The long-term global warming trend is largely due to human activities that have increased emissions of carbon dioxide and other greenhouse gases into the atmosphere. Changes in the global climate are altering the average characteristics of climate systems, intensity, frequency, spatial extent, duration, and timing of climate extremes (IPCC 2013; Herring et al. 2014). These impacts include heavy precipitation, droughts, severe cyclones, heat waves, rising sea levels, and changes in marine and terrestrial ecosystems.

The severe flood affected southern China in 1931, Bhola Cyclone in Bangladesh (1970) and Hurricane Allen affected the Caribbean, eastern and northern Mexico and southern Texas in 1980 are some of the severe extreme events, which had major socioeconomic impacts. To assess scientific, technical and socio-economic information relevant to the understanding of climate change impacts, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) had jointly established the intergovernmental panel on climate change (IPCC) in 1988. The IPCC prepares comprehensive Assessment Reports (AR) about the state of scientific, technical and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place.

The latest IPCC AR6 report projects socioeconomic global changes using Shared Socioeconomic Pathways (SSPs) Scenarios (IPCC 2016). The AR6 has numerous advantages, including combined representative concentration pathways (RCPs) with shared socioeconomic pathways (SSPs), improvements in the models and additional experiments, higher spatial resolution, lower biases, and better representation of synoptic processes (Kamal et al. 2021; Su et al. 2021a). The SSPs provide five distinctly different pathways (Figure 1) about future socioeconomic developments as

they might unfold in the absence of explicit additional policies and measures to limit climate forcing or to enhance adaptive capacity- adopted by IPCC-AR6.

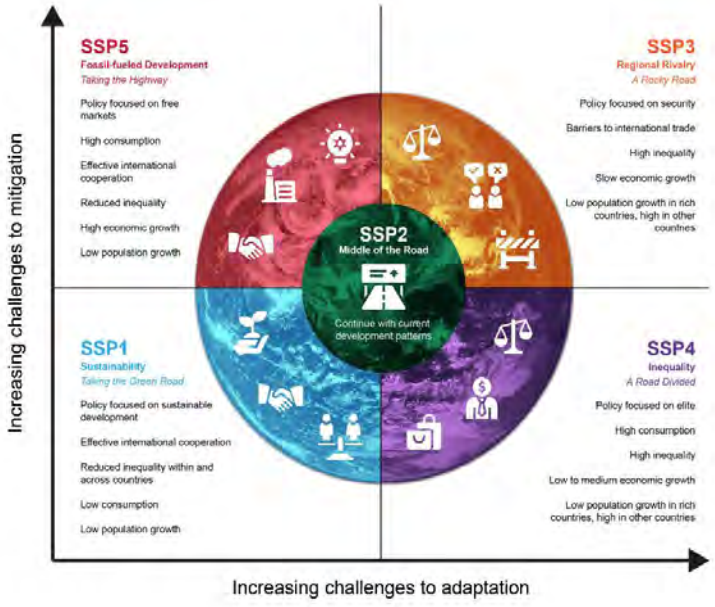


Figure 1 Shared socioeconomic pathways (SSPs)

Ranging from pathways emphasizing sustainability and equitable development (SSP1) to those characterized by inequality and high emissions (SSP5) as summarized in Table 1.

The details of five SSP scenarios are as follows.

- **SSP1-1.9: Very ambitious scenario to comply with the 1.5°C objective of the Paris Agreement**

  This is the most optimistic scenario. Global CO_2 emissions fall to zero by 2050. Societies adopt more environmentally friendly practices, with the focus shifting from economic growth to general well-being. Investments in education and health increase and inequality decreases. Severe weather events are more frequent, but the world has avoided the worst consequences of climate change.

  Challenges for adaptation and mitigation: low

- **SSP1-2.6: Sustainable development scenario**

  Global CO_2 emissions are strongly reduced but less rapidly. The objective of zero emissions is reached after 2050. This scenario presents the same socio-economic trends towards sustainable development as in the first scenario, but the temperature increase stabilizes at around 1.8°C by the end of century.

  Challenges *for adaptation and mitigation: moderate*

- **SSP2-4.5: Middle of the road scenario**

  CO_2 emissions hover around current levels before beginning to decline by mid-century. Socio-economic factors follow their historical trends, with no significant change. Progress toward sustainability is slow, with disparate development and income growth. Under this scenario, temperatures rise by 2.7°C by the end of the century.

  Challenges for adaptation and mitigation: high

- **SSP3-7.0: Regional rivalry scenario**

  Greenhouse gas emissions and temperatures keep regularly increasing, with CO_2 emissions almost doubling from current levels by 2100. Countries become more competitive with each other, prioritizing issues of national and food security. By the end of the century, average temperatures have risen by 3.6°C.

  Challenges for adaptation: high and Challenges for mitigation: low

- **SSP5-8.5: Fossil fuel-driven development scenario**

  This is the "worst case scenario". Current levels of CO_2 emissions are almost doubled by 2050. The world economy grows rapidly, but this growth is driven by fossil fuel exploitation and very energy-Intense lifestyles. By 2100, the average temperature of the planet will have risen by a catastrophic 4.4°C.

  Challenges for adaptation: low and Challenges for mitigation: high.

Table 1. Shared Socioeconomic Pathway (SSP) Scenarios

SSP1 Sustainability	SSP2 Middle of the Road	SSP3 Regional Rivalry	SSP4 Inequality	SSP5 Fossil fuel development
More sustainable pathways	Social and economic trends Continue	Nationalism – Focus on Regional Issues	Unequal investments in Human Capital	Market driven Fossil fuel dependent World
Human well- being over Economic growth	Inequalities Not Alleviated	Less investment in Education/ Technology	High Challenges to Adaptation	Integrated Global Society
Reduced inequality	Some efficiency improvements	Material Intensive consumption	Social Cohesion Degrades	High investment in Human Capital
Less intensive consumption	High Vulnerability to Environmental Changes	Continued Degradation in some Countries	High technological Development	Faith in Technological Solutions

The IPCC in collaboration with the global scientific community had developed General or Global Circulation Models (GCMs) based on the latest assessment reports to understand present climate and future climate under different scenarios of IPCC. GCMs are the primary tools that provide reasonably accurate global-, hemispheric, and continental-scale climate information and are most widely used for projecting the future of the Earth's climate. Coupled Model Intercomparison Project (CMIP) is the responsibility of the Working Group on Coupled Modelling committee (which is part of the World Climate Research Programme (WCRP) based at the World Meteorological Organization in Geneva) is a framework for climate model experiments, allowing scientists to analyse, validate and improve GCMs in a systematic way. The limitation of GCMs is that spatial resolution is generally quite coarse, with a grid size of about 100–500 kilometres and it is generally unsuitable for simulating local climate, since many important phenomena occur at spatial scales less than 50 km. Thus, downscaling techniques have been developed which take the large-scale predictions provided by a GCM and apply methods to extract

implied climate change information at more regional/local scales. Downscaling techniques can be either Statistical Downscaling or Dynamical Downscaling to get the regional/local scale information at the high resolution. The future climate projections generated by regional climate models are primary for the assessment of climate change impacts on sectors such as Water resources, Agriculture, Forestry and Coastal ecosystem.

TAMILNADU AT A GLANCE

CLIMATE MODELING

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2 TAMIL NADU AT A GLANCE

Tamil Nadu is situated in the southern part of India between north latitude 8°5′ and 13°35′ and east longitude between 76°15′ and 80°20′. It has 38 districts and the total area of the state is 1,30,058 sq.km, making it the eleventh largest state in the country with 4.11% of the Union areas(SoER,2017). It is one of the important coastal states with a coastline of 1076 km from Pazhaverkadu of Tiruvallur district to Ezhudesam of Kanyakumari district, which is about 15% of the coastline of India. It is bordered by the Union Territory of Puducherry and the States of Kerala, Karnataka and Andhra Pradesh. It is also bounded by the Eastern Ghats on the north, by the Nilgiris and the Anamalai Hills on the west, by the Bay of Bengal on the east, by the Gulf of Mannar and the Palk Strait on the southeast and by the Indian Ocean on the south. It shares a maritime border with the country of Sri Lanka. Kanyakumari forms the southernmost tip of the Indian subcontinent where the Indian Ocean, Bay of Bengal and Arabian Sea meet (SDMP-29-08 Report, 2018).

Due to the topographical features and geographical area, the climate of Tamil Nadu is referred to as semi-arid and tropical monsoon. The long coastal stretch in the east, hills on the western rim, and a flat interior significantly influence the climate of the State. The average temperature for most parts of the state ranges between 28 °C and 40 °C in the summer season and between 18 °C and 26 °C in the short-lived winter seasons. In the hilly terrain, the maximum temperature may be as low as 26 °C. Tamil Nadu is the only state in India that receives rain from both the northeast (NE) and southwest (SW) monsoons. Of the annual rainfall, 32% is received during the SW monsoon (June–September) and 48% during the NE monsoon (October– December). The Western Ghats acting as a barrier deprive the State from the full blast of South-west monsoon winds. The State mostly depends on the north-east monsoon rains that are brought by the troughs of low pressure establishing in south Bay of Bengal (WASCA Scoping Preliminary Assessment Report,2020). The normal annual rainfall is 950 mm (TNSAPCC Report 2013; IMD 1973; Geetha et al 2019).

The State is frequently subjected to extreme weather. Since the last decade, the State is facing a noticeably higher incidence of cyclonic events (Michaung 2023, Mandous 2020, Gaja 2018, Ockhi 2017, Vardah 2016), severe floods (2023, 2021, 2019, 2017 and 2015) and extreme drought in the years 2022,

2021, 2020 and 2016 (Geetha et al 2019). This has an adverse effect on agricultural production. Drought, water depletion, soil erosion, sea water incursion, species extinction and thermal discomfort which are the major manifestations of climate change.

2.1 OBSERVED CLIMATE PROFILE OF TAMIL NADU

2.1.1 Temperature profile

To assess the current variability of precipitation and temperature, the high resolution (0.25°x0.25°) daily gridded rainfall datasets for Tamil Nadu covering 184 grids and 1.0°x1.0° latitude and longitude daily gridded temperature datasets covering 23 grids for maximum and minimum temperatures, spanning over 30 years (1985-2014) provided by India Meteorological Department (IMD) (https://www.imdpune.gov.in/lrfindex.php) have been used.

The mean annual maximum temperature for Tamil Nadu over the period of 1985-2014 is 32.5°C with a range varying from 29.5°C to 33.4°C (Figure 2). It is also observed that the highest value is attained for the districts, viz., Chennai, Kancheepuram, Chengalpattu, Thiruvallur, Tiruvarur and Cuddalore while the lowest value is attained for the Nilgiris district of Tamil Nadu.

The mean annual minimum temperature is 22.6°C with a range varying from 19.4°C to 24.1°C (Figure 2). It is also seen that for annual minimum temperature the highest value is attained for the district Tiruvarur followed by Cuddalore, Mayiladuthurai and Nagapattinam districts while the lowest value is attained for the district, Nilgiris: lying in Hilly Zone, for the period of 1985-2014 (30 years).

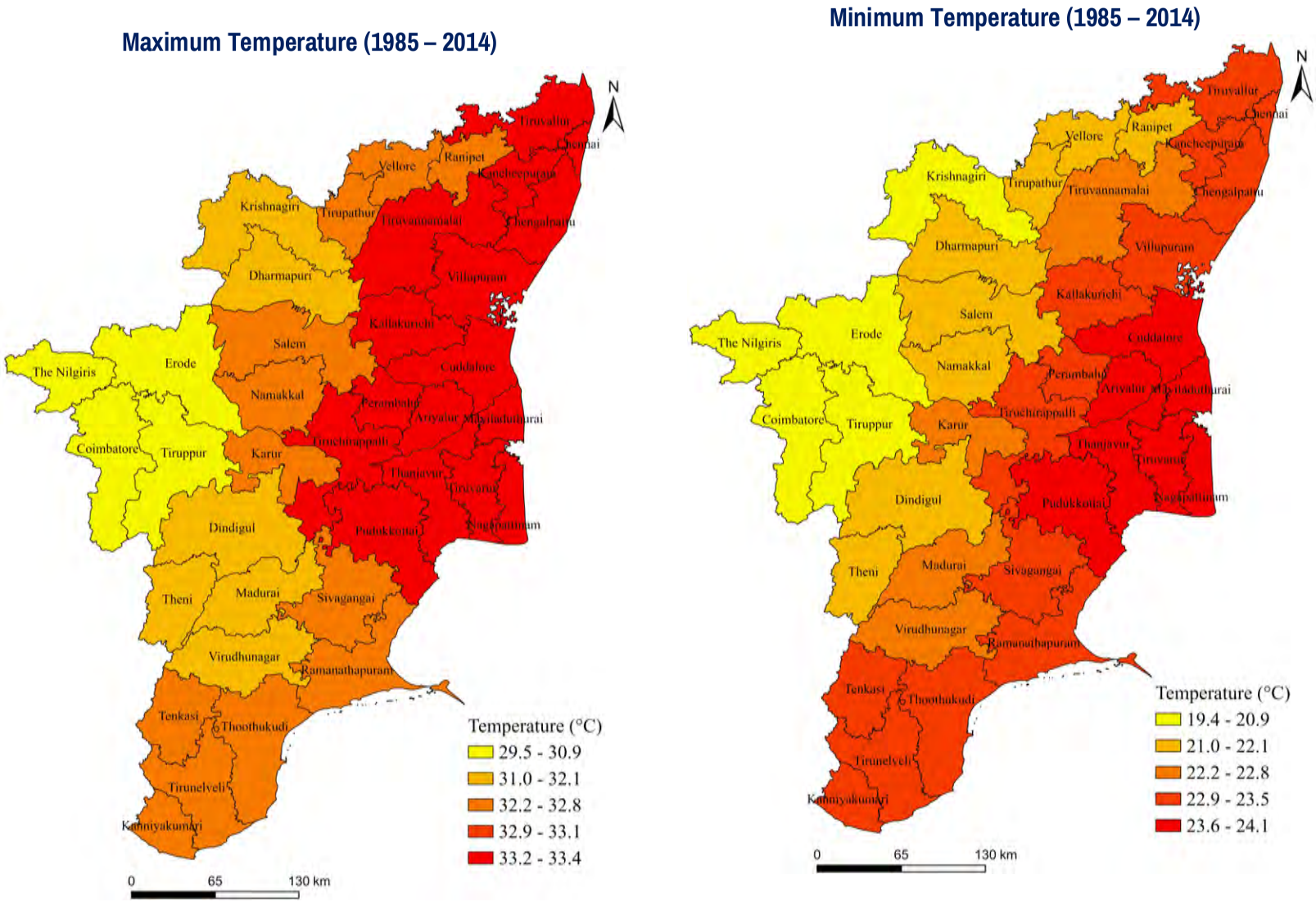


Figure 2 Spatial Variation in Observed Annual Maximum and Annual Minimum Temperature (1985 - 2014)

The monthly observed highest value of maximum temperature (37.2°C) and minimum temperature (26.2°C) is observed during the month of May while the lowest value of maximum (26.3°C) and minimum temperature (17.3°C) is observed in the months of December and January respectively as depicted in Figure 3.

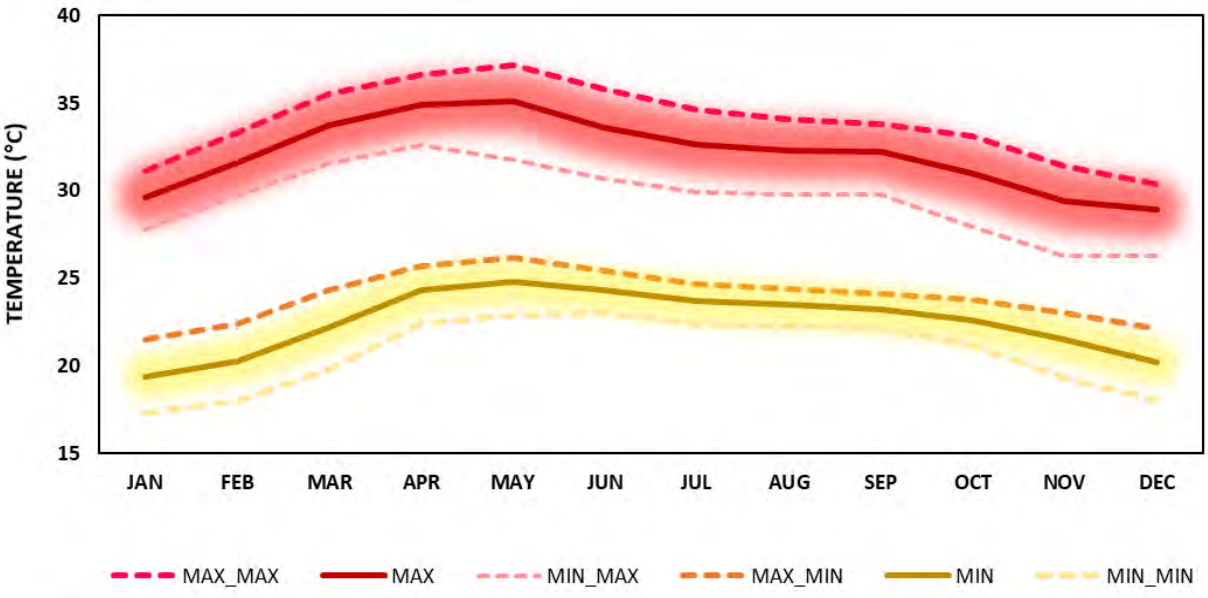


Figure 3 Long term monthly average, maximum and minimum temperature (1985 -2014)

The trend of observed annual maximum and minimum temperature is depicted in Figure 4 and 5. It is observed that there is a significant increasing trend in both observed annual maximum and minimum temperature during the 30 years at a rate of 0.2°C and 0.3°C respectively.

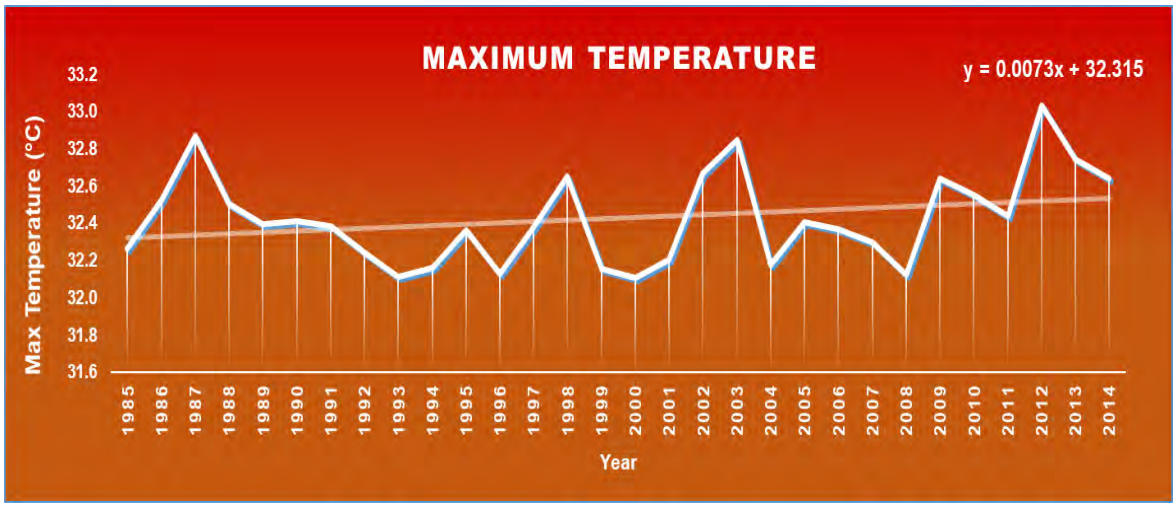


Figure 4 ***Trend of observed annual maximum temperature of Tamil Nadu (1985 -2014)***

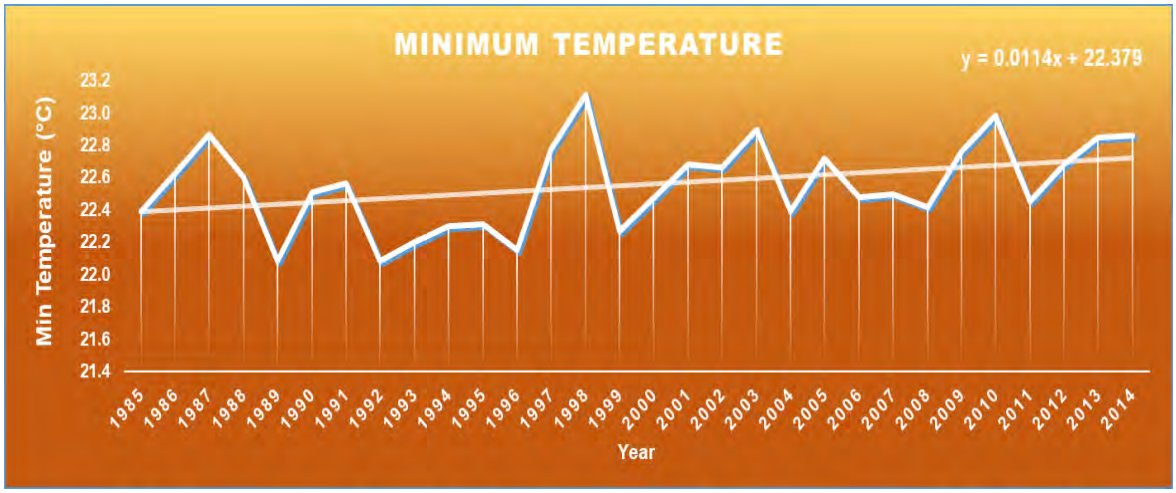


Figure 5 ***Trend of observed annual minimum temperature of Tamil Nadu (1985-2014)***

2.1.2 Rainfall

The average annual rainfall of Tamil Nadu is 989 mm within the district values ranging from 763 mm to 1432 mm over the 30 years period (1985-2014). As depicted in Figure 6 amongst all districts, The Nilgiris, Thiruvallur, Chennai, Kancheepuram, Chengalpattu, Cuddalore, Tiruvarur, Mayiladuthurai and Nagapattinam receives the maximum average annual rainfall while Erode, Tiruppur, Karur, Namakkal,

Tiruchirappalli, Krishnagiri, Tirupathur, Tenkasi, Thoothukudi and Tirunelveli receives the lowest annual average rainfall.

AVERAGE ANNUAL RAINFALL (1985 – 2014)

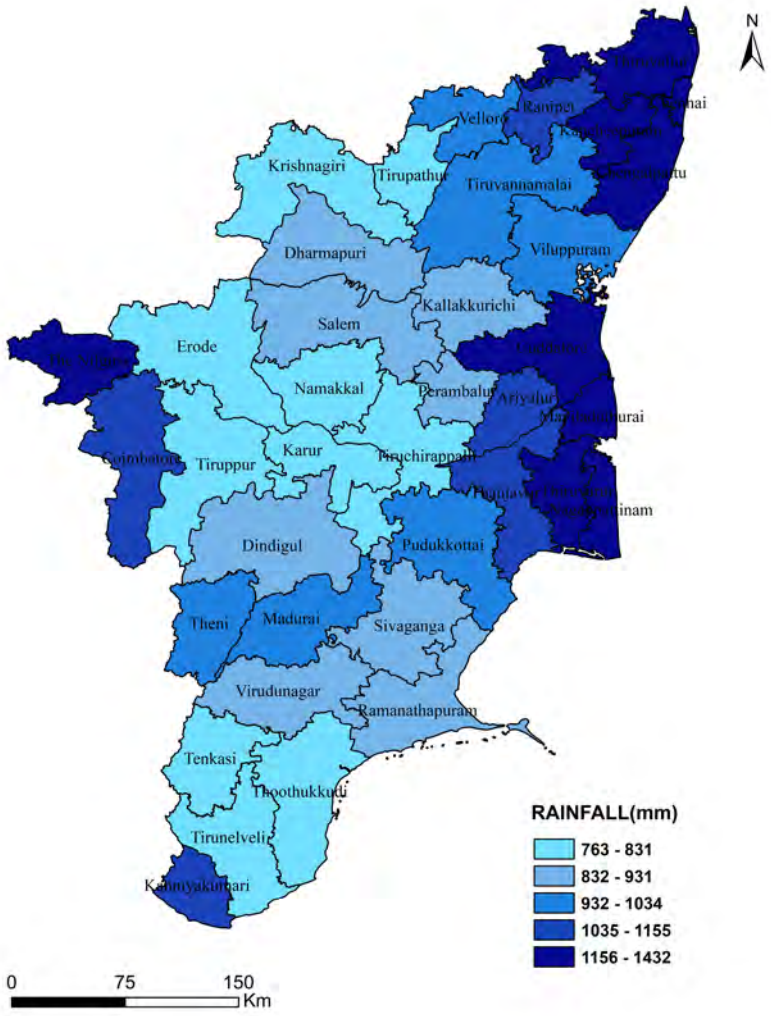


Figure 6 Spatial Variations in Observed Annual Rainfall (1985-2014)

Figure 7 highlights the fact that the post monsoon period comprising months of October, November, December (OND) rainfall contributes the maximum to annual rainfall for Tamil Nadu. The trend of observed annual rainfall of Tamil Nadu is shown in Figure 8. It indicates an insignificant increase of 5.3mm/year during the period of 1985 -2014).

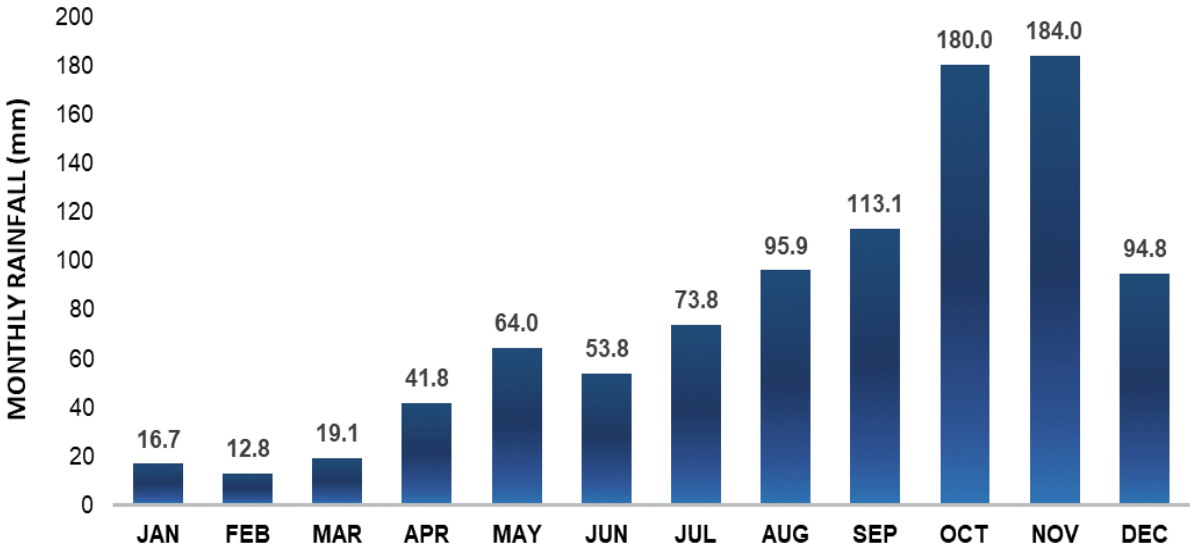


Figure 7 Monthly Average Annual Rainfall of Tamil Nadu (1985-2014)

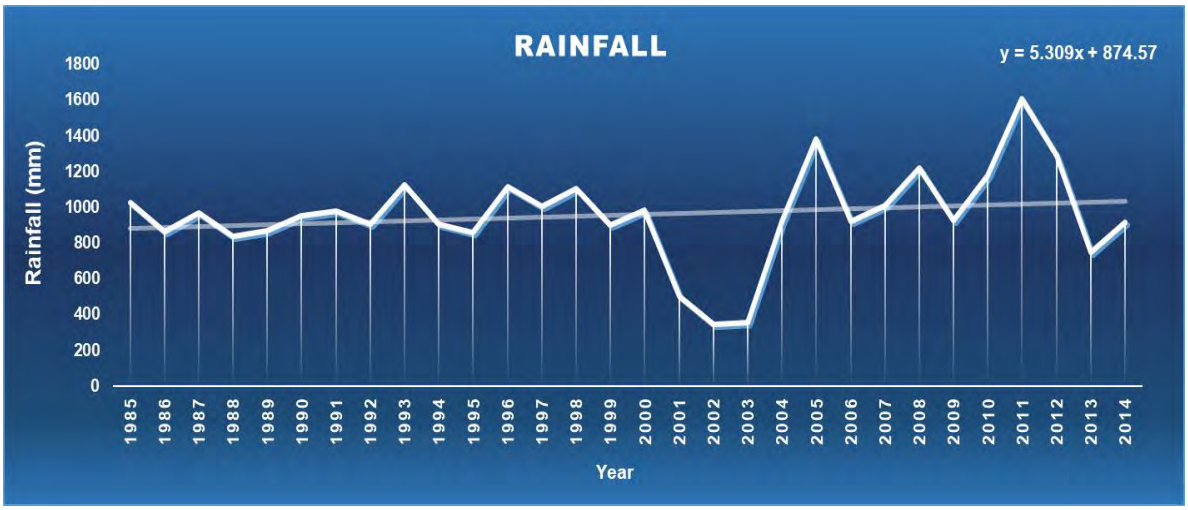


Figure 8 Trend of Observed Annual Rainfall of Tamil Nadu (1985-2014)

Annual rainfall distribution is classified with respect to the rainfall volume as excess, normal, deficient or scanty based on the departure of the rainfall from the long period average rainfall (LPA). Based on the IMD classification, if the rainfall received in a particular year is within + or - 19% of the LPA, that year is called as a normal rainfall year, -19% to -59% of the LPA is deficient rainfall year, <-59% of LPA is grouped under scanty rainfall year. On the other hand, if the rainfall is +19% to +59% of LPA, it is an excess rainfall year and >+59% LPA is termed as wet year. Figure 9 shows the decade wise frequency of excess, normal, deficient and scanty rainfall years.

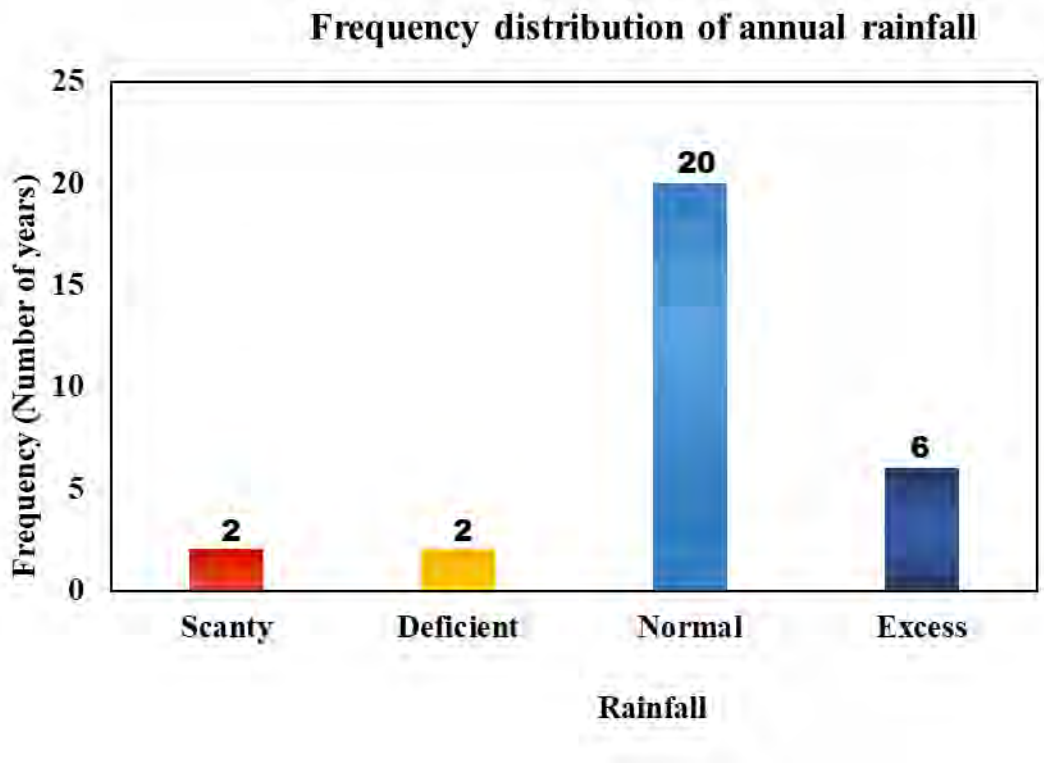


Figure 9 Frequency distribution of annual rainfall – Tamil Nadu's districts (1985-2014)

It is observed that during the period of 1985-2014, the State on an average had 20 normal rainfall years, 6 excess rainfall years; 2 deficit rainfall years and 2 scanty rainfall years for the period of 1985 -2014.

CLIMATE MODELING AND PROJECTIONS

3 CLIMATE MODELING AND PROJECTIONS

Tamil Nadu is one of the extremes-prone states in India that faces extreme cyclones and drought recurrently. The State is frequently subjected to extreme weather conditions such as flooding in the coastal districts and severe droughts in the interior due to monsoon failure (Bal et al 2016). This has an adverse effect on agricultural production. Drought, water depletion, soil erosion, sea water incursion, forest fire, species extinction and thermal discomfort etc. are the major manifestations of climate change. Monsoon rains are a major source of water for irrigation which makes its linkages with the agricultural sector very critical. In order to evade these circumstances, there is a great need to develop high resolution future climate information for assessing climate projections and extremities and providing that information for sectoral impact studies and then can put concrete efforts to formulate adaptation and mitigation strategies for the different developing sectors.

The major objectives include:

(i) Identification of Suitable GCM for Indian Scenario

(ii) Downscaling GCM to Regional Climate Model (RCM)

(iii) Development of Readily Available Cadastral data – District wise for Tamil Nadu state

(iv) Climate and extremities projections for Tamil Nadu

The overall methodology is depicted in Figure 10. The GCMs from the Coupled Model Intercomparison Project Phase 6 (CMIP6) repository are selected based on the previous research and with the nominal resolution of (100 x 100) sq.km to downscale it to the probable highest resolution. (Almazroui et al.2020). Table 3 shows the lists of GCMs selected for this work

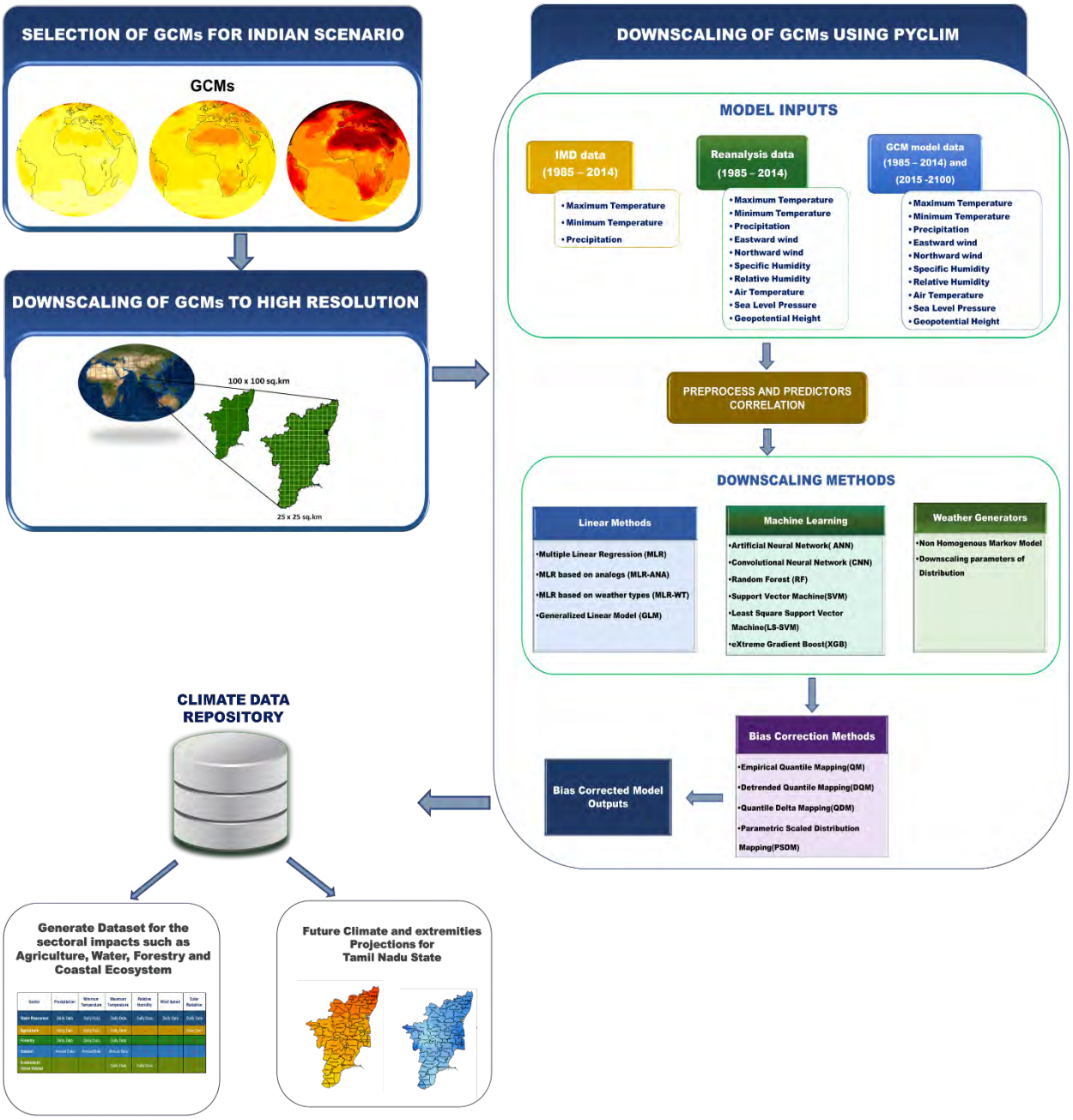


Figure 10 Overall Framework of Climate modelling

Table 2 GCMs Selected from CMIP6 repository

GCM	INSTITUTION
EC-Earth3 (European Community Earth System Model-3)	**EC-EARTH CONSORTIUM, Europe**
EC-Earth3-Veg (European Community Earth-Vegetation model version 3)	**EC-EARTH CONSORTIUM, Europe**
EC-Earth3-CC (European Community Earth System Model coupled carbon cycle version 3)	**EC-EARTH CONSORTIUM, Europe**
GFDL-CM4 (Geophysical Fluid Dynamics Laboratory Coupled Model version 4)	**NOAA, GFDL, USA**
GFDL-ESM4 (Geophysical Fluid Dynamics Laboratory earth system model version 4)	**NOAA, GFDL, USA**
HadGEM3-GC31-MM (Hadley Centre Global Environment Model version 3- Medium atmosphere and Medium ocean resolution)	**MOHC, UK**
MPI-ESM1-2-HR (Max Planck Institute Earth System Model version 2 – High Resolution)	**MPI-N, Germany**

3.1 EVALUATION OF GCMs

The selected models are spatially and statistically evaluated for the ranking of best model.

3.1.1 Statistical Evaluation of GCMs

A performance indicator or metric is a quantifiable measure for any GCM to determine how well it simulates the observed data (Srinivasa Raju et al. 2014). Statistical evaluation is carried out using Root Mean Square Error (RMSE).

Smaller values of RMSE indicate better performance of the model. Ideally, a value close to 0 indicates a higher accuracy in estimation. Table 3 gives the RMSE computed for Precipitation, Maximum and

Minimum Temperature. It is identified that EC – Earth3 model performs better for Rainfall with the less RMSE value.

Table 3 RMSE Computed for Precipitation and Temperature of selected GCMs

GCM	RMSE-Precipitation (mm)	RMSE-Maximum Temperature (°C)	RMSE-Minimum Temperature (°C)
EC-Earth3	41	3.2	3.3
EC-Earth3-Veg	56	3.3	3.2
EC-Earth3-CC	53	3.3	3.4
GFDL-ESM4	52	4.9	3.9
GFDL-CM4	51	5.2	5
HadGEM3-GC31-MM	60	1.7	4.1
MPI-ESM1-2-HR	53	3.9	2.2

3.1.2 Spatial Evaluation of GCMs

Figure 11 and 12 shows the spatial evaluation of the selected GCMs from CMIP6 repository with the observation data for 1985-2014.

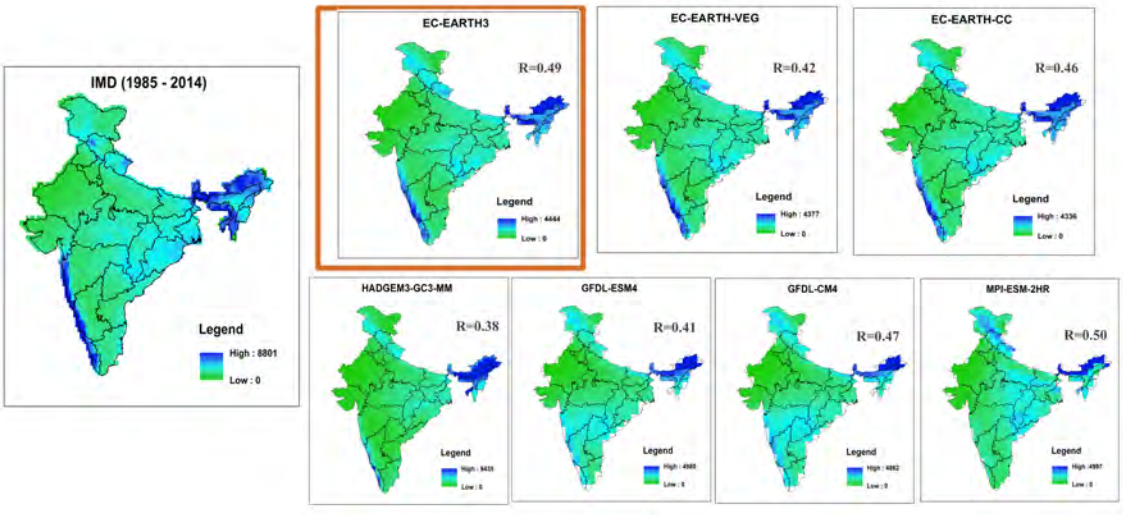


Figure 11 Spatial Evaluation of Average Annual Precipitation- IMD vs GCM

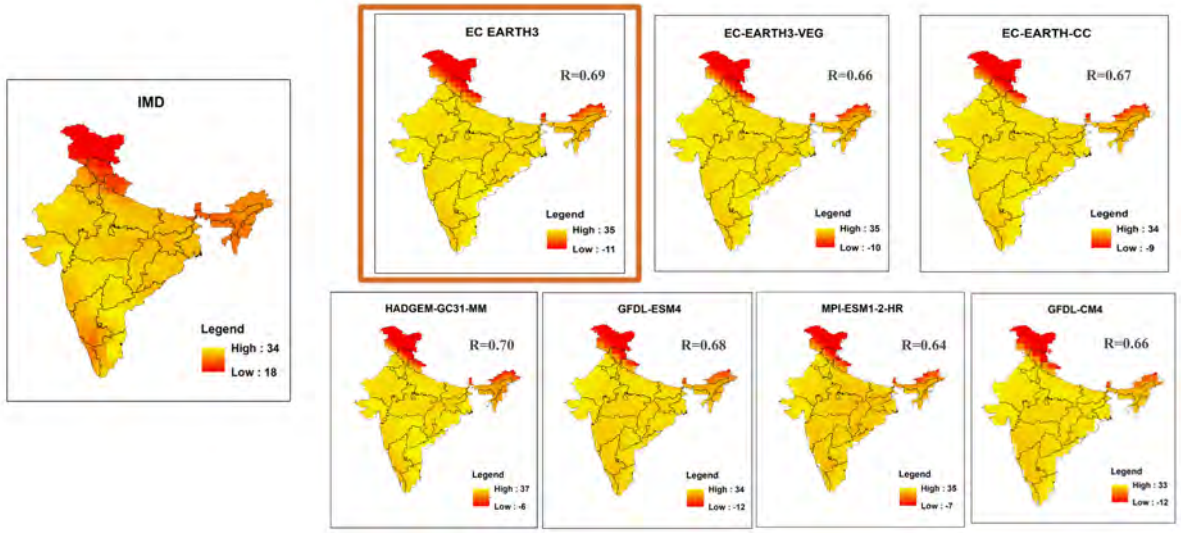


Figure 12 Spatial Evaluation of Average Annual Temperature- IMD vs GCM

Moran's index of spatial autocorrelation (R) is calculated from the spatial data. Table 4 shows the R values for precipitation, Maximum temperature and Minimum temperature.

Table 4 Spatial correlation (R) of Precipitation and Temperature for selected GCMs

GCM	R - Precipitation	R - Maximum Temperature	R - Minimum Temperature
EC-Earth3	0.49	0.69	0.70
EC-Earth3-Veg	0.42	0.66	0.68
EC-Earth3-CC	0.46	0.67	0.69
GFDL-ESM4	0.41	0.68	0.69
GFDL-CM4	0.47	0.64	0.65
HadGEM3-GC31-MM	0.38	0.70	0.68
MPI-ESM1-2-HR	0.50	0.66	0.70

The comprehensive rating metric (Chen et al., 2011) was used to obtain the overall ranks of GCMs. The comprehensive rating index MR, which is defined as

$$\mathbf{MR} = \mathbf{1} - \frac{\mathbf{1}}{\boldsymbol{nm}} \sum_{\boldsymbol{i=1}}^{\boldsymbol{n}} \mathbf{rank}_{\boldsymbol{i}}$$

where n refers to the number of GCMs, m refers to the number of metrics. If the value of MR is closer to 1, then higher the skill of the simulation (Kamal Ahmed et al.2019, Jiang et al.2015). Table 5 lists the rank of the GCMs using comprehensive rating metrics (MR). The highest MR value ranks first in best performing model.

Table 5 Ranking of GCMs

GCM	RMSE			R			Overall MR Value	Overall Rank
	Pr Rank	Tmax Rank	Tmin Rank	Pr Rank	Tmax Rank	Tmin Rank		
EC-Earth3	1	2	3	2	2	1	0.74	1
MPI-ESM1-2-HR	4	5	1	1	5	1	0.60	2
EC-Earth3-CC	4	3	4	4	4	3	0.48	3
EC-Earth3-Veg	6	3	2	5	5	5	0.38	4
GFDL-ESM4	3	6	5	6	3	3	0.38	4
HadGEM3-GC31-MM	7	1	6	7	1	5	0.36	6
GFDL-CM4	2	7	7	3	7	7	0.21	7

Based on the comprehensive MR value ranking, EC-Earth3 model is selected as best performing model for downscaling.

3.1.3 Downscaling of GCM to High Resolution RCM

The GCM model was downscaled from 100×100 km spatial resolution to 25×25 km spatial resolution for Tamil Nadu using a python based tool named pyClim-SDM for the scenarios of SSP2-4.5 and SSP5-8.5 of IPCC AR6.

Statistical Downscaling Models (SDM) involve deriving empirical relationships linking large-scale atmospheric variables (predictors) and local/regional climate variables (predictands). These relationships may then be applied to equivalent predictors from global models. Pyclim-SDM was used for statistical downscaling of climate change projections for daily surface variables: maximum and minimum temperature, precipitation, wind speed, relative humidity and solar radiation. A statistical relationship has been derived between observed small scale (IMD daily data) variables and larger (ERA5 Reanalysis data and GCM data) scale variables, using a transfer function for the historical/baseline period (1985 - 2014) and then applied to GCM for the future period (2015 -2100) to get the local climate projections at higher resolution (Sailor and Li, 1999; Wilby et al., 2002).

The pyClim-SDM incorporates a large set of state-of-the-art SDMs such as Raw Models (no downscaling), Model Output Statistics (MOS), Analog/Weather Typing methods (ANA/WT), Linear methods (LIN), Machine Learning (ML) methods and Weather Generators (Hernanz et al 2022) (Figure 10).

The EC-Earth3 model is downscaled with all the SDMs in the pyClim and validated with the daily rainfall data from both the India Meteorological Data (IMD) and the Aphrodite data at a grid resolution of 25 km x 25 km. Similarly, the daily temperature is also validated with the data from IMD of 100km x 100km resolution which is regridded to 25km x 25km resolution for the period of 1985-2014.

The downscaled RCMs were then bias corrected to reduce the biases in the model data. The bias correction Methods such as Empirical Quantile Mapping(QM), Detrended Quantile Mapping (DQM), Quantile Delta Mapping(QDM) and Parametric Scaled Distribution Mapping (PSDM) had been employed to model data and the ANN-QDM method leads to better performance based on the statistical measures such as RMSE (0.92) and Correlation coefficient (0.96).

The downscaled and bias corrected climate data have been utilized for the future projection of Tamil Nadu State.

3.2 CLIMATE CHANGE PROJECTIONS FOR TAMIL NADU

3.2.1 Temperature Projections

The climate projections are analyzed for near-century (2021-2050), mid-century (2051- 2080) and by end-century (2081-2100) with reference to the baseline (1985-2014). Figure 13 indicates that the annual mean maximum temperature of the State may rise by up to 0.4 ℃, 1.3℃ and 1.7 ℃ in near-century mid-century and by end-century respectively with reference to the baseline (1985-2014) under SSP2-4.5 scenario (Table 6). With respect to the SSP5-8.5 scenario, the maximum temperature may rise by 0.6℃, 1.7℃ and 3.5℃ in near-century, mid-century and by end-century respectively (Table 6, Figure 14).

District wise projections indicate that the northern districts such as Chennai, Thiruvallur, Kancheepuram, Vellore, Chengalpattu and Ranipet is projected to have maximum increase by the end of the century under both SSP2-4.5 and SSP5-8.5 Scenarios.

Table 6 Change in Annual Average Maximum Temperature

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2 4.5	SSP5 8.5
Near Century (2021-2050)	0.4	0.6
Mid Century (2051-2080)	1.3	1.7
End Century (2081-2100)	1.7	3.5

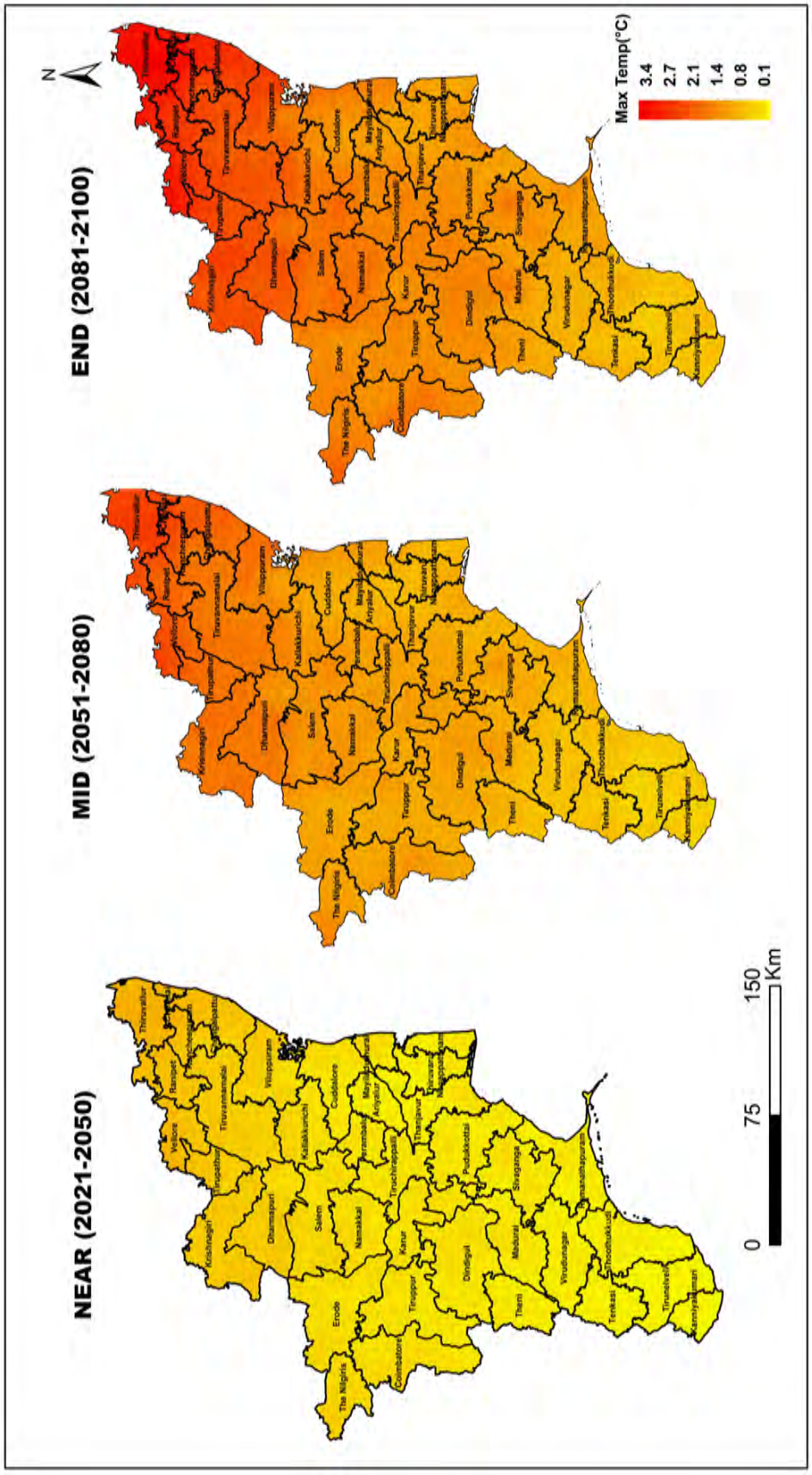


Figure 13 Projected Changes in Annual Maximum Temperature by near-century, mid- century (MC) and end of century (EC) under SSP2-4.5 Scenario

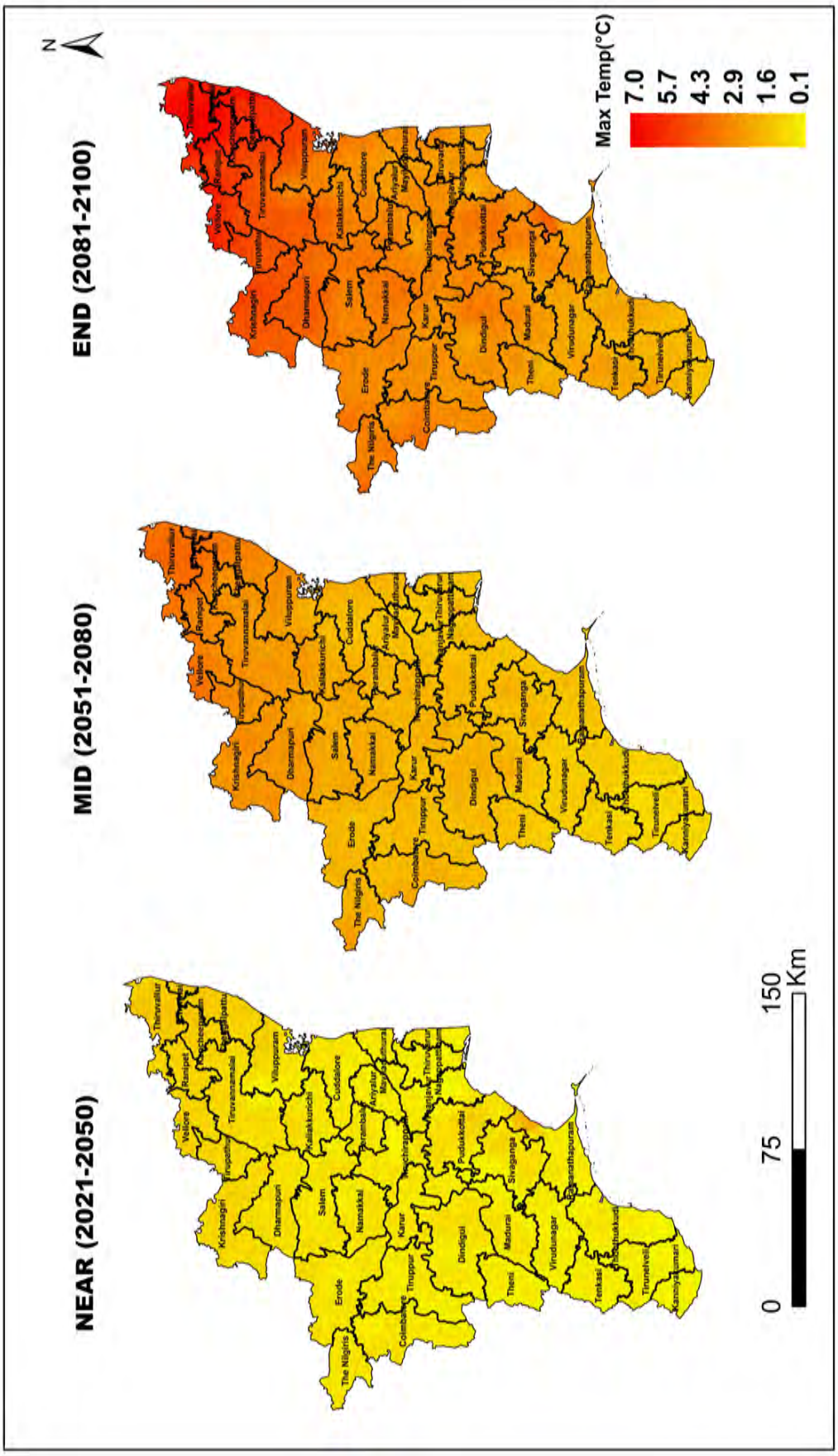


Figure 14 Projected Changes in Annual Maximum Temperature by near-century, mid- century (MC) and end of century (EC) under SSP5-8.5

3.2.2 Rainfall Projections

Average rainfall in Tamil Nadu State is projected to increase marginally, by 4% towards near-century, 11% in the mid-century and increase about 16% towards end-century under SSP2-4.5 scenario (Table 7, Figure 15). Using the SSP5-8.5 scenario, the increase in rainfall is by 7% towards the near-century, 18% in the mid-century and increases about 26% towards the end-century (Figure 16).

The coastal districts such as Cuddalore, Nagapattinam and Mayiladuthurai is projected to have maximum change in rainfall by the end of the century under both SSP2-4.5 and SSP5-8.5 Scenarios.

Table 7 Rainfall Projections under SSP2-4.5 and SSP5-8.5

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4	7
Mid Century (2051-2080)	11	18
End Century (2081-2100)	16	26

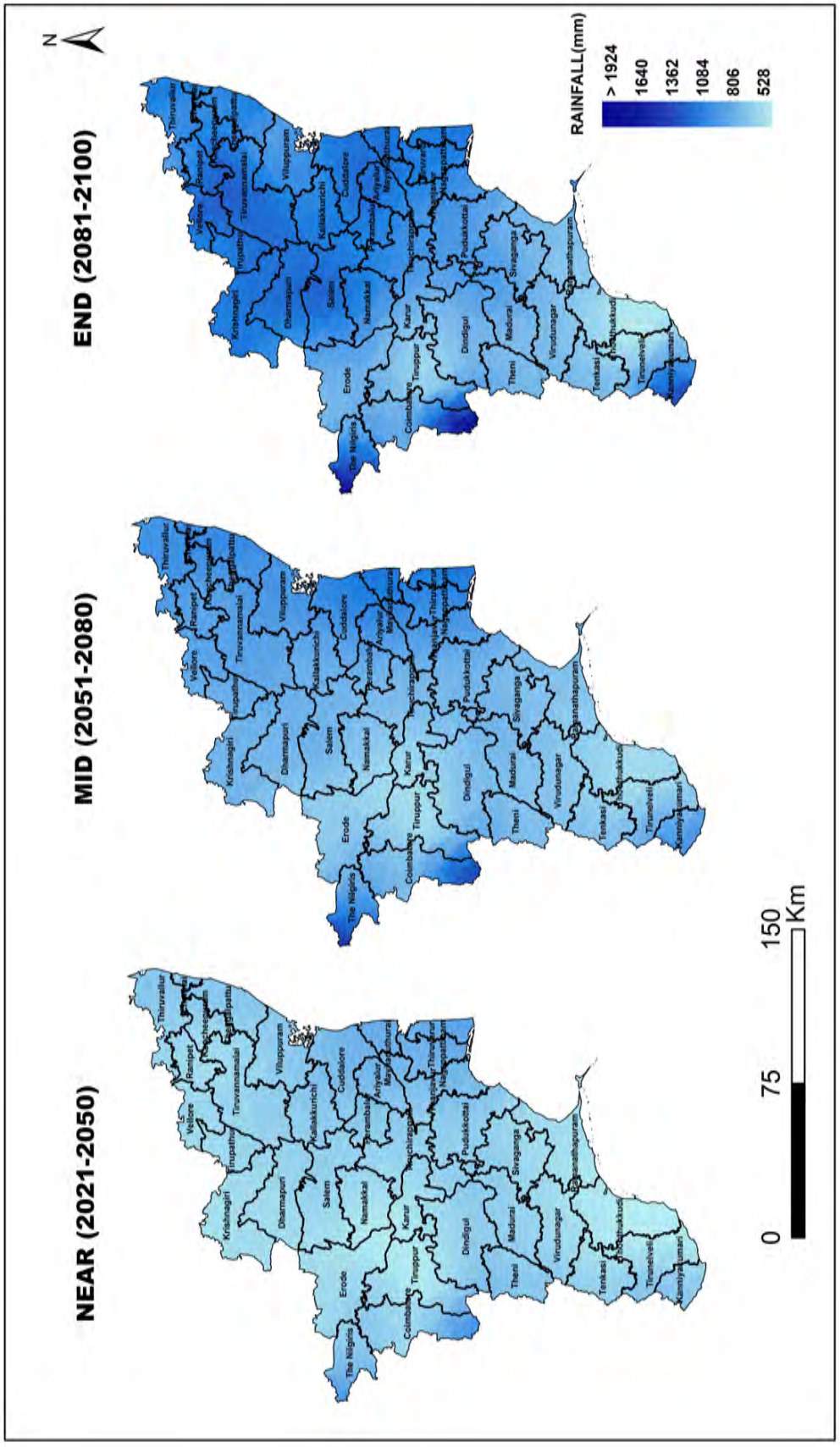


Figure 15 Projected Average Annual Rainfall by near- century(NC), mid-century (MC) and end of century (EC) under SSP2-4.5

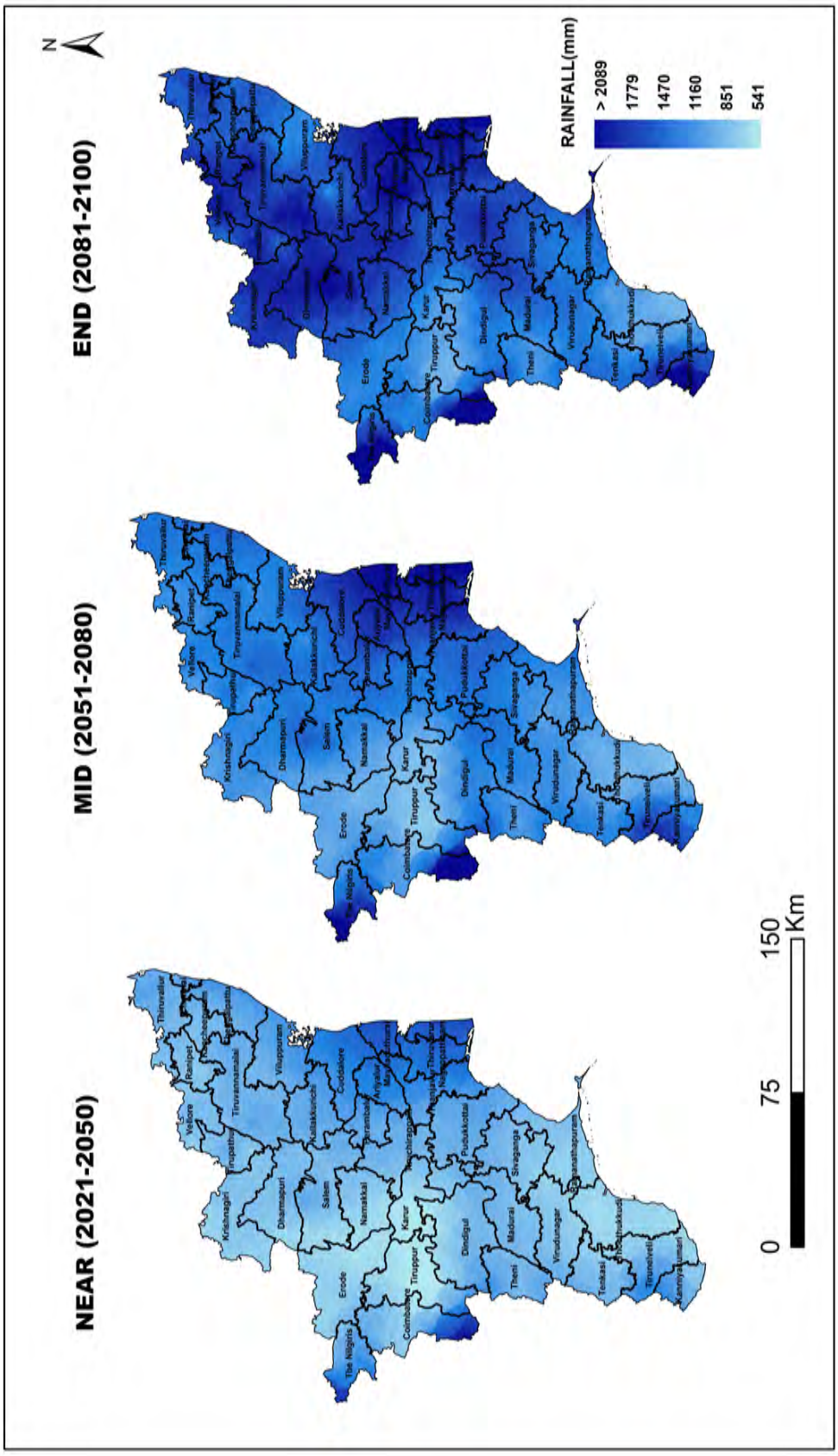


Figure 16 Projected Average Annual Rainfall by near-century(NC), mid-century (MC) and end of century (EC) under SSP5-8.5

3.3 CLIMATE EXTREMITIES

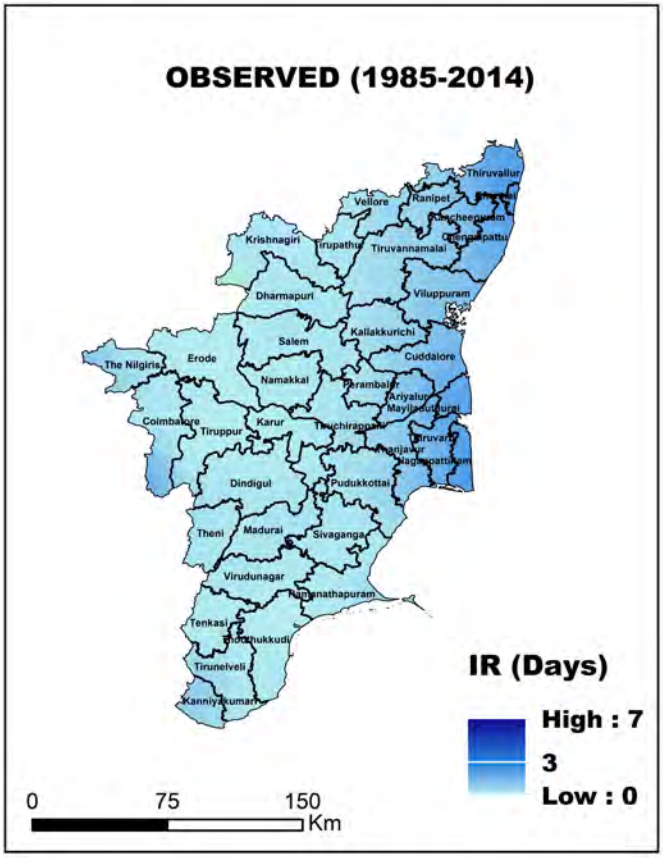
3.3.1 Intense Rainfall

The occurrences of extreme events such as heat waves and intense rainfall (IR) have become a key issue due to climate change which has major impacts on society.

Based on the IMD classification, the rainfall above 64.5 mm per day is classified as Intense Rainfall. The Intense rainfall is further classified as Heavy Rain (64.5-115.5 mm), very heavy rain (115.6-204.4mm) and Extremely Heavy Rain (>204.5mm). Tamil Nadu has experienced the Intense rainfall of 3 days per year for the period of 1985 -2014 of which 2 days are Heavy Rainfall and 1 day are Very Heavy Rainfall (Table 8). The future projections of Intense Rainfall are expected to increase by 4 days per year in the Near-century, 5 days per year in the Mid-century and 7 days per year by the end of the Century under SSP2-4.5 (Figure 17).

Table 8 Intense Rainfall Events (Days per year) under SSP2-4.5

	Observed (1985-2014)	Near Century (2021-2050)	Mid Century (2051-2080)	End Century (2081-2100)
HEAVY RAINFALL (64.5<) and (>115.5)	2	3	4	4
VERY HEAVY RAINFALL(115.5<) and (>204.5)	1	1	1	2
EXTREME HEAVY RAINFALL (>204.6)	0	0	0	1
TOTAL NO. OF INTENSE RAINFALL EVENTS	3	4	5	7



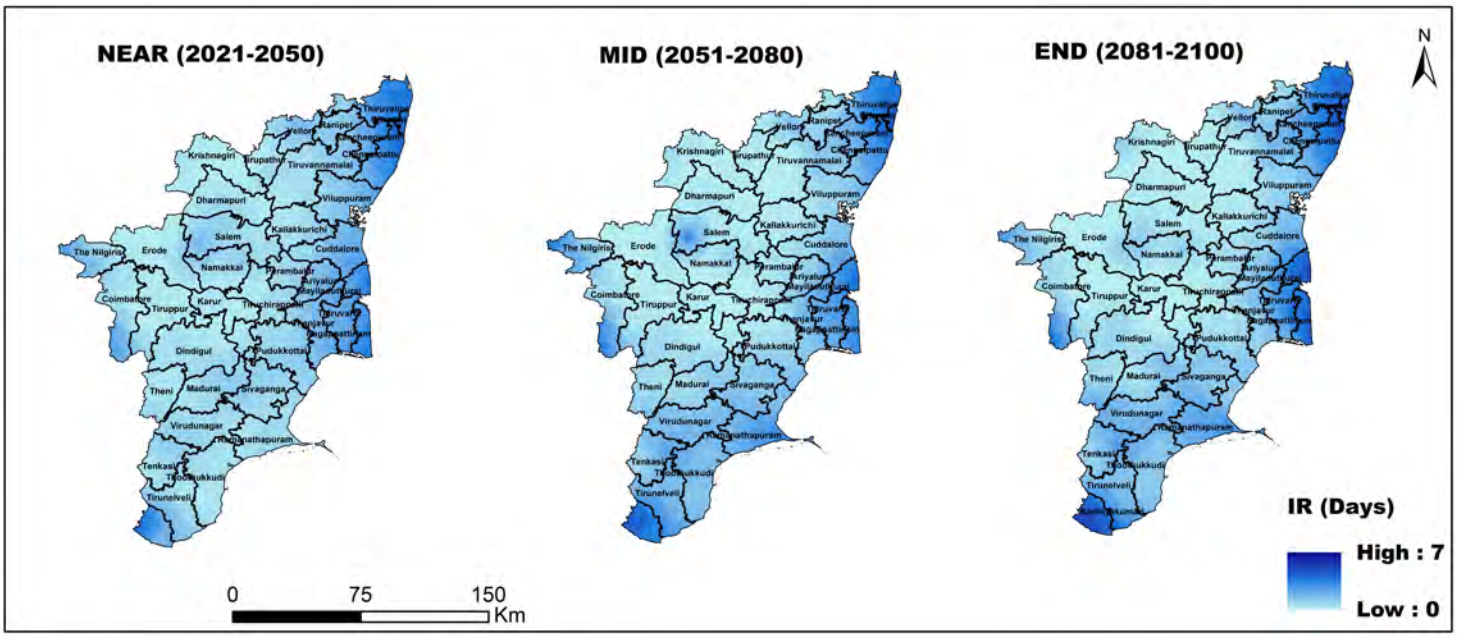


Figure 17 Intense Rainfall above 64.5mm for observed and near-century(NC), mid-century (MC) and end of century (EC) under SSP2-4.5

3.3.2 Heatwaves

Heatwaves (HW) are understood as prolonged episodes of extreme temperature over any region. These episodes are defined based on temperature threshold, which may vary with the physiography and climate of the region and different durations considered. HW days are calculated if the maximum temperature is above 4.5 °C from the normal value for the period of 1985-2014.

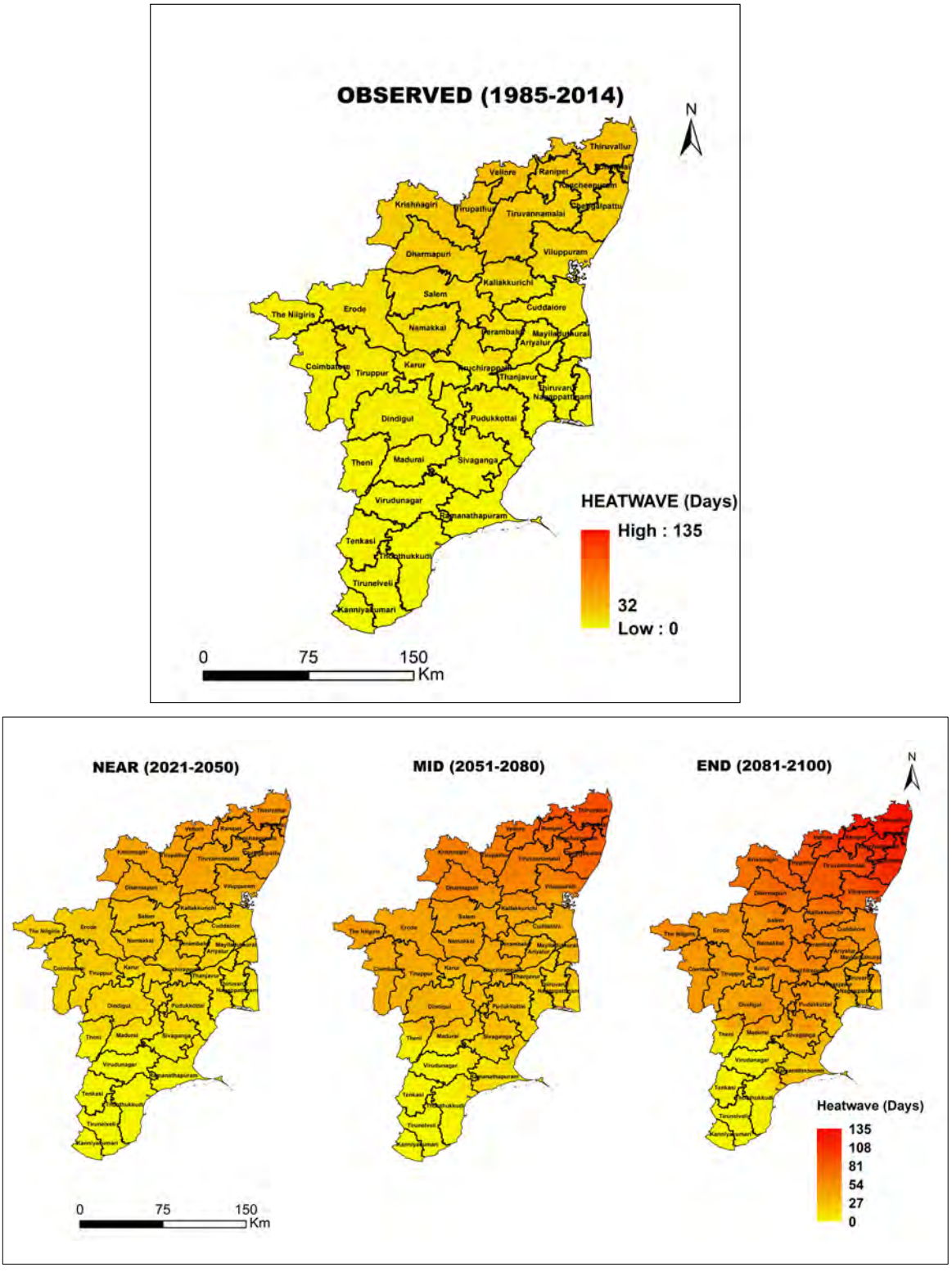


Figure 18 Observed and Projected Heatwaves under SSP2-4.5

Tamil Nadu has faced the heatwaves of 12 days (ranging from 0 -28 days) per year for the period of 1985-2014 and the average projected Heatwave days for the near-century (2021-2050) is 22 days per year; for the mid-century (2051-2070) is 40 days per year and for the end-century (2071-2100) is 55 days per year under SSP2-4.5 (Figure 18).

The projected climate data utilized for the impact studies on the various sectors such as water resources, agriculture, coastal and forestry for the climate impact assessments on each sector (Table 9). This climate change impact assessment aims to analyse the effects of changing climatic conditions on key sectors and identify potential vulnerabilities and provide adaptation strategies. By identifying vulnerabilities and providing adaptation strategies tailored to each sector, we can foster resilience and build a more sustainable future in the face of climate change.

Table 9 Climate Data for Sectoral impact Assessments

Sector	Precipitation	Minimum Temperature	Maximum Temperature	Relative Humidity	Wind Speed	Solar Radiation
Water Resources	Daily Data	Daily Data	Daily Data	Daily Data	Daily Data	Daily Data
Agriculture	Daily Data	Daily Data	Daily Data	×	×	Daily Data
Forestry	Daily Data	Daily Data	Daily Data	×	×	×
Coastal	Annual Data	Annual Data	Annual Data	×	×	×
Sustainable Urban Habitat	×	×	Daily Data	Daily Data	×	×

DISTRICTWISE CLIMATE PROFILE

OF TAMILNADU

CLIMATE MODELING

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4 DISTRICTWISE CLIMATE PROFILE OF TAMIL NADU

The Tamil Nadu state comprises of 38 districts (Figure 19). The distrcitwise climate information of State including current climate of the district for the period 1985-2014, future projections for near-century, mid-century and end-century under SSP2-4.5 and SSP5-8.5 scenarios and climate extremes under SSP2-4.5 scenario for each district are as follows:

Figure 19 Districts of Tamil Nadu

CLIMATE PROFILE AND PROJECTIONS OF ARIYALUR DISTRICT

CLIMATE MODELING

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4.1 Climate Profile and Projections of Ariyalur District

Observed Maximum Temperature

The annual mean maximum temperature of Ariyalur for the baseline period (1985 to 2014) is 33.2°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 20).

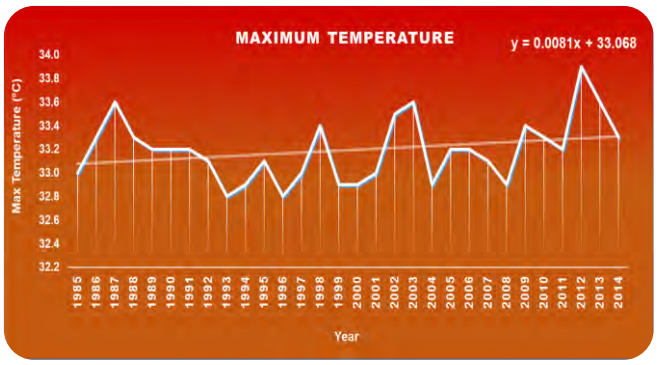

Figure 20 Maximum Temperature Trend of Ariyalur (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Ariyalur for the baseline period (1985 to 2014) is 23.6°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 21).

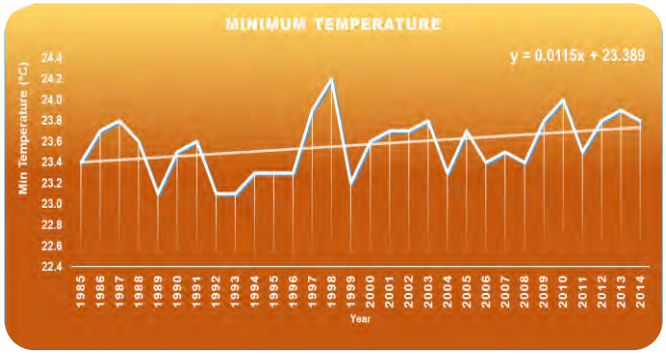

Figure 21 Minimum Temperature Trend of Ariyalur (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.4ºC and 2.9ºC under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 10).

Table 10 Maximum Temperature Projections of Ariyalur

Projection Period	Increase in Annual Average Maximum Temperature (ºC)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.2	0.4
Mid Century (2051-2080)	0.9	1.4
End Century (2081-2100)	1.4	2.9

Minimum Temperature Projections

Similarly, the projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.0°C and 3.6°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 11).

Table 11 Minimum Temperature Projections of Ariyalur

Projection Period	Increase in Annual Average Minimum Temperature (ºC)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.8
Mid Century (2051-2080)	1.4	2.0
End Century (2081-2100)	2.0	3.6

Observed Rainfall

The annual average rainfall of Ariyalur for the baseline period (1985 to 2014) is 1060.1mm. The trend of rainfall indicates an increase of 12.3mm/year in the period of 1985 -2014 (Figure 22).

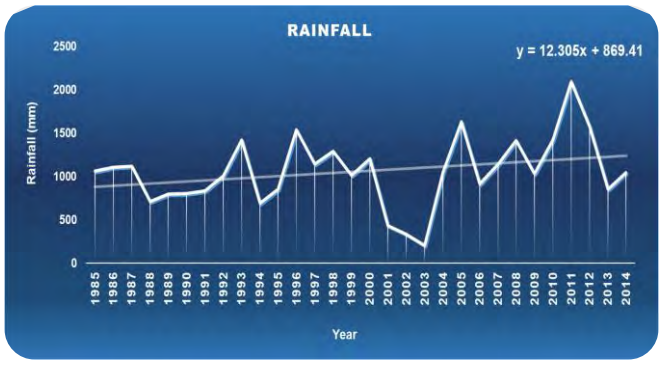

Figure 22 Rainfall Trend of Ariyalur (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 24.1% and 32.8% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 13).

Table 13 Rainfall Projections of Ariyalur

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	7.2	9.6
Mid Century (2051-2080)	11.0	23.4
End Century (2081-2100)	24.1	32.8

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985-2014).

Projected Heatwave Days

Average projected Heatwave days for Ariyalur district is 56 days per year for the end century (Table 12).

Table 12 Heatwave days of Ariyalur

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	18
Mid Century (2051-2080)	35
End Century (2081-2100)	56

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Ariyalur is expected to increase by 2 days per year by the end of century (Table 14).

Table 14 Intense Rainfall events of Ariyalur

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	2

CLIMATE PROFILE AND PROJECTIONS OF CHENGALPATTU DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.2 Climate Profile and Projections of Chengalpattu District

Observed Maximum Temperature

The annual mean maximum temperature of Chengalpattu for the baseline period (1985 to 2014) is 33.4°C and the trend indicates an increase in maximum temperature by 0.4°C (Figure 23).

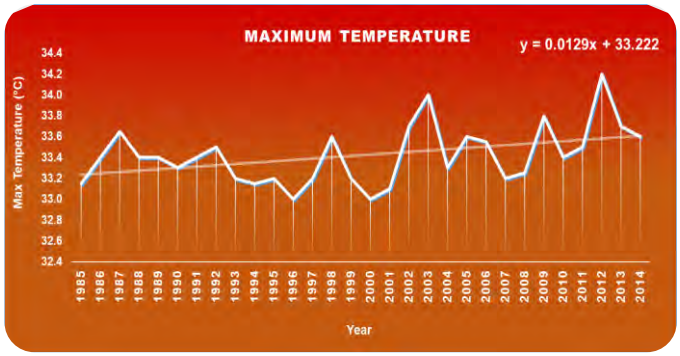

Figure 23 Maximum Temperature Trend of Chengalpattu (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Chengalpattu for the baseline period (1985 to 2014) is 23.3°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 24).

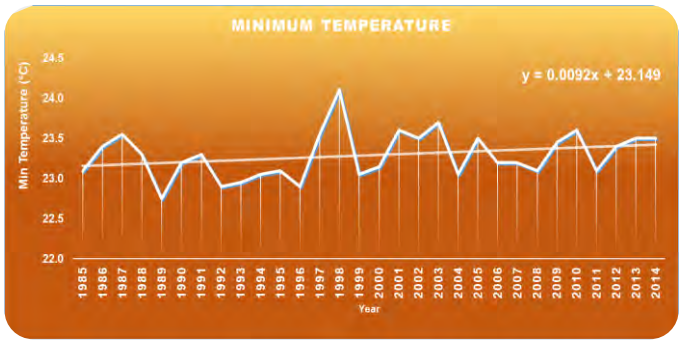

Figure 24 Minimum Temperature Trend of Chengalpattu (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.6°C and 5.5°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 15).

Table 15 Maximum Temperature Projections of Chengalpattu

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	1.1
Mid Century (2051-2080)	1.8	2.9
End Century (2081-2100)	2.6	5.5

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.9°C and 5.9°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 16).

Table 16 Minimum Temperature Projections of Chengalpattu

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	1.0	1.1
Mid Century (2051-2080)	2.0	3.1
End Century (2081-2100)	2.9	5.9

Observed Rainfall

The annual average rainfall of Chengalpattu for the baseline period (1985 to 2014) is 1215.5mm. The trend of rainfall indicates a decrease of 3mm/year in the period of 1985 -2014 (Figure 25).

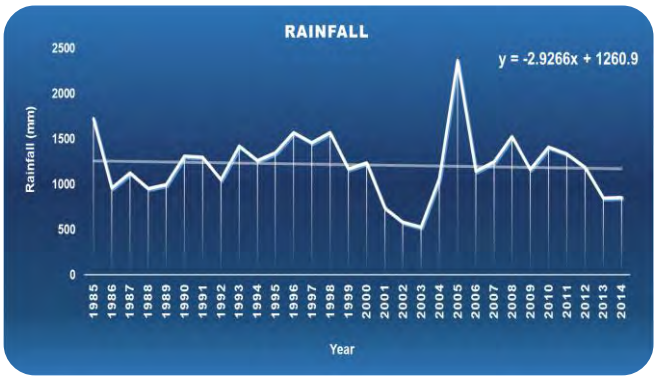

Figure 25 Rainfall Trend of Chengalpattu (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 16.5% and 31.8% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 18).

Table 18 Rainfall Projections of Chengalpattu

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4.6	8.4
Mid Century (2051-2080)	9.8	21.7
End Century (2081-2100)	16.5	31.8

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 - 2014) is 20 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Chengalpattu district is 107 days per year for the end century (Table 17).

Table 17 Heatwave days of Chengalpattu

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	43
Mid Century (2051-2080)	78
End Century (2081-2100)	107

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 2 days per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Chengalpattu is expected to increase by 4 days per year by the end of century (Table 19).

Table 19 Intense Rainfall events of Chengalpattu

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	2
Mid Century (2051-2080)	3
End Century (2081-2100)	4

CLIMATE PROFILE AND PROJECTIONS OF CHENNAI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.3 Climate Profile and Projections of Chennai District

Observed Maximum Temperature

The annual mean maximum temperature of Chennai for the baseline period (1985 to 2014) is 33.4°C and the trend indicates an increase in maximum temperature by 0.4°C (Figure 26) .

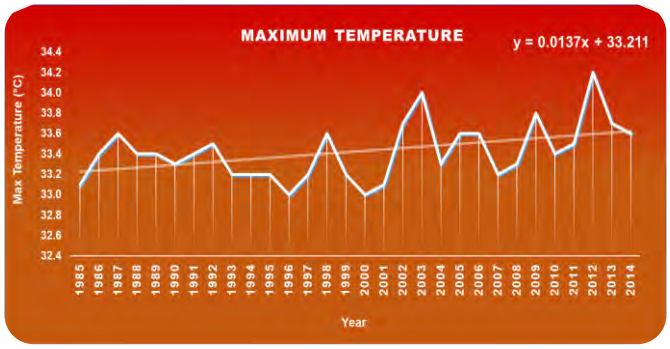

Figure 26 Maximum Temperature Trend of Chennai (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Chennai for the baseline period (1985 to 2014) is 23.3°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 27).

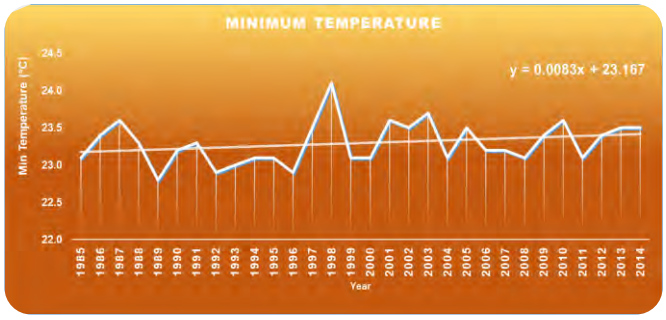

Figure 27 Minimum Temperature Trend of Chennai (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.9ºC and 5.3ºC under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 20).

Table 20 Maximum Temperature Projections of Chennai

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.9	1.2
Mid Century (2051-2080)	2.0	3.2
End Century (2081-2100)	2.9	5.3

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 3.1°C and 5.7°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 21).

Table 21 Minimum Temperature Projections of Chennai

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	1.0	1.5
Mid Century (2051-2080)	2.2	3.5
End Century (2081-2100)	3.1	5.7

Observed Rainfall

The annual average rainfall of Chennai for the baseline period (1985 to 2014) is 1249.5 mm. The trend of rainfall indicates a decrease of 7.6 mm/year in the period of 1985 -2014 (Figure 28).

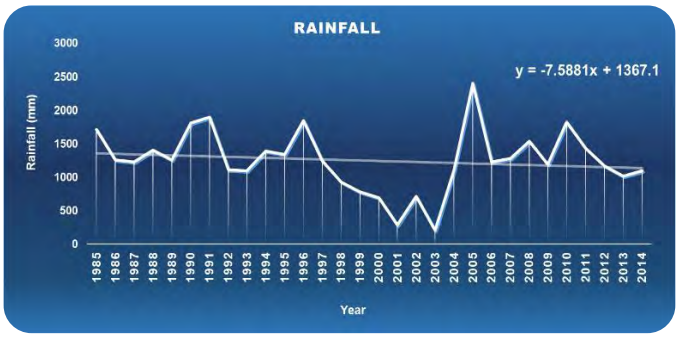

Figure 28 Rainfall Trend of Chennai (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 15.1% and 30.5% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 23).

Table 23 Rainfall Projections of Chennai

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4.1	7.7
Mid Century (2051-2080)	9.4	20.9
End Century (2081-2100)	15.1	30.5

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 24 days per year.

Projected Heatwave Days

Average projected Heatwave days for the Chennai district is 125 days per year for the end century (Table 22).

Table 22 Heatwave days of Chennai

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	49
Mid Century (2051-2080)	93
End Century (2081-2100)	125

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 3 days per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Chennai is expected to increase by 6 days per year by the end of century (Table 24).

Table 24 Intense Rainfall events of Chennai

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	4
Mid Century (2051-2080)	5
End Century (2081-2100)	6

CLIMATE PROFILE AND PROJECTIONS OF COIMBATORE DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.4 Climate Profile and Projections of Coimbatore District

Observed Maximum Temperature

The annual mean maximum temperature of Coimbatore for the baseline period (1985 to 2014) is 30.4°C and the trend indicates an increase in maximum temperature by 0.04°C (Figure 29).

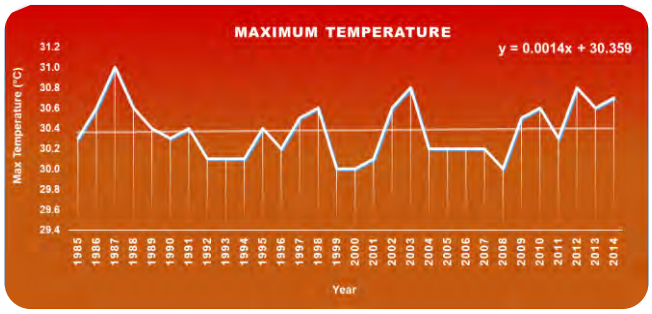

Figure 29 Maximum Temperature Trend of Coimbatore (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Coimbatore for the baseline period (1985 to 2014) is 20.5°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 30).

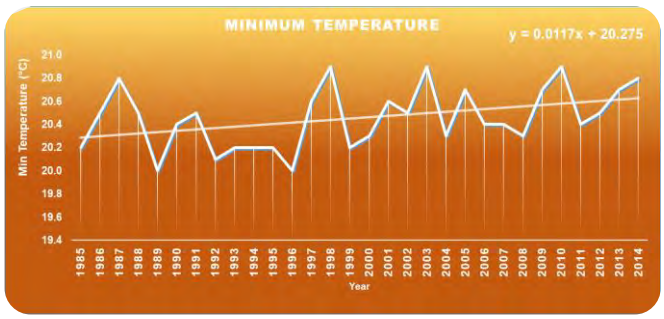

Figure 30 Minimum Temperature Trend of Coimbatore (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.6°C and 2.0°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 25).

Table 25 Maximum Temperature Projections of Coimbatore

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.5
Mid Century (2051-2080)	1.1	1.4
End Century (2081-2100)	1.6	2.0

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.5°C and 3.0°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 26).

Table 26 Minimum Temperature Projections of Coimbatore

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.7
Mid Century (2051-2080)	1.1	1.7
End Century (2081-2100)	1.5	3.0

Observed Rainfall

The annual average rainfall of Coimbatore for the baseline period (1985 to 2014) is 1067.2mm. The trend of rainfall indicates an increase of 2.2mm/year in the period of 1985 -2014 (Figure 31).

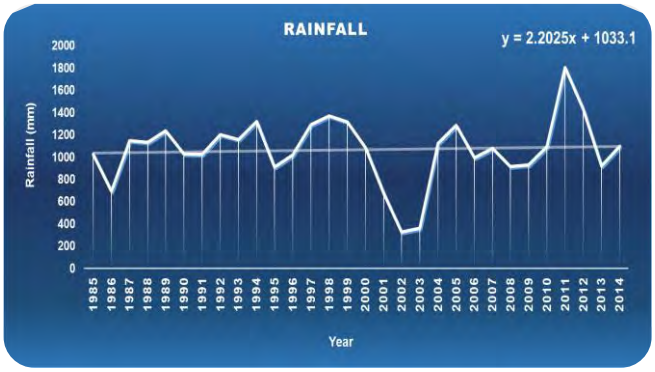

Figure 31 Rainfall Trend of Coimbatore (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 26.7% and 32.6% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 28).

Table 28 Rainfall Projections of Coimbatore

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	6.6	9.3
Mid Century (2051-2080)	18.6	22.5
End Century (2081-2100)	26.7	32.6

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 4 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Coimbatore district is 47 days per year for the end century (Table 27).

Table 27 Heatwave days of Coimbatore

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	17
Mid Century (2051-2080)	38
End Century (2081-2100)	47

Observed Intense Rainfall Days (above 64.5mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Coimbatore is expected to increase by 1 day per year by the end of century (Table 29).

Table 29 Intense Rainfall events of Coimbatore

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF CUDDALORE DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.5 Climate Profile and Projections of Cuddalore District

Observed Maximum Temperature

The annual mean maximum temperature of Cuddalore for the baseline period (1985 to 2014) is 33.4°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 32).

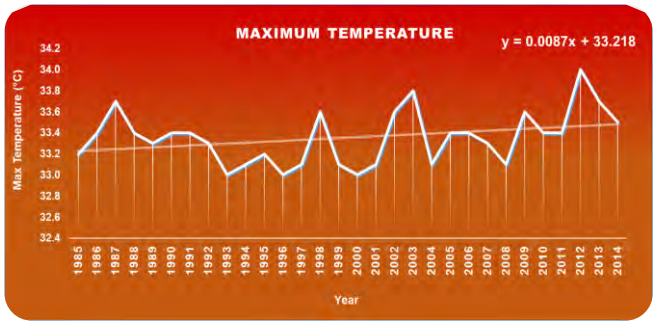

Figure 32 Maximum Temperature Trend of Cuddalore (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.5°C and 3.0°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 30).

Table 30 Maximum Temperature Projections of Cuddalore

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.3	0.5
Mid Century (2051-2080)	1.1	1.5
End Century (2081-2100)	1.5	3.0

Observed Minimum Temperature

The annual mean minimum temperature of Cuddalore for the baseline period (1985 to 2014) is 23.9°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 33).

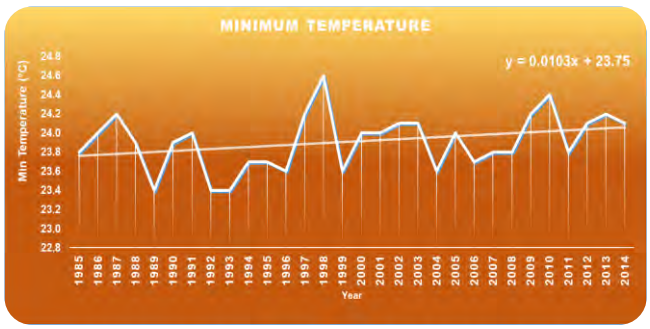

Figure 33 Minimum Temperature Trend of Cuddalore (1985 -2014)

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.1°C and 4.5°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 31).

Table 31 Minimum Temperature Projections of Cuddalore

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	1.0
Mid Century (2051-2080)	1.5	2.4
End Century (2081-2100)	2.1	4.5

Observed Rainfall

The annual average rainfall of Cuddalore for the baseline period (1985 to 2014) is 1255.3mm. The trend of rainfall indicates an increase of 4.7mm/year in the period of 1985 -2014 (Figure 34).

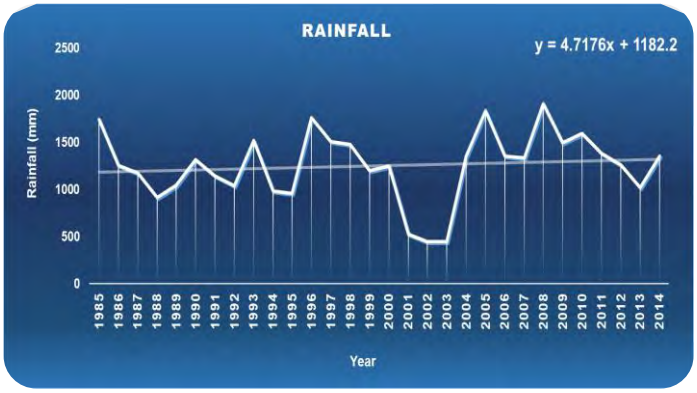

Figure 34 Rainfall Trend of Cuddalore (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 18.4% and 32.8% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 33).

Table 33 Rainfall Projections of Cuddalore

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	5.7	9.5
Mid Century (2051-2080)	10.4	22.7
End Century (2081-2100)	18.4	32.8

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 6 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Cuddalore district is 57 days per year for the end century (Table 32).

Table 32 Heatwave days of Cuddalore

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	19
Mid Century (2051-2080)	36
End Century (2081-2100)	57

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 2 days per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Cuddalore is expected to increase by 3 days per year by the end of century.

Table 34 Intense Rainfall events of Cuddalore

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	2
Mid Century (2051-2080)	2
End Century (2081-2100)	3

CLIMATE PROFILE AND PROJECTIONS OF DHARMAPURI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.6 Climate Profile and Projections of Dharmapuri District

Observed Maximum Temperature

The annual mean maximum temperature of Dharmapuri for the baseline period (1985 to 2014) is 32.1°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 35).

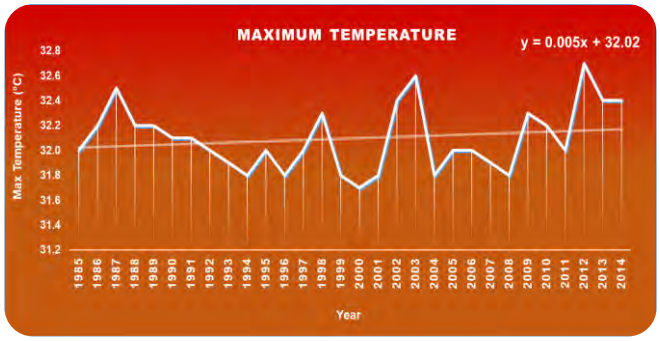

Figure 35 Maximum Temperature Trend of Dharmapuri (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Dharmapuri for the baseline period (1985 to 2014) is 21.5°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 36).

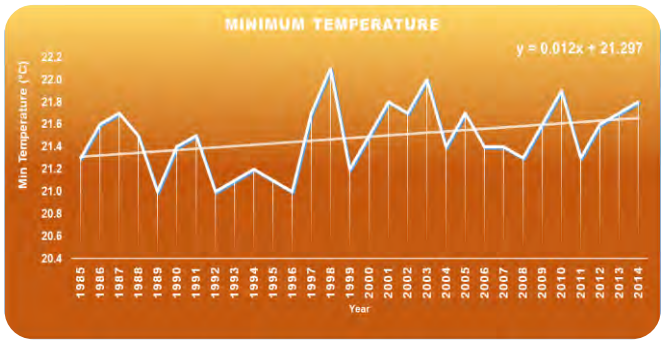

Figure 36 Minimum Temperature Trend of Dharmapuri (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.1°C and 4.4°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 35).

Table 35 Maximum Temperature Projections of Dharmapuri

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.8
Mid Century (2051-2080)	1.5	2.2
End Century (2081-2100)	2.1	4.4

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.2°C and 5.0°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 36).

Table 36 Minimum Temperature Projections of Dharmapuri

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.9	1.0
Mid Century (2051-2080)	1.6	2.6
End Century (2081-2100)	2.2	5.0

Observed Rainfall

The annual average rainfall of Dharmapuri for the baseline period (1985 to 2014) is 872.2mm. The trend of rainfall indicates an increase of 0.3mm/year in the period of 1985 -2014 (Figure 37).

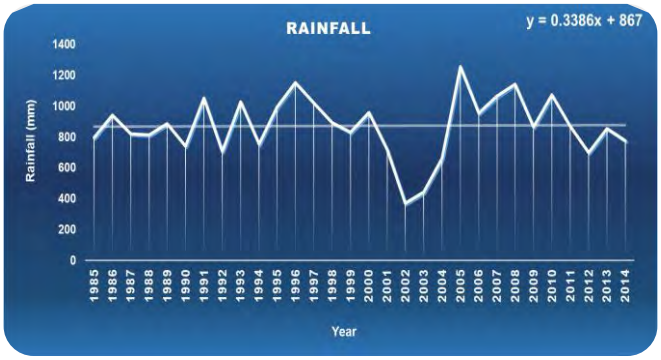

Figure 37 Rainfall of Dharmapuri (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 12.7% and 22.9% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 38).

Table 38 Rainfall Projections of Dharmapuri

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.6	6.4
Mid Century (2051-2080)	8.1	17.1
End Century (2081-2100)	12.7	22.9

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 19 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Dharmapuri district is 70 days per year for the end century.

Table 37 Heatwave days of Dharmapuri

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	38
Mid Century (2051-2080)	60
End Century (2081-2100)	70

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Dharmapuri is expected to increase by 1 day per year by the end of century (Table 39).

Table 39 Intense Rainfall events of Dharmapuri

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	0
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF DINDIGUL DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.7 Climate Profile and Projections of Dindigul District

Observed Maximum Temperature

The annual mean maximum temperature of Dindigul for the baseline period (1985 to 2014) is 31.7°C and the trend indicates an increase in maximum temperature by 0.1°C (Figure 38).

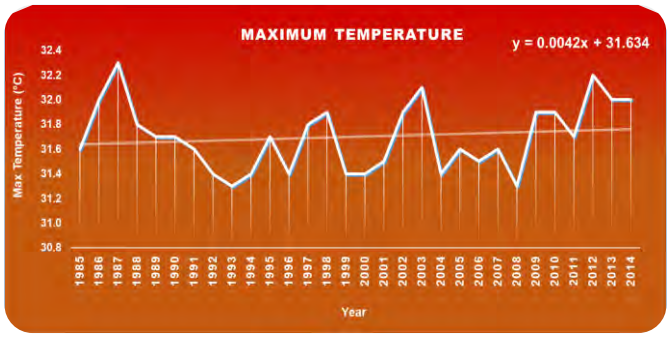

Figure 38 Maximum Temperature Trend of Dindigul (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Dindigul for the baseline period (1985 to 2014) is 21.8°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 39).

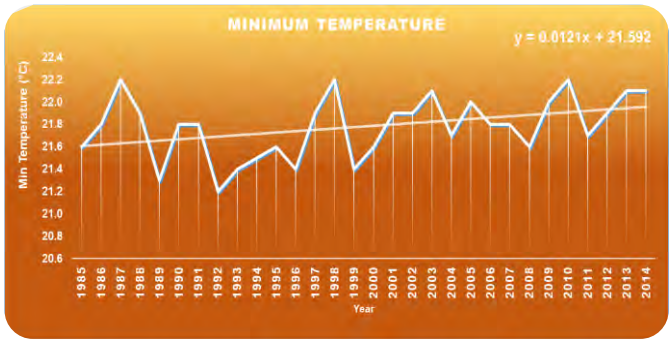

Figure 39 Minimum Temperature Trend of Dindigul (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.5°C and 2.1°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 40).

Table 40 Maximum Temperature Projections of Dindigul

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.3	0.6
Mid Century (2051-2080)	1.1	1.7
End Century (2081-2100)	1.5	2.1

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.8°C and 3.4°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 41).

Table 41 Minimum Temperature Projections of Dindigul

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.8
Mid Century (2051-2080)	1.3	1.9
End Century (2081-2100)	1.8	3.4

Observed Rainfall

The annual average rainfall of Dindigul for the baseline period (1985 to 2014) is 859.2mm. The trend of rainfall indicates an increase of 12mm/year in the period of 1985 -2014 (Figure 40).

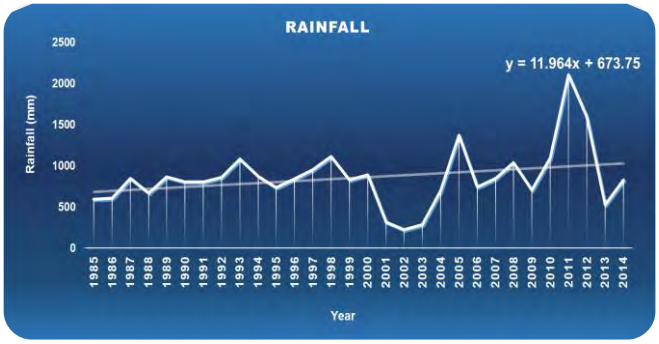

Figure 40 Rainfall Trend of Dindigul (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 12.9% and 20.4% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 43).

Table 43 Rainfall Projections of Dindigul

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.4	5.0
Mid Century (2051-2080)	9.0	14.5
End Century (2081-2100)	12.9	20.4

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 2 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Dindigul district is 43 days per year for the end century.

Table 42 Heatwave days of Dindigul

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	10
Mid Century (2051-2080)	31
End Century (2081-2100)	43

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The district may not experience intense rainfall above 64.5mm for the future period (2021-2100) (Table 44).

Table 44 Intense Rainfall events of Dindigul

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF ERODE DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.8 Climate Profile and Projections of Erode District

Observed Maximum Temperature

The annual mean maximum temperature of Erode for the baseline period (1985 to 2014) is 30.6°C and the trend indicates a decrease in maximum temperature by 0.1°C (Figure 41).

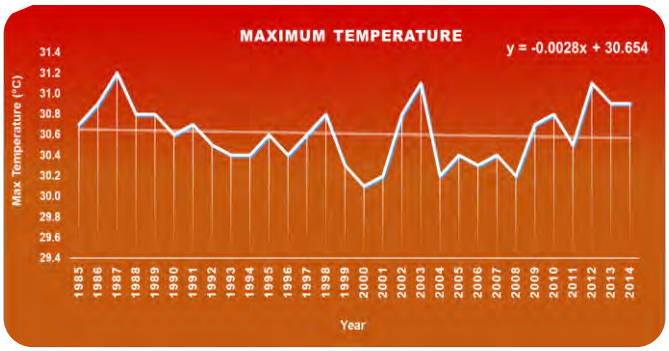

Figure 41 Maximum Temperature Trend of Erode (1985 - 2014)

Observed Minimum Temperature

The annual mean minimum temperature of Erode for the baseline period (1985 to 2014) is 20.2°C and the trend indicates an increase in minimum temperature by 0.5°C (Figure 42).

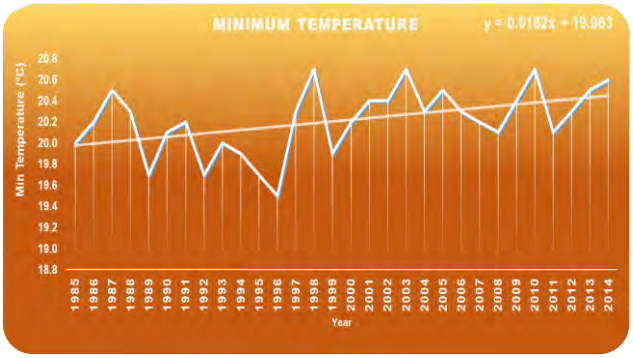

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Figure 42 Minimum Temperature Trend of Erode (1985 - 2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.5°C and 3.1°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 45).

Table 45 Maximum Temperature Projections of Erode

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.5
Mid Century (2051-2080)	1.0	1.6
End Century (2081-2100)	1.5	3.1

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.7°C and 3.3°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 46).

Table 46 Minimum Temperature Projections of Erode

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.7
Mid Century (2051-2080)	1.2	1.7
End Century (2081-2100)	1.7	3.3

Observed Rainfall

The annual average rainfall of Erode for the baseline period (1985 to 2014) is 767.6mm. The trend of rainfall indicates a decrease of 3.7mm/year in the period of 1985 -2014(Figure 43).

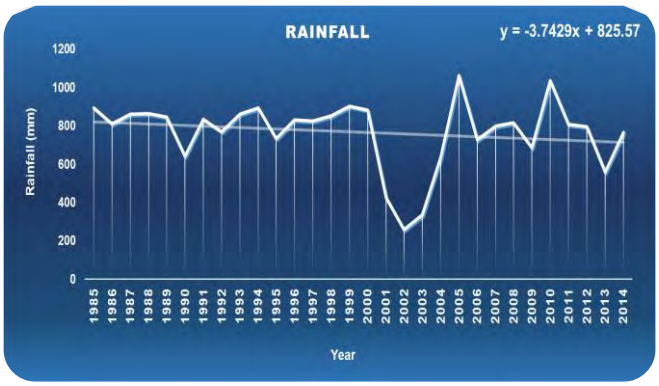

Figure 43 Rainfall Trend of Erode (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 16.9% and 18.4% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 48).

Table 48 Rainfall Projections of Erode

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	1.7	3.9
Mid Century (2051-2080)	9.4	12.5
End Century (2081-2100)	16.9	18.4

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 8 days per year.

Projected Heatwave Days

Average projected Heatwave days for the Erode district is 49 days per year for the end century (Table 47).

Table 47 Heatwave days of Erode

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	21
Mid Century (2051-2080)	43
End Century (2081-2100)	49

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The district may experience less intense rainfall above 64.5mm for the future period (2021-2100) (Table 49).

Table 49 Intense Rainfall events of Erode

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	0
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF KALLAKURICHI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.9 Climate Profile and Projections of Kallakurichi District

Observed Maximum Temperature

The annual mean maximum temperature of Kallakurichi for the baseline period (1985 to 2014) is 33.2°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 44).

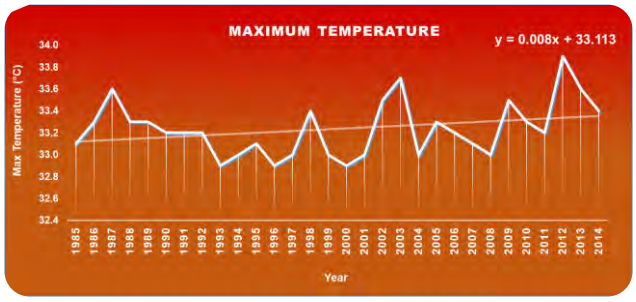

Figure 44 Maximum Temperature Trend of Kallakurichi (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Kallakurichi for the baseline period (1985 to 2014) is 23.2°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 45).

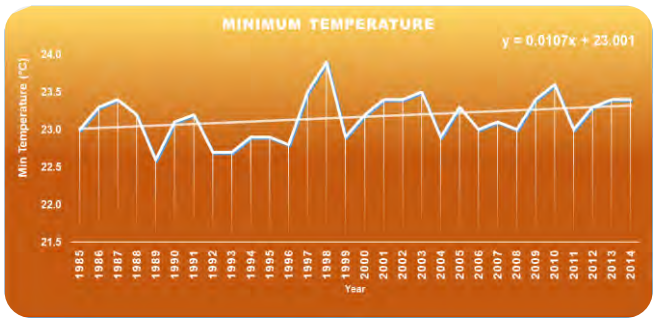

Figure 45 Minimum Temperature Trend of Kallakurichi (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.8°C and 3.4°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 50).

Table 50 Maximum Temperature Projections of Kallakurichi

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.6
Mid Century (2051-2080)	1.3	1.7
End Century (2081-2100)	1.8	3.4

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.2°C and 4.8°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 51).

Table 51 Minimum Temperature Projections of Kallakurichi

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.8	0.9
Mid Century (2051-2080)	1.6	2.5
End Century (2081-2100)	2.2	4.8

Observed Rainfall

The annual average rainfall of Kallakurichi for the baseline period (1985 to 2014) is 923mm. The trend of rainfall indicates an increase of 1.9mm/year in the period of 1985 -2014 (Figure 46).

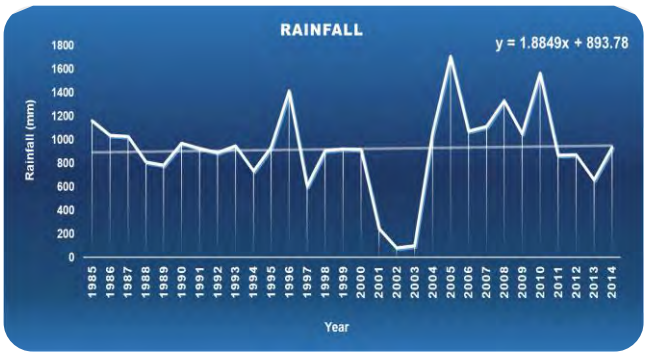

Figure 46 Rainfall Trend of Kallakurichi(1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 22.5% and 30.3% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 53).

Table 53 Rainfall Projections of Kallakurichi

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4.8	7.6
Mid Century (2051-2080)	16.3	19.2
End Century (2081-2100)	22.5	30.3

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 11 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Kallakurichi district is 67 days per year for the end century (Table 52).

Table 52 Heatwave days of Kallakurichi

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	29
Mid Century (2051-2080)	48
End Century (2081-2100)	67

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Kallakurichi is expected to increase by 1 day per year by the end of century (Table 54).

Table 54 Intense Rainfall events of Kallakurichi

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF KANCHEEPURAM DISTRICT

CLIMATE MODELING

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4.10 Climate Profile and Projections of Kancheepuram District

Observed Maximum Temperature

The annual mean maximum temperature of Kancheepuram for the baseline period (1985 to 2014) is 33.4°C and the trend indicates an increase in maximum temperature by 0.4°C (Figure 47).

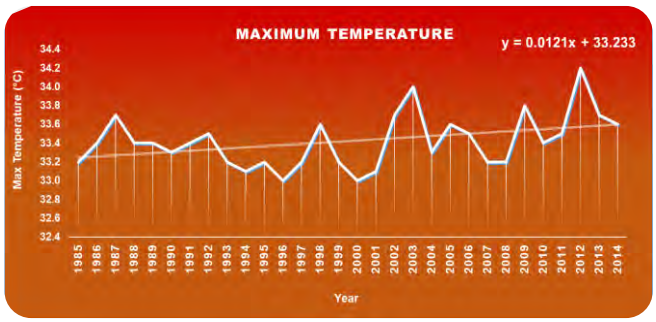

Figure 47 Maximum Temperature Trend of Kancheepuram (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Kancheepuram for the baseline period (1985 to 2014) is 23.3°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 48).

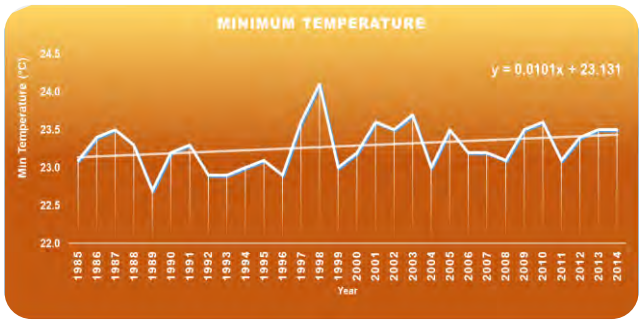

Figure 48 Minimum Temperature Trend of Kancheepuram (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.9°C and 5.4°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 55).

Table 55 Maximum Temperature Projections of Kancheepuram

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.8	1.1
Mid Century (2051-2080)	2.0	3.1
End Century (2081-2100)	2.9	5.4

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 3.1°C and 5.7°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 56).

Table 56 Minimum Temperature Projections of Kancheepuram

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	1.1	1.4
Mid Century (2051-2080)	2.1	3.4
End Century (2081-2100)	3.1	5.7

Observed Rainfall

The annual average rainfall of Kancheepuram for the baseline period (1985 to 2014) is 1212.9mm. The trend of rainfall indicates a decrease of 2.6mm/year in the period of 1985 -2014 (Figure 49).

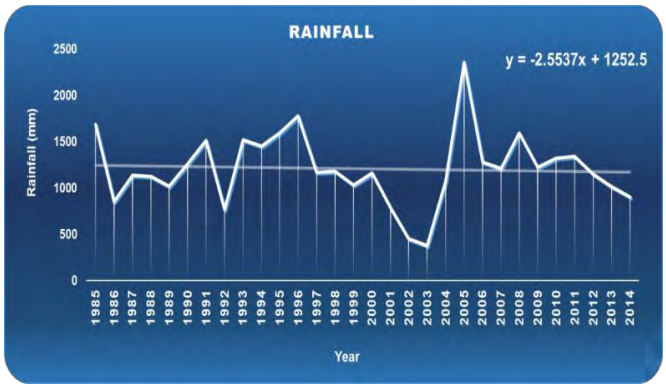

Figure 49 Rainfall Trend of Kancheepuram (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 15.4% and 29.4% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 58).

Table 58 Rainfall Projections of Kancheepuram

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4.8	7.5
Mid Century (2051-2080)	9.6	17.8
End Century (2081-2100)	15.4	29.4

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 25 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Kancheepuram district is 118 days per year for the end century (Table 57).

Table 57 Heatwave days of Kancheepuram

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	51
Mid Century (2051-2080)	88
End Century (2081-2100)	118

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Kancheepuram is expected to increase by 2 days per year by the end of century (Table 59).

Table 59 Intense Rainfall events of of Kancheepuram

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	2
Mid Century (2051-2080)	2
End Century (2081-2100)	2

CLIMATE PROFILE AND PROJECTIONS OF KANNIYAKUMARI DISTRICT

CLIMATE MODELING

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4.11 Climate Profile and Projections of Kanniyakumari District

Observed Maximum Temperature

The annual mean maximum temperature of Kanniyakumari for the baseline period (1985 to 2014) is 32.5°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 50).

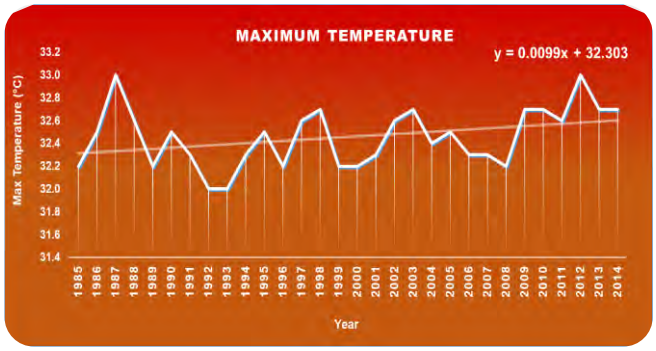

Figure 50 Maximum Temperature Trend of Kanniyakumari (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Kanniyakumari for the baseline period (1985 to 2014) is 23.5°C and the trend indicates an increase in minimum temperature by 0.2°C (Figure 51).

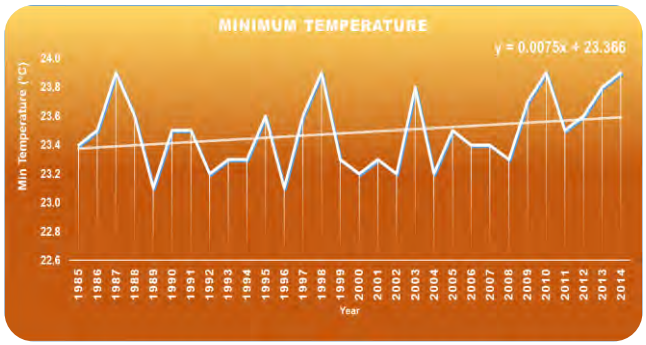

Figure 51 Minimum Temperature Trend of Kanniyakumari(1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 0.7°C and 1.8°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 60).

Table 60 Maximum Temperature Projections of Kanniyakumari

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.1	0.4
Mid Century (2051-2080)	0.6	0.9
End Century (2081-2100)	0.7	1.8

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.2°C and 2.4°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 61).

Table 61 Minimum Temperature Projections of Kanniyakumari

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.5	0.8
Mid Century (2051-2080)	0.9	1.4
End Century (2081-2100)	1.2	2.4

Observed Rainfall

The annual average rainfall of Kanniyakumari for the baseline period (1985 to 2014) is 1122.9mm. The trend of rainfall indicates an increase of 1.6mm/year in the period of 1985 -2014 (Figure 52).

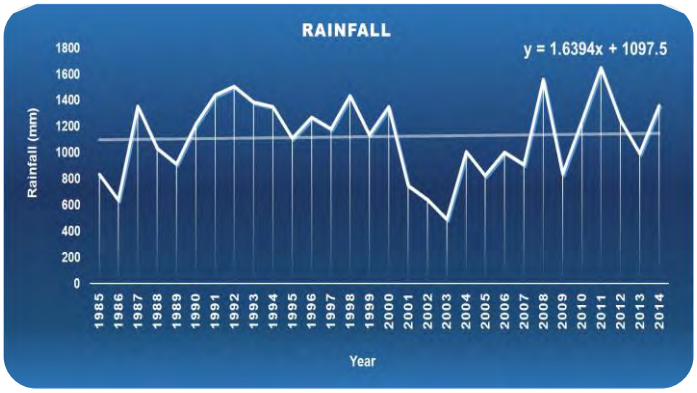

Figure 52 Rainfall Trend of Kanniyakumari(1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 16.5% and 31.7% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 63).

Table 63 Rainfall Projections of Kanniyakumari

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	5.5	8.4
Mid Century (2051-2080)	11.5	21.6
End Century (2081-2100)	16.5	31.7

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985 – 2014).

Projected Heatwave Days

The average projected Heatwave days for the Kanniyakumari district is 11 days per year for the end century (Table 62).

Table 62 Heatwave days of Kanniyakumari

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	2
Mid Century (2051-2080)	6
End Century (2081-2100)	11

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Kanniyakumari is expected to increase by 5 days per year by the end of century (Table 64).

Table 64 Intense Rainfall events of Kanniyakumari

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	3
Mid Century (2051-2080)	4
End Century (2081-2100)	5

CLIMATE PROFILE AND PROJECTIONS OF KARUR DISTRICT

CLIMATE MODELING

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4.12 Climate Profile and Projections of Karur District

Observed Maximum Temperature

The annual mean maximum temperature of Karur for the baseline period (1985 to 2014) is 32.5°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 53).

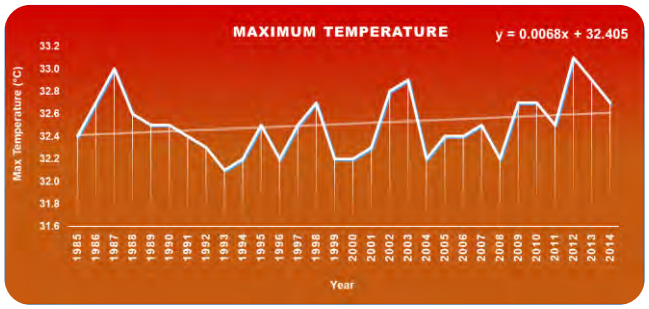

Figure 53 Maximum Temperature Trend of Karur (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Karur for the baseline period (1985 to 2014) is 22.4°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 54).

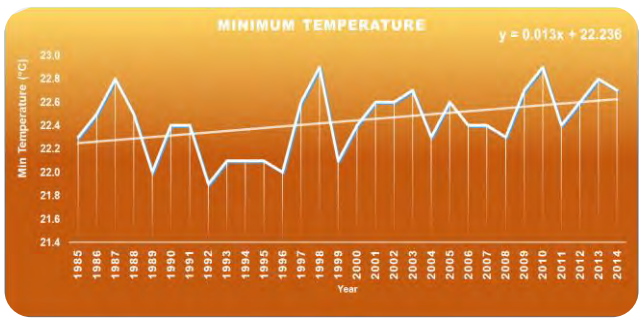

Figure 54 Minimum Temperature Trend of Karur (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.5°C and 3.2°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 65).

Table 65 Maximum Temperature Projections of Karur

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.6
Mid Century (2051-2080)	1.1	1.7
End Century (2081-2100)	1.5	3.2

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.8°C and 3.3°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 66).

Table 66 Minimum Temperature Projections of Karur

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.7
Mid Century (2051-2080)	1.2	1.8
End Century (2081-2100)	1.8	3.3

Observed Rainfall

The annual average rainfall of Karur for the baseline period (1985 to 2014) is 808.4mm. The trend of rainfall indicates an increase of 10mm/year in the period of 1985-2014 (Figure 55).

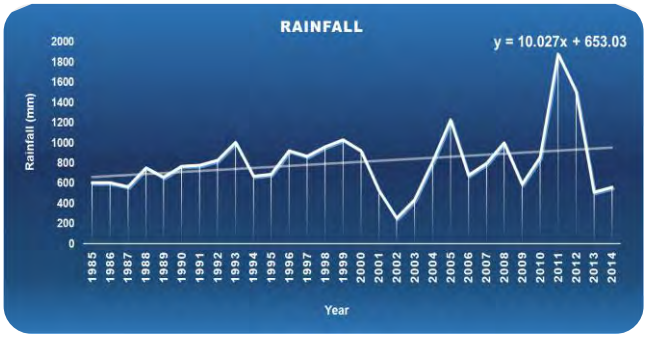

Figure 55 Rainfall Trend of Karur(1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 13.0% and 16.8% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 68).

Table 68 Rainfall Projections of Karur

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	1.5	3.6
Mid Century (2051-2080)	6.9	10.6
End Century (2081-2100)	13.0	16.8

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 3 days per year.

Projected Heatwave Days

Average projected Heatwave days for the Karur district is 50 days per year for the end century (Table 67).

Table 67 Heatwave days of Karur

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	17
Mid Century (2051-2080)	36
End Century (2081-2100)	50

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The district may experience less intense rainfall above 64.5mm for the future period (2021-2100) (Table 69).

Table 69 Intense Rainfall events of Karur

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	0
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF KRISHNAGIRI DISTRICT

CLIMATE MODELING

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4.13 Climate Profile and Projections of Krishnagiri District

Observed Maximum Temperature

The annual mean maximum temperature of Krishnagiri for the baseline period (1985 to 2014) is 31.7°C and the trend indicates an increase in maximum temperature by 0.4°C (Figure 56).

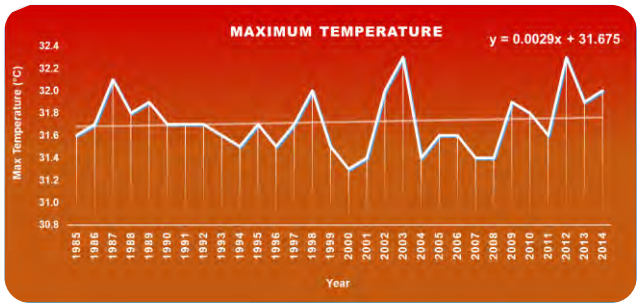

Figure 56 Maximum Temperature Trend of Krishnagiri (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Krishnagiri for the baseline period (1985 to 2014) is 20.9°C and the trend indicates an increase in minimum temperature by 0.1°C (Figure 57).

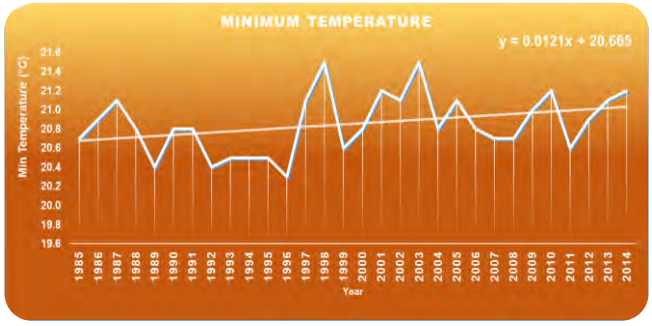

Figure 57 Minimum Temperature Trend of Krishnagiri (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.3°C and 4.6°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 70).

Table 70 Maximum Temperature Projections of Krishnagiri

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.9
Mid Century (2051-2080)	1.6	2.4
End Century (2081-2100)	2.3	4.6

Minimum Temperature Projections

Similarly, the projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.2°C and 5.1°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 71).

Table 71 Minimum Temperature Projections of Krishnagiri

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.8	1.0
Mid Century (2051-2080)	1.6	2.6
End Century (2081-2100)	2.2	5.1

Observed Rainfall

The annual average rainfall of Krishnagiri for the baseline period (1985 to 2014) is 799.7mm. The trend of rainfall indicates a decrease of 1.1mm/year in the period of 1985 -2014 (Figure 58).

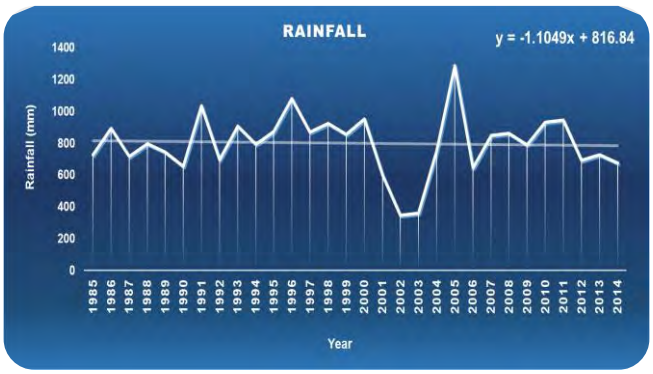

Figure 58 Rainfall Trend of Krishnagiri(1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 25.8% and 19.9% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 73).

Table 73 Rainfall Projections of Krishnagiri

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	2.3	4.7
Mid Century (2051-2080)	14.6	13.4
End Century (2081-2100)	25.8	19.9

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 22 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Krishnagiri district is 74 days per year for the end century.

Table 72 Heatwave days of Krishnagiri

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	41
Mid Century (2051-2080)	63
End Century (2081-2100)	74

Observed Intense Rainfall Days (above 64.5mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Krishnagiri is expected to increase by 1 days per year by the end of century (Table 74).

Table 74 Intense Rainfall events of Krishnagiri

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	0
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF MADURAI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.14 Climate Profile and Projections of Madurai District

Observed Maximum Temperature

The annual mean maximum temperature of Madurai for the baseline period (1985 to 2014) is 32.1°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 59).

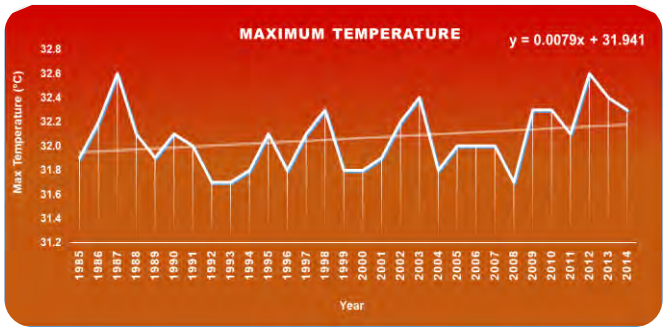

Figure 59 Maximum Temperature Trend of Madurai (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Madurai for the baseline period (1985 to 2014) is 22.5°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 60).

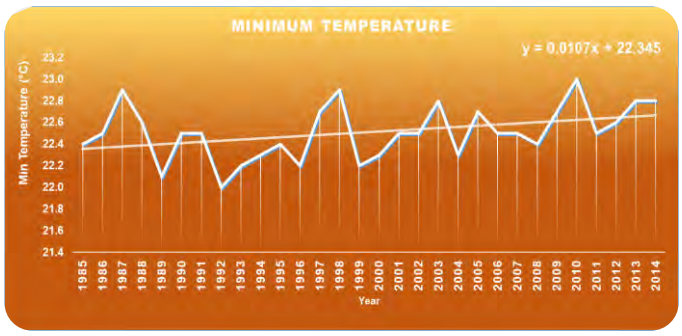

Figure 60 Minimum Temperature Trend of Madurai (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.2°C and 2.5°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 75).

Table 75 Maximum Temperature Projections of Madurai

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.3	0.5
Mid Century (2051-2080)	0.9	1.3
End Century (2081-2100)	1.2	2.5

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.6°C and 3.0°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 76).

Table 76 Minimum Temperature Projections of Madurai

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.8
Mid Century (2051-2080)	1.2	1.8
End Century (2081-2100)	1.6	3.0

Observed Rainfall

The annual average rainfall of Madurai for the baseline period (1985 to 2014) is 956mm. The trend of rainfall indicates an increase of 10.1mm/year in the period of 1985 -2014 (Figure 61).

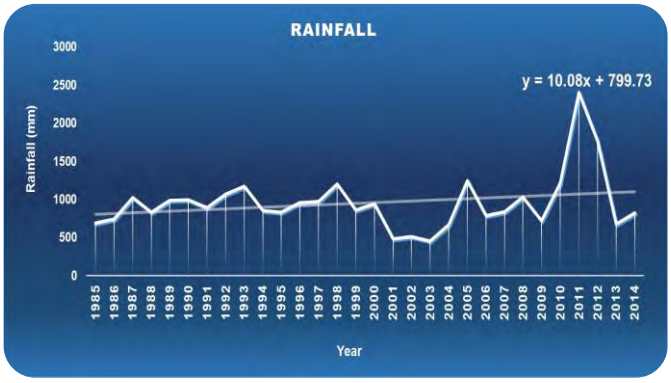

Figure 61 Rainfall Trend of Madurai (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 7.4% and 20.4% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 78).

Table 78 Rainfall Projections of Madurai

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	2.8	5.1
Mid Century (2051-2080)	5.2	14.6
End Century (2081-2100)	7.4	20.4

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985 – 2014).

Projected Heatwave Days

The average projected Heatwave days for the Madurai district is 25 days per year for the end century.

Table 77 Heatwave days of Madurai

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	12
End Century (2081-2100)	25

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Madurai is expected to increase by 1 day per year by the end of century (Table 79).

Table 79 Intense Rainfall events of Madurai

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF MAYILADUTHURAI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.15 Climate Profile and Projections of Mayiladuthurai District

Observed Maximum Temperature

The annual mean maximum temperature of Mayiladuthurai for the baseline period (1985 to 2014) is 33.3°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 62).

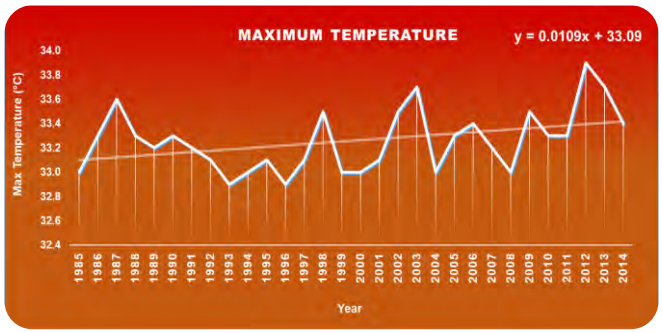

Figure 62 Maximum Temperature Trend of Mayiladuthurai (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Mayiladuthurai for the baseline period (1985 to 2014) is 23.9°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 63).

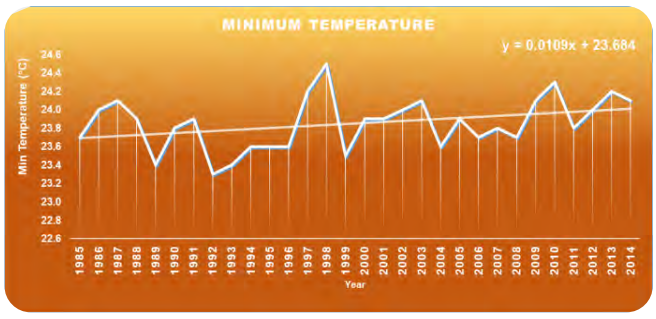

Figure 63 Minimum Temperature Trend of Mayiladuthurai (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.6oC and 4.1oC under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 80).

Table 80 Maximum Temperature Projections of Mayiladuthurai

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.7
Mid Century (2051-2080)	1.1	2.0
End Century (2081-2100)	1.6	4.1

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.1°C and 4.3°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 81).

Table 81 Minimum Temperature Projections of Mayiladuthurai

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.8
Mid Century (2051-2080)	1.4	2.2
End Century (2081-2100)	2.1	4.3

Observed Rainfall

The annual average rainfall of Mayiladuthurai for the baseline period (1985 to 2014) is 1238.1mm. The trend of rainfall indicates an increase of 14.3mm/year in the period of 1985 -2014 (Figure 64).

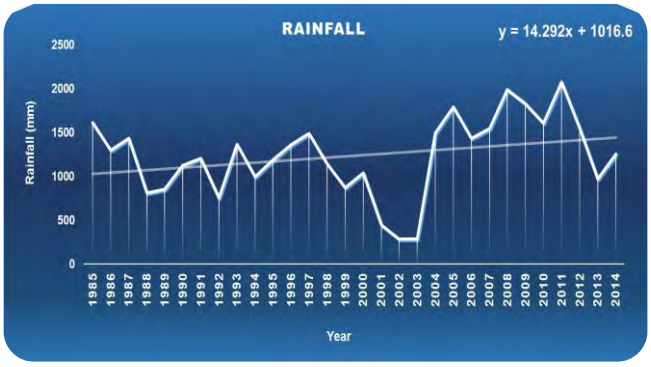

Figure 64 Rainfall Trend of Mayiladuthurai (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 25.4% and 34.7% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 83).

Table 83 Rainfall Projections of Mayiladuthurai

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	8.6	11.4
Mid Century (2051-2080)	21.8	30.7
End Century (2081-2100)	25.4	34.7

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 3 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Mayiladuthurai district is 40 days per year for the end century.

Table 82 Heatwave days of Mayiladuthurai

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	12
Mid Century (2051-2080)	29
End Century (2081-2100)	40

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 2 days per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Mayiladuthurai is expected to increase by 5 days per year by the end of century (Table 84).

Table 84 Intense Rainfall events of Mayiladuthurai

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	3
Mid Century (2051-2080)	4
End Century (2081-2100)	5

CLIMATE PROFILE AND PROJECTIONS OF NAGAPATTINAM DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.16 Climate Profile and Projections of Nagapattinam District

Observed Maximum Temperature

The annual mean maximum temperature of Nagapattinam for the baseline period (1985 to 2014) is 33.3°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 65).

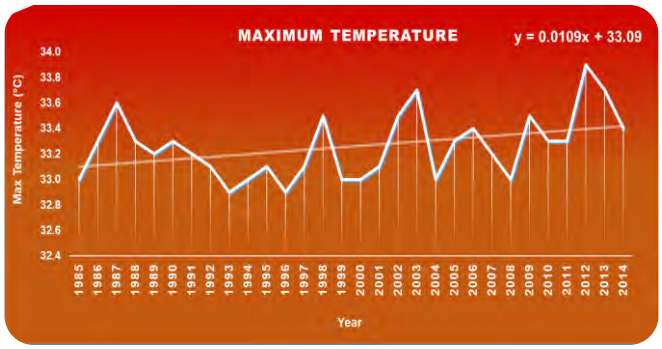

Figure 65 Maximum Temperature Trend of Nagapattinam (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.1°C and 4.2°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 85).

Table 85 Maximum Temperature Projections of Nagapattinam

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.7
Mid Century (2051-2080)	0.8	1.9
End Century (2081-2100)	1.1	4.2

Observed Minimum Temperature

The annual mean minimum temperature of Nagapattinam for the baseline period (1985 to 2014) is 23.9°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 66).

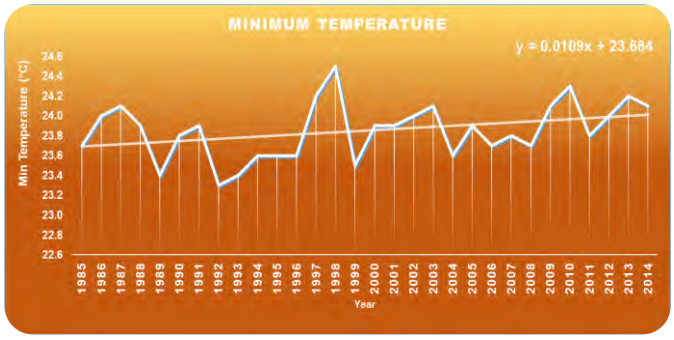

Figure 66 Minimum Temperature Trend of Nagapattinam (1985 -2014)

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.7°C and 4.5°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 86).

Table 86 Minimum Temperature Projections of Nagapattinam

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.8
Mid Century (2051-2080)	1.2	2.0
End Century (2081-2100)	1.7	4.5

Observed Rainfall

The annual average rainfall of Nagapattinam for the baseline period (1985 to 2014) is 1432mm. The trend of rainfall indicates an increase of 1.3mm/year in the period of 1985 -2014 (Figure 67).

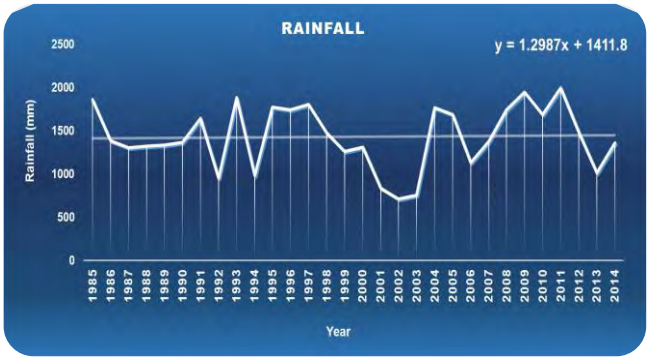

Figure 67 Rainfall Trend of Nagapattinam (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 14.5% and 31.6% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 88) .

Table 88 Rainfall Projections of Nagapattinam

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.3	8.2
Mid Century (2051-2080)	10.7	21.3
End Century (2081-2100)	14.5	31.6

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985-2014).

Projected Heatwave Days

The average projected Heatwave days for the Nagapattinam district is 24 days per year for the end century.

Table 87 Heatwave days of Nagapattinam

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	5
Mid Century (2051-2080)	16
End Century (2081-2100)	24

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 3 days per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Nagapattinam is expected to increase by 6 days per year by the end of century (Table 89).

Table 89 Intense Rainfall events of Nagapattinam

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	3
Mid Century (2051-2080)	4
End Century (2081-2100)	6

CLIMATE PROFILE AND PROJECTIONS OF NAMAKKAL DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.17 Climate Profile and Projections of Namakkal District

Observed Maximum Temperature

The annual mean maximum temperature of Namakkal for the baseline period (1985 to 2014) is 32.5°C and the trend indicates an increase in maximum temperature by 0.04°C (Figure 68).

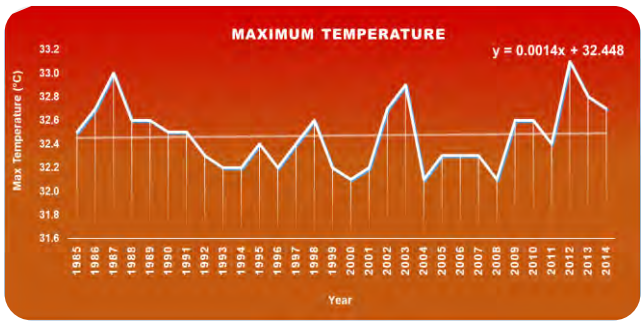

Figure 68 Maximum Temperature Trend of Namakkal (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Namakkal for the baseline period (1985 to 2014) is 22.1°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 69).

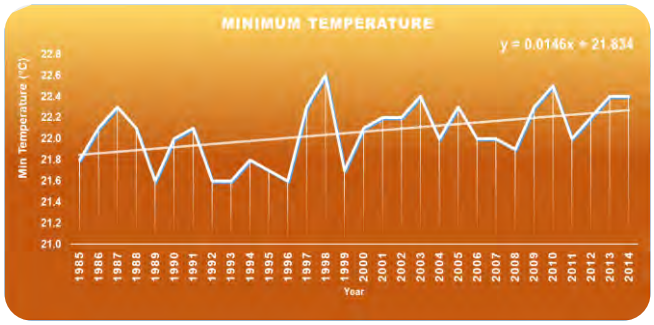

Figure 69 Minimum Temperature Trend of Namakkal (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.8°C and 2.3°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 90).

Table 90 Maximum Temperature Projections of Namakkal

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.6
Mid Century (2051-2080)	1.2	1.7
End Century (2081-2100)	1.8	2.3

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.8°C and 3.9°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 91).

Table 91 Minimum Temperature Projections of Namakkal

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.9
Mid Century (2051-2080)	1.3	2.1
End Century (2081-2100)	1.8	3.9

Observed Rainfall

The annual average rainfall of Namakkal for the baseline period (1985 to 2014) is 762.6 mm. The trend of rainfall indicates a decrease of 3.8mm/year in the period of 1985 -2014 (Figure 70).

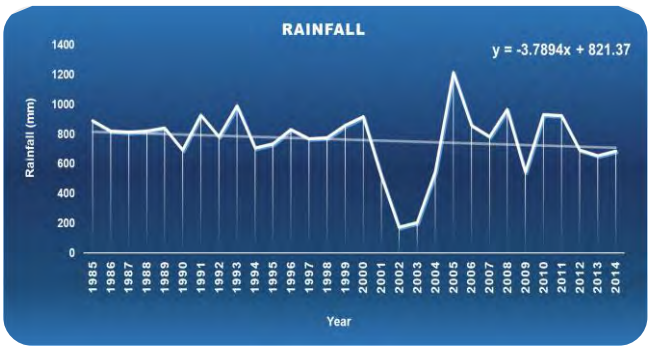

Figure 70 Rainfall Trend of Namakkal (1985-2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 11.9% and 28.7% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 93).

Table 93 Rainfall Projections of Namakkal

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4.1	7.4
Mid Century (2051-2080)	8.9	17.7
End Century (2081-2100)	11.9	28.7

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 9 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Namakkal district is 57 days per year for the end century.

Table 92 Heatwave days of Namakkal

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	19
Mid Century (2051-2080)	44
End Century (2081-2100)	57

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Namakkal is expected to increase by 1 day per year by the end of century (Table 94).

Table 94 Intense Rainfall events of Namakkal

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF PERAMBALUR DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.18 Climate Profile and Projections of Perambalur District

Observed Maximum Temperature

The annual mean maximum temperature of Perambalur for the baseline period (1985 to 2014) is 33.2°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 71).

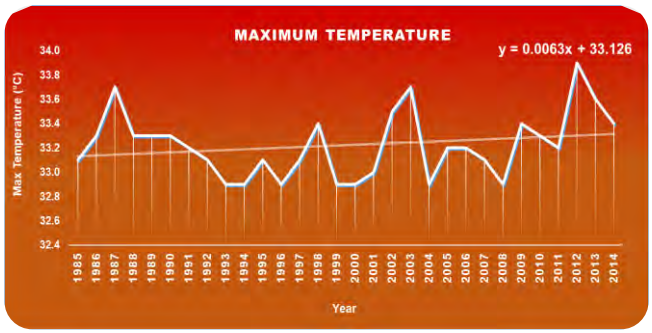

Figure 71 Maximum Temperature Trend of Perambalur (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Perambalur for the baseline period (1985 to 2014) is 23.1°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 72).

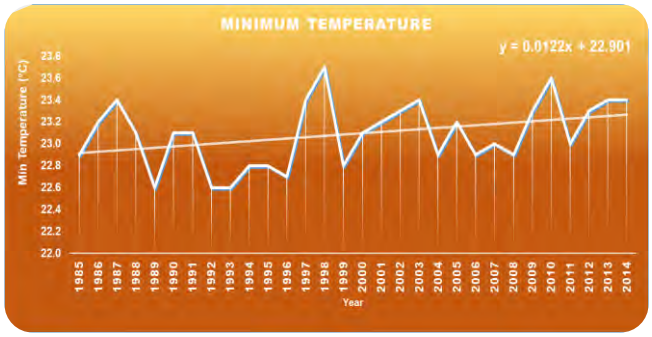

Figure 72 Minimum Temperature Trend of Perambalur (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.5°C and 3.6°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 95).

Table 95 Maximum Temperature Projections of Perambalur

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.3	0.7
Mid Century (2051-2080)	1.1	1.9
End Century (2081-2100)	1.5	3.6

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.0°C and 4.2°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 96).

Table 96 Minimum Temperature Projections of Perambalur

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.9
Mid Century (2051-2080)	1.4	2.3
End Century (2081-2100)	2.0	4.2

Observed Rainfall

The annual average rainfall of Perambalur for the baseline period (1985 to 2014) is 836.7mm. The trend of rainfall indicates an increase of 8mm/year in the period of 1985 -2014 (Figure 73).

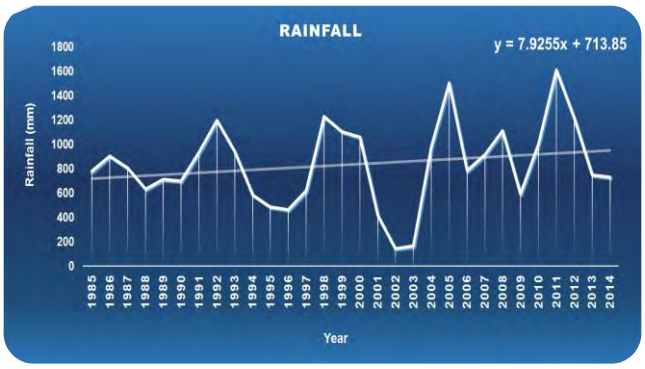

Figure 73 Rainfall Temperature Trend of Perambalur (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 24.8% and 32.6% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 98).

Table 98 Rainfall Projections of Perambalur

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	6.4	9.1
Mid Century (2051-2080)	18.4	22.2
End Century (2081-2100)	24.8	32.6

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 8 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Perambalur district is 58 days per year for the end century.

Table 97 Heatwave days of Perambalur

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	22
Mid Century (2051-2080)	38
End Century (2081-2100)	58

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Perambalur is expected to increase by 1 day per year by the end of century (Table 99).

Table 99 Intense Rainfall events of Perambalur

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF PUDUKKOTTAI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.19 Climate Profile and Projections of Pudukkottai District

Observed Maximum Temperature

The annual mean maximum temperature of Pudukkottai for the baseline period (1985 to 2014) is 33.3°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 74).

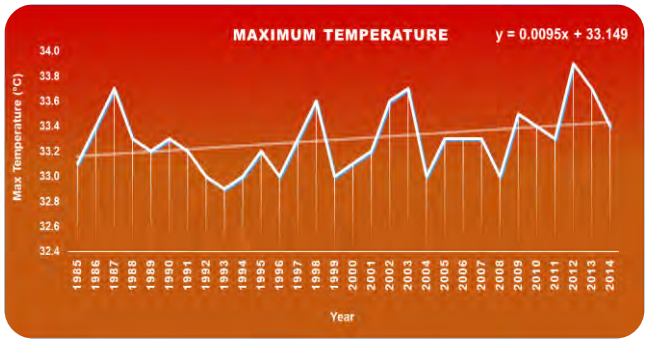

Figure 74 Maximum Temperature Trend of Pudukkottai (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Pudukkottai for the baseline period (1985 to 2014) is 23.6°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 75).

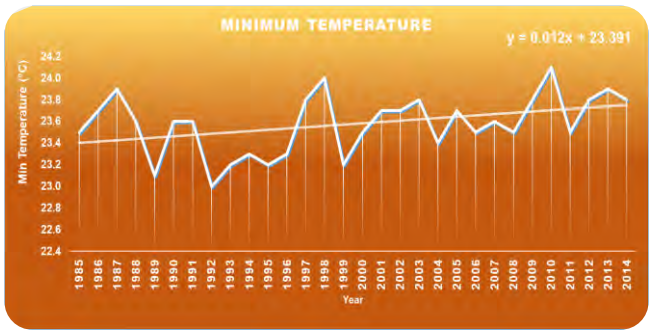

Figure 75 Minimum Temperature Trend of Pudukkottai (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.4°C and 3.8°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 100).

Table 100 Maximum Temperature Projections of Pudukkottai

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.5	0.9
Mid Century (2051-2080)	1.0	2.2
End Century (2081-2100)	1.4	3.8

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.9°C and 4.1°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 101).

Table 101 Minimum Temperature Projections of Pudukkottai

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	1.0
Mid Century (2051-2080)	1.3	2.6
End Century (2081-2100)	1.9	4.1

Observed Rainfall

The annual average rainfall of Pudukkottai for the baseline period (1985 to 2014) is 951.5mm. The trend of rainfall indicates an increase of 13.1mm/year in the period of 1985 -2014 (Figure 76).

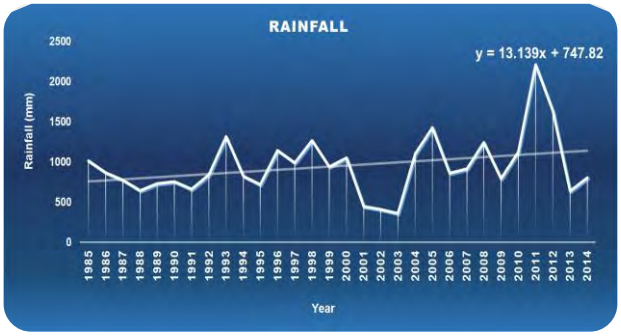

Figure 76 Rainfall Trend of Pudukkottai(1985 -2014))

Rainfall Projections

The rainfall projections imply an increase of rainfall of 15.3% and 31.6% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 103).

Table 103 Rainfall Projections of Pudukkottai

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	5.6	8.4
Mid Century (2051-2080)	11.6	21.4
End Century (2081-2100)	15.3	31.6

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 1 day per year.

Projected Heatwave Days

The average projected Heatwave days for the Pudukkottai district is 40 days per year for the end century (Table 102).

Table 102 Heatwave days of Pudukkottai

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	11
Mid Century (2051-2080)	26
End Century (2081-2100)	40

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Pudukkottai is expected to increase by 1 day per year by the end of century (Table 104).

Table 104 Intense Rainfall events of Pudukkottai

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF RAMANATHAPURAM DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.20 Climate Profile and Projections of Ramanathapuram District

Observed Maximum Temperature

The annual mean maximum temperature of Ramanathapuram for the baseline period (1985 to 2014) is 32.5°C and the trend indicates an increase in maximum temperature by 0.4°C (Figure 77).

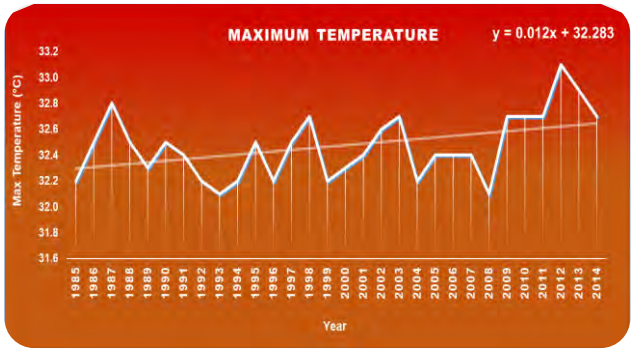

Figure 77 Maximum Temperature Trend of Ramanathapuram (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Ramanathapuram for the baseline period (1985 to 2014) is 23.2°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 78).

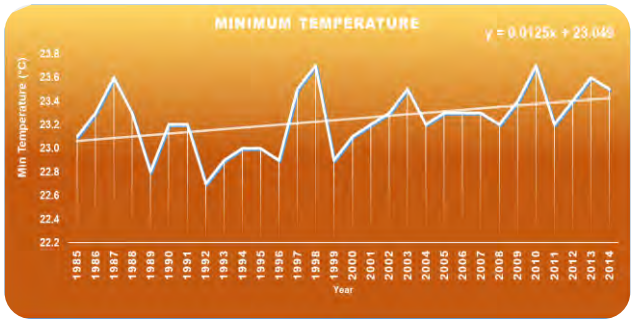

Figure 78 Minimum Temperature Trend of Ramanathapuram (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.2°C and 2.9°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 105).

Table 105 Maximum Temperature Projections of Ramanathapuram

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.6
Mid Century (2051-2080)	0.8	1.5
End Century (2081-2100)	1.2	2.9

Minimum Temperature Projections

Similarly, the projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.7°C and 3.2°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 106).

Table 106 Minimum Temperature Projections of Ramanathapuram

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.8
Mid Century (2051-2080)	1.2	1.8
End Century (2081-2100)	1.7	3.2

Observed Rainfall

The annual average rainfall of Ramanathapuram for the baseline period (1985 to 2014) is 898.7mm. The trend of rainfall indicates an increase of 18.4mm/year in the period of 1985 -2014 (Figure 79).

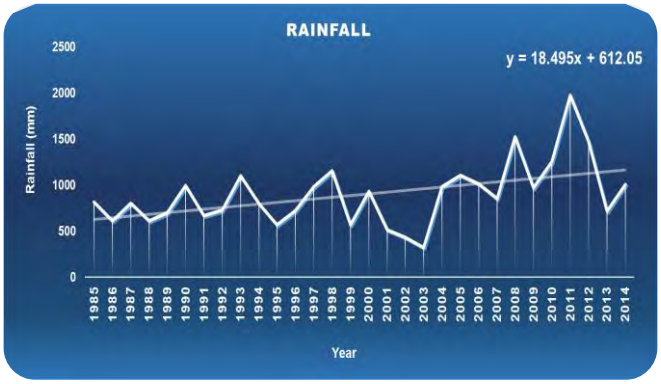

Figure 79 Rainfall Trend of Ramanathapuram (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 13.7% and 20.2% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 108).

Table 108 Rainfall Projections of Ramanathapuram

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	2.4	4.8
Mid Century (2051-2080)	10.3	14.5
End Century (2081-2100)	13.7	20.2

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985-2014).

Projected Heatwave Days

The average projected Heatwave days for the Ramanathapuram district is 26 days per year for the end century (Table 107).

Table 107 Heatwave days of Ramanathapuram

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	3
Mid Century (2051-2080)	15
End Century (2081-2100)	26

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Ramanathapuram is expected to increase by 2 days per year by the end of century (Table 109).

Table 109 Intense Rainfall events of Ramanathapuram

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	2
End Century (2081-2100)	2

CLIMATE PROFILE AND PROJECTIONS OF RANIPET DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.21 Climate Profile and Projections of Ranipet District

Observed Maximum Temperature

The annual mean maximum temperature of Ranipet for the baseline period (1985 to 2014) is 32.8°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 80).

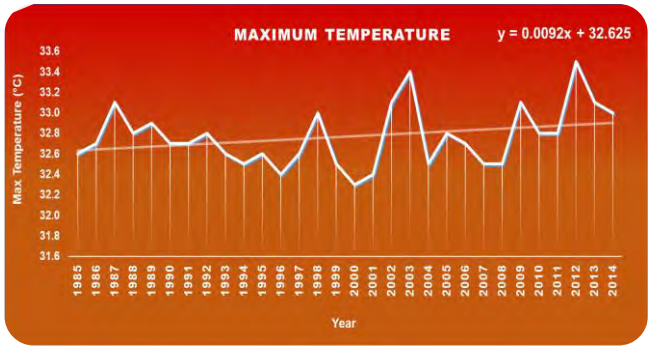

Figure 80 Maximum Temperature Trend of Ranipet (1985 - 2014)

Observed Minimum Temperature

The annual mean minimum temperature of Ranipet for the baseline period (1985 to 2014) is 22.2°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 81).

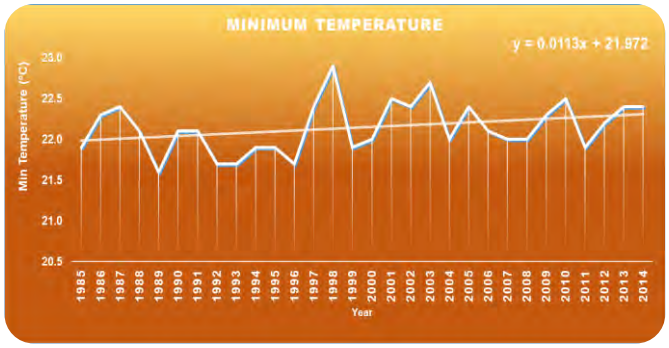

Figure 81 Minimum Temperature Trend of Ranipet (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.5°C and 5.3°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 110).

Table 110 Maximum Temperature Projections of Ranipet

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	1.0
Mid Century (2051-2080)	1.7	2.7
End Century (2081-2100)	2.5	5.3

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.9°C and 6.4°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 111).

Table 111 Minimum Temperature Projections of Ranipet

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	1.2	1.3
Mid Century (2051-2080)	2.3	3.5
End Century (2081-2100)	2.9	6.4

Observed Rainfall

The annual average rainfall of Ranipet for the baseline period (1985 to 2014) is 1004.7mm. The trend of rainfall indicates an increase of 1.4mm/year in the period of 1985 -2014 (Figure 82).

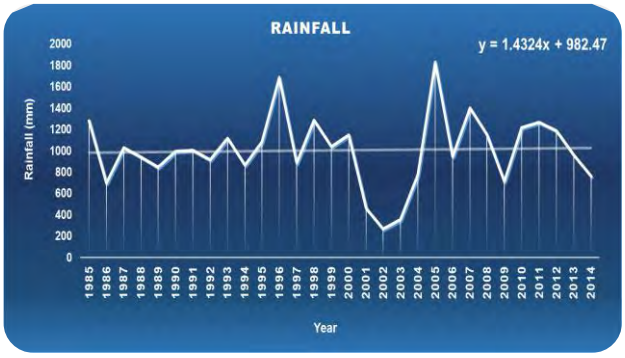

Figure 82 Rainfall Trend of Ranipet (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 14.0% and 19.8% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 113).

Table 113 Rainfall Projections of Ranipet

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	2.1	4.7
Mid Century (2051-2080)	8.1	13.3
End Century (2081-2100)	14.0	19.8

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 20 days per year.

Projected Heatwave Days

Average projected Heatwave days for Ranipet district is 98 days per year for the end century (Table 112).

Table 112 Heatwave days of Ranipet

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	45
Mid Century (2051-2080)	71
End Century (2081-2100)	98

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Ranipet is expected to increase by 1 day per year by the end of century (Table 114).

Table 114 Intense Rainfall events of Ranipet

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF SALEM DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.22 Climate Profile and Projections of Salem District

Observed Maximum Temperature

The annual mean maximum temperature of Salem for the baseline period (1985 to 2014) is 32.6°C and the trend indicates an increase in maximum temperature by 0.1°C (Figure 83).

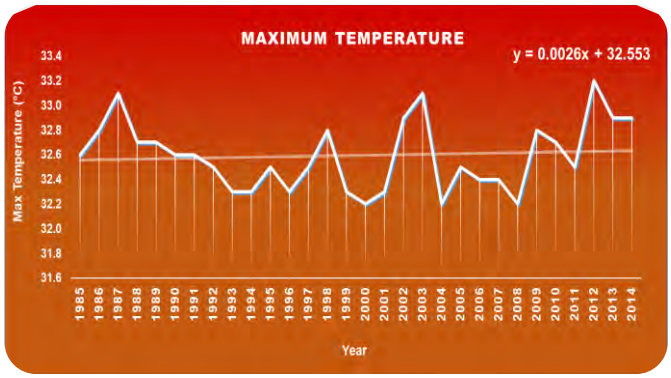

Figure 83 Maximum Temperature Trend of Salem (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Salem for the baseline period (1985 to 2014) is 22.1°C and the trend indicates an increase in minimum temperature by 0.5°C (Figure 84).

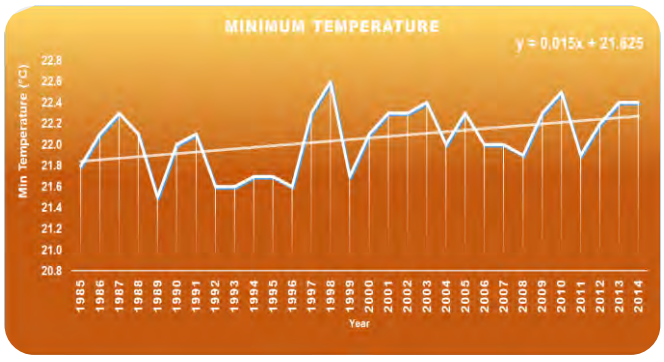

Figure 84 Minimum Temperature Trend of Salem (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.8°C and 3.5°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 115).

Table 115 Maximum Temperature Projections of Salem

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.6
Mid Century (2051-2080)	1.3	1.7
End Century (2081-2100)	1.8	3.5

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.1°C and 3.9°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 116).

Table 116 Minimum Temperature Projections of Salem

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.8	0.9
Mid Century (2051-2080)	1.5	2.1
End Century (2081-2100)	2.1	3.9

Observed Rainfall

The annual average rainfall of Salem for the baseline period (1985 to 2014) is 912.1mm. The trend of rainfall indicates a decrease of 3.4mm/year in the period of 1985 -2014 (Figure 85).

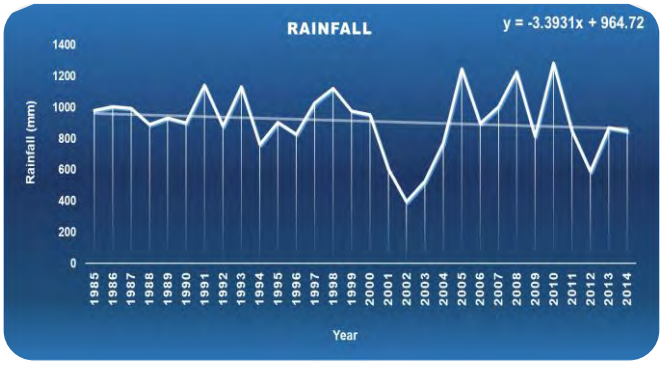

Figure 85 Rainfall Trend of Salem(1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 22.1% and 24.9% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 118).

Table 118 Rainfall Projections of Salem

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	5.0	7.3
Mid Century (2051-2080)	14.5	17.3
End Century (2081-2100)	22.1	24.9

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 8 days per year.

Projected Heatwave Days

Average projected Heatwave days for the Salem district is 55 days per year for the end century (Table 117).

Table 117 Heatwave days of Salem

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	16
Mid Century (2051-2080)	45
End Century (2081-2100)	55

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Salem is expected to increase by 1 day per year by the end of century (Table 119).

Table 119 Intense Rainfall events of Salem

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF SIVAGANGA DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.23 Climate Profile and Projections of Sivaganga District

Observed Maximum Temperature

The annual mean maximum temperature of Sivaganga for the baseline period (1985 to 2014) is 32.6°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 86).

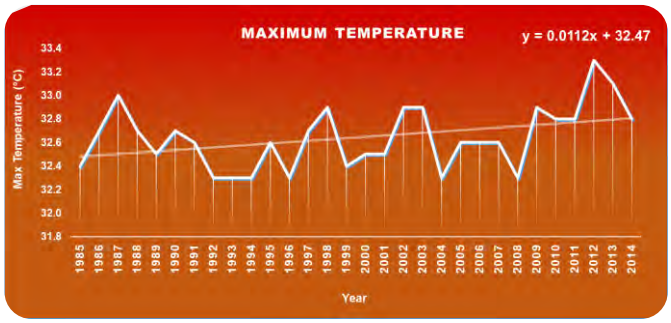

Figure 86 Maximum Temperature Trend of Sivaganga (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Sivganga for the baseline period (1985 to 2014) is 23.2°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 87).

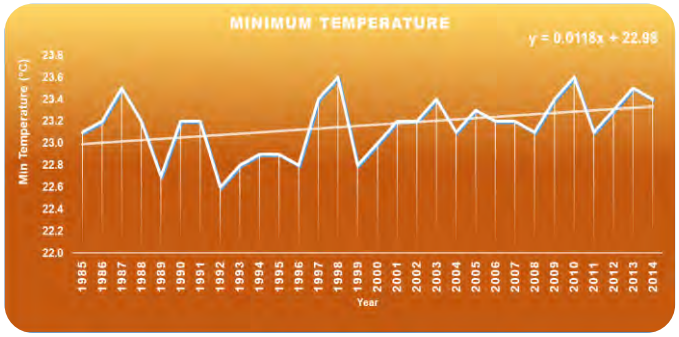

Figure 87 Minimum Temperature Trend of Sivaganga (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.5°C and 2.0°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 120).

Table 120 Maximum Temperature Projections of Sivaganga

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.3	0.6
Mid Century (2051-2080)	1.1	1.5
End Century (2081-2100)	1.5	2.0

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.6°C and 3.8°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 121).

Table 121 Minimum Temperature Projections of Sivaganga

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.9
Mid Century (2051-2080)	1.2	2.2
End Century (2081-2100)	1.6	3.8

Observed Rainfall

The annual average rainfall of Sivaganga for the baseline period (1985 to 2014) is 905mm. The trend of rainfall indicates an increase of 13.1mm/year in the period of 1985 -2014 (Figure 88).

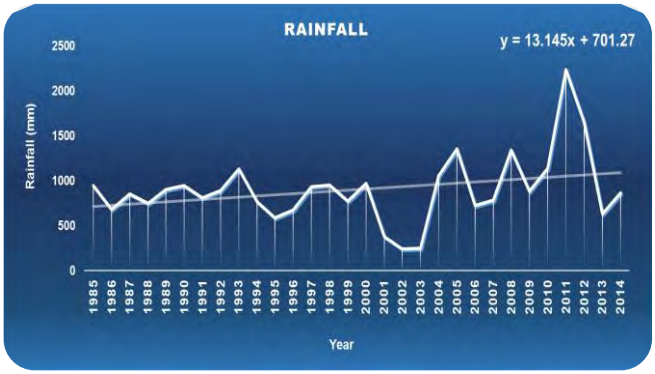

Figure 88 Rainfall Trend of Sivaganga (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 13.2% and 21.8% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 123).

Table 123 Rainfall Projections of Sivaganga

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.0	5.5
Mid Century (2051-2080)	9.0	15.4
End Century (2081-2100)	13.2	21.8

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 2 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Sivaganga district is 46 days per year for the end century (Table 122).

Table 122 Heatwave days of Sivaganga

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	10
Mid Century (2051-2080)	28
End Century (2081-2100)	46

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Sivaganga is expected to increase by 1 day per year by the end of century (Table 124).

Table 124 Intense Rainfall events of Sivaganga

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF TENKASI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.24 Climate Profile and Projections of Tenkasi District

Observed Maximum Temperature

The annual mean maximum temperature of Tenkasi for the baseline period (1985 to 2014) is 32.3°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 89).

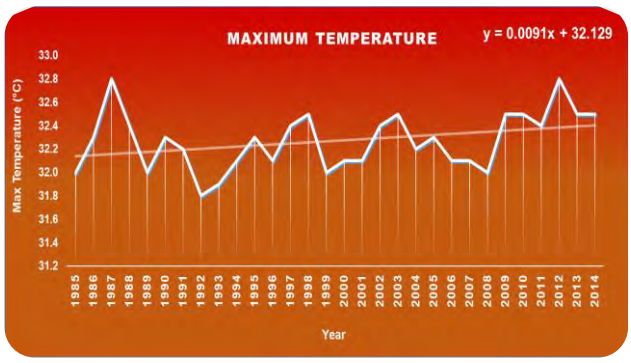

Figure 89 Maximum Temperature Trend of Tenkasi (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Tenkasi for the baseline period (1985 to 2014) is 23.2°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 90).

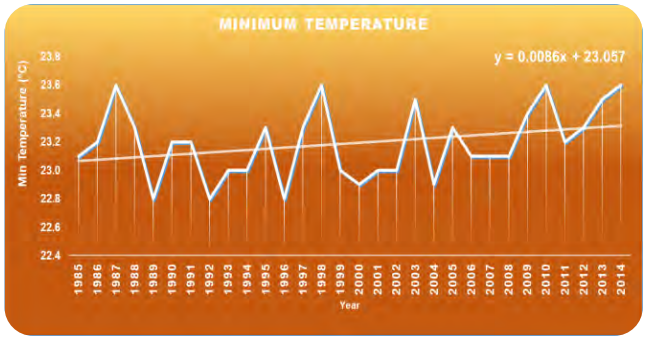

Figure 90 Minimum Temperature Trend (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 0.9°C and 2.2°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 125).

Table 125 Maximum Temperature Projections of Tenkasi

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.2	0.3
Mid Century (2051-2080)	0.7	0.9
End Century (2081-2100)	0.9	2.2

Minimum Temperature Projections

Similarly, the projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.2°C and 2.1°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 126).

Table 126 Minimum Temperature Projections of Tenkasi

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.5	0.6
Mid Century (2051-2080)	0.9	1.3
End Century (2081-2100)	1.2	2.1

Observed Rainfall

The annual average rainfall of Tenkasi for the baseline period (1985 to 2014) is 875.9mm. The trend of rainfall indicates an increase of 12.2mm/year in the period of 1985 -2014 (Figure 91).

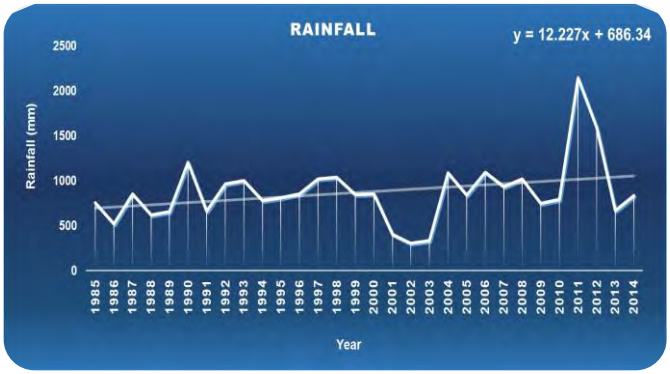

Figure 91 Observed Rainfall Trend (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 12.0% and 23.6% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 128).

Table 128 Rainfall Projections of Tenkasi

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.3	6.6
Mid Century (2051-2080)	9.2	17.2
End Century (2081-2100)	12.0	23.6

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985-2014).

Projected Heatwave Days

Average projected Heatwave days for the Tenkasi district is 12 days per year for the end century (Table 127).

Table 127 Heatwave days of Tenkasi

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	6
Mid Century (2051-2080)	9
End Century (2081-2100)	12

Observed Intense Rainfall Days (above 64.5mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Tenkasi is expected to increase by 2 days per year by the end of century (Table 129).

Table 129 Intense Rainfall events of Tenkasi

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	1
End Century (2081-2100)	2

CLIMATE PROFILE AND PROJECTIONS OF THANJAVUR DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.25 Climate Profile and Projections of Thanjavur District

Observed Maximum Temperature

The annual mean maximum temperature of Thanjavur for the baseline period (1985 to 2014) is 33.2°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 92).

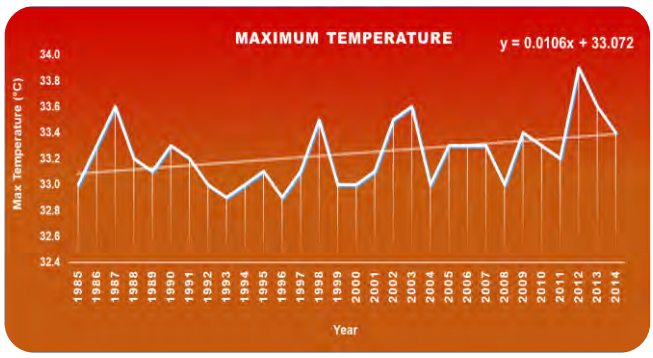

Figure 92 Maximum Temperature Trend of Thanjavur (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Thanjavur for the baseline period (1985 to 2014) is 23.7°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 93).

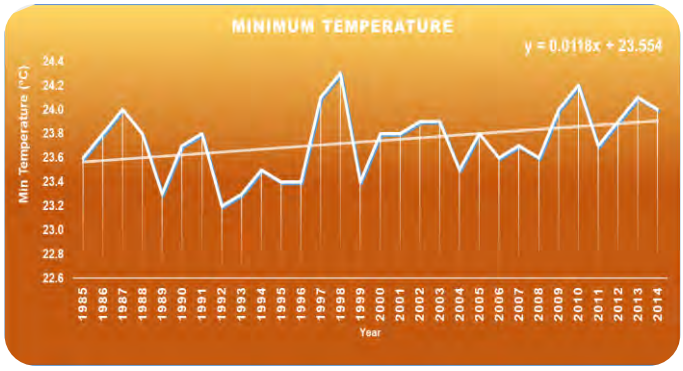

Figure 93 Minimum Temperature Trend of Thanjavur (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.3°C and 3.2°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 130).

Table 130 Maximum Temperature Projections of Thanjavur

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.5	0.7
Mid Century (2051-2080)	0.9	1.5
End Century (2081-2100)	1.3	3.2

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.8°C and 3.5°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 131).

Table 131 Minimum Temperature Projections of Thanjavur

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.8
Mid Century (2051-2080)	1.3	1.9
End Century (2081-2100)	1.8	3.5

Observed Rainfall

The annual average rainfall of Thanjavur for the baseline period (1985 to 2014) is 1155.2mm. The trend of rainfall indicates an increase of 13.8mm/year in the period of 1985 -2014 (Figure 94).

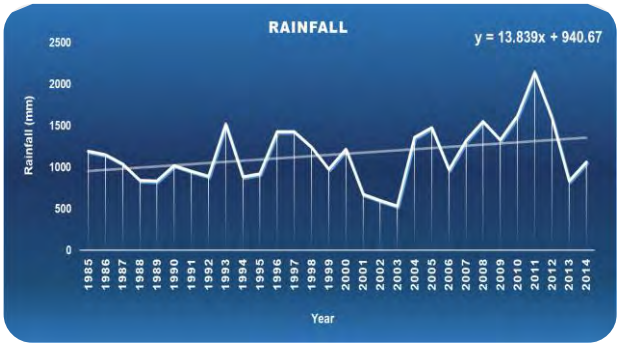

Figure 94 Rainfall Trend of Thanjavur (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 17.8% and 26.6% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 133).

Table 133 Rainfall Projections of Thanjavur

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4.7	7.4
Mid Century (2051-2080)	12.3	17.5
End Century (2081-2100)	17.8	26.6

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 1 day per year.

Projected Heatwave Days

The average projected Heatwave days for the Thanjavur district is 28 days per year for the end century (Table 132).

Table 132 Heatwave days of Thanjavur

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	7
Mid Century (2051-2080)	18
End Century (2081-2100)	28

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Thanjavur is expected to increase by 2 days per year by the end of century (Table 134).

Table 134 Intense Rainfall events of Thanjavur

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	2
End Century (2081-2100)	2

CLIMATE PROFILE AND PROJECTIONS OF THE NILGIRIS DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.26 Climate Profile and Projections of The Nilgiris District

Observed Maximum Temperature

The annual mean maximum temperature of The Nilgiris for the baseline period (1985 to 2014) is 29.5°C and the trend indicates a decrease in maximum temperature by 0.1°C (Figure 95).

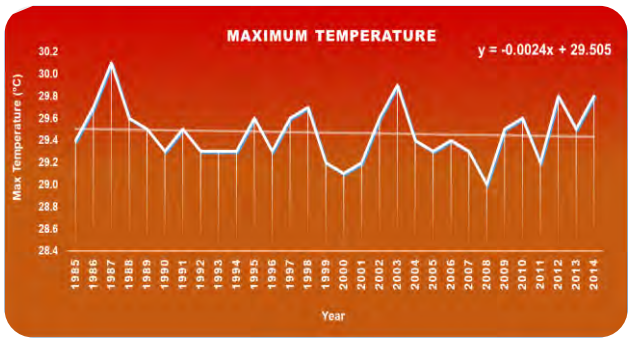

Figure 95 Maximum Temperature Trend of The Nilgiris (1985-2014)

Observed Minimum Temperature

The annual mean minimum temperature of The Nilgiris for the baseline period (1985 to 2014) is 19.4°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 96).

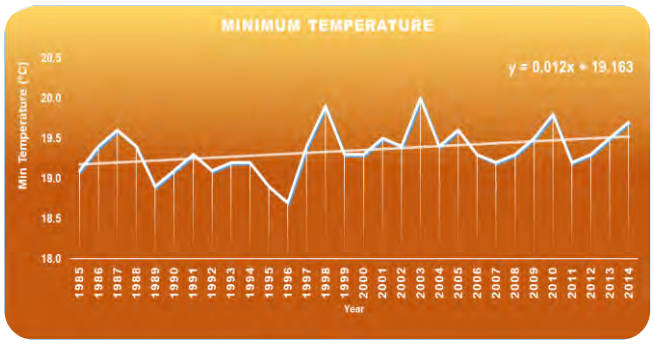

Figure 96 Maximum Temperature Trend of The Nilgiris (1985 -2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.8°C and 3.8°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 135).

Table 135 Maximum Temperature Projections of The Nilgiris

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.5	0.7
Mid Century (2051-2080)	1.2	1.9
End Century (2081-2100)	1.8	3.8

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.7°C and 3.9°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 136).

Table 136 Minimum Temperature Projections of The Nilgiris

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.8
Mid Century (2051-2080)	1.2	2.1
End Century (2081-2100)	1.7	3.9

Observed Rainfall

The annual average rainfall of The Nilgiris for the baseline period (1985 to 2014) is 1331.7mm. The trend of rainfall indicates an increase of 9.8mm/year in the period of 1985 -2014 (Figure 97).

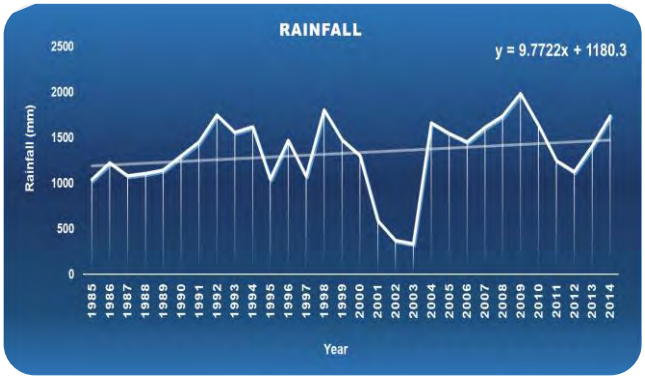

Figure 97 Rainfall Trend of The Nilgiris (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 5.9% and 19.4% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 138).

Table 138 Rainfall Projections of The Nilgiris

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	1.2	4.5
Mid Century (2051-2080)	3.7	12.8
End Century (2081-2100)	5.9	19.4

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 4 days per year.

Projected Heatwave Days

Average projected Heatwave days for the Nilgiris district is 55 days per year for the end century (Table 137).

Table 137 Heatwave days of The Nilgiris

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	19
Mid Century (2051-2080)	47
End Century (2081-2100)	55

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in The Nilgiris is expected to increase by 1 day per year by the end of century (Table 139).

Table 139 Intense Rainfall events of The Nilgiris

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF THENI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.27 Climate Profile and Projections of Theni District

Observed Maximum Temperature

The annual mean maximum temperature of Theni for the baseline period (1985 to 2014) is 31.5°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 98).

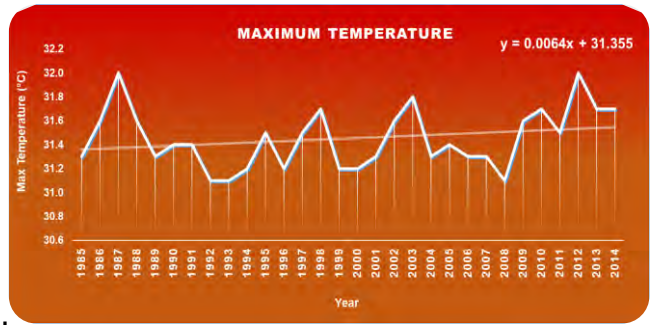

Figure 98 Maximum Temperature Trend of Theni (1985 - 2014)

Observed Minimum Temperature

The annual mean minimum temperature of Theni for the baseline period (1985 to 2014) is 22.0°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 99).

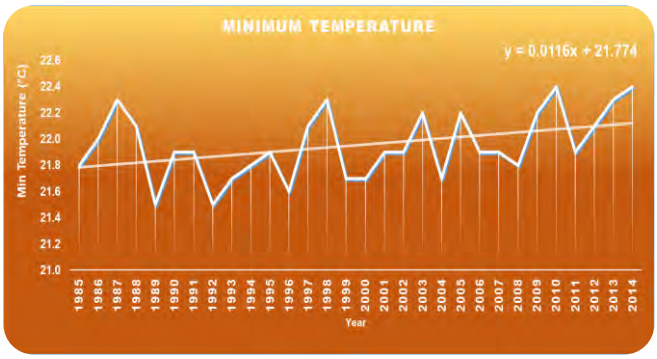

Figure 99 Minimum Temperature Trend (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.2°C and 2.5°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table).

Table 140 Maximum Temperature Projections of Theni

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.2	0.4
Mid Century (2051-2080)	0.8	1.1
End Century (2081-2100)	1.2	2.5

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.5°C and 2.4°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 141).

Table 141 Minimum Temperature Projections of Theni

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.7
Mid Century (2051-2080)	1.1	1.4
End Century (2081-2100)	1.5	2.4

Observed Rainfall

The annual average rainfall of Theni for the baseline period (1985 to 2014) is 953.1 mm. The trend of rainfall indicates an increase of 15.6mm/year in the period of 1985 -2014 (Figure 100).

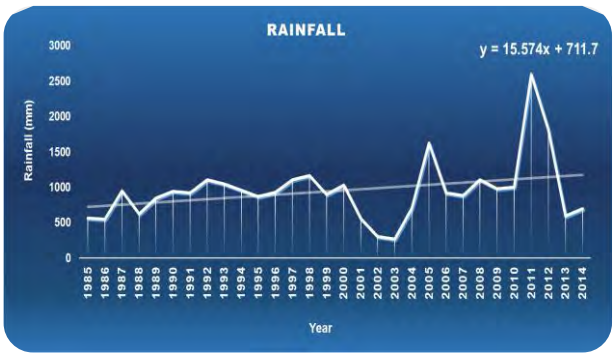

Figure 100 Rainfall Trend of Theni (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 10.6% and 23.2% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 143).

Table 143 Rainfall Projections of Theni

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.1	6.9
Mid Century (2051-2080)	7.4	17.2
End Century (2081-2100)	10.6	23.2

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985-2014).

Projected Heatwave Days

Average projected Heatwave days for the Theni district is 13 days per year for the end century (Table 142).

Table 142 Heatwave days of Theni

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	3
Mid Century (2051-2080)	9
End Century (2081-2100)	13

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Theni is expected to increase by 1 day per year by the end of century (Table 144).

Table 144 Intense Rainfall events of Theni

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF THOOTHUKUDI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.28 Climate Profile and Projections of Thoothukudi District

Observed Maximum Temperature

The annual mean maximum temperature of Thoothukudi for the baseline period (1985 to 2014) is 32.3°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 101).

Figure 101 Maximum Temperature Trend of Thoothukudi (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Thoothukudi for the baseline period (1985 to 2014) is 23.2°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 102).

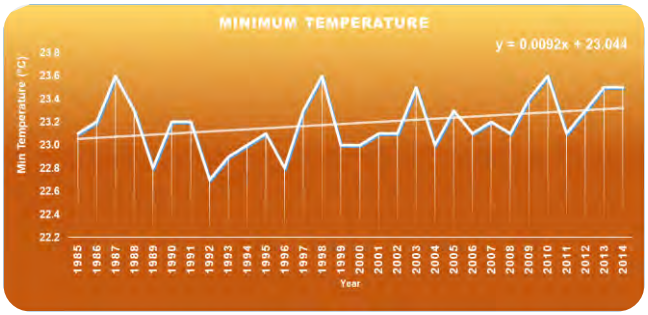

Figure 102 Minimum Temperature Trend of Thoothukudi (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 0.9°C and 2.1°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 145).

Table 145 Maximum Temperature Projections of Thoothukudi

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.2	0.4
Mid Century (2051-2080)	0.7	1.0
End Century (2081-2100)	0.9	2.1

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.3°C and 2.2°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 146).

Table 146 Minimum Temperature Projections of Thoothukudi

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.5	0.6
Mid Century (2051-2080)	0.9	1.3
End Century (2081-2100)	1.3	2.2

Observed Rainfall

The annual average rainfall of Thoothukudi for the baseline period (1985 to 2014) is 779.5 mm. The trend of rainfall indicates an increase of 9.8mm/year in the period of 1985 -2014 (Figure 103).

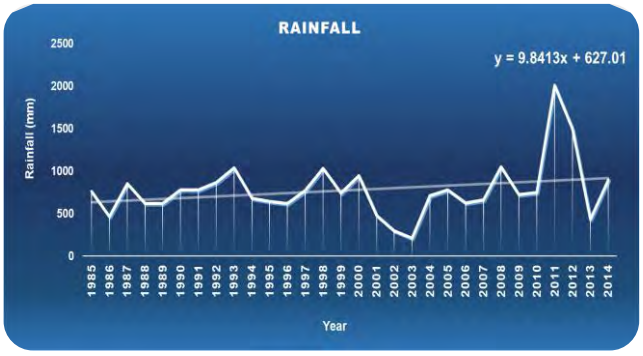

Figure 103 Rainfall Trend of Thoothukudi (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 7.9% and 30.2% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 148).

Table 148 Rainfall Projections of Thoothukudi

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	2.4	7.6
Mid Century (2051-2080)	6.0	18.3
End Century (2081-2100)	7.9	30.2

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985-2014).

Projected Heatwave Days

The average projected Heatwave days for the Thoothukudi district is 3 days per year for the end century (Table 147).

Table 147 Heatwave days of Thoothukudi

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	4
Mid Century (2051-2080)	0
End Century (2081-2100)	3

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Thoothukudi is expected to increase by 1 day per year by the end of century (Table 149).

Table 149 Intense Rainfall events of Thoothukudi

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF TIRUCHIRAPPALLI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.29 Climate Profile and Projections of Tiruchirappalli District

Observed Maximum Temperature

The annual mean maximum temperature of Tiruchirappalli for the baseline period (1985 to 2014) is 33.3°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 104).

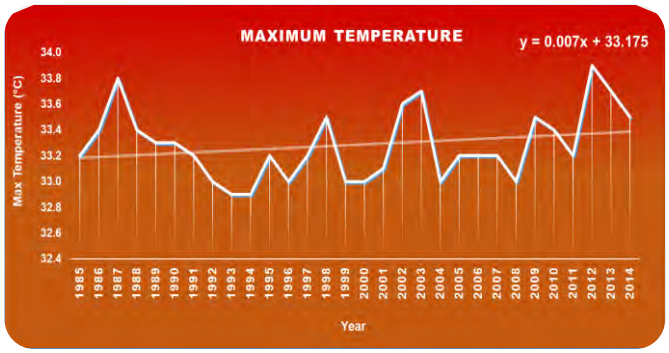

Figure 104 Maximum Temperature Trend of Tiruchirappalli (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Tiruchirappalli for the baseline period (1985 to 2014) is 23.2°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 105).

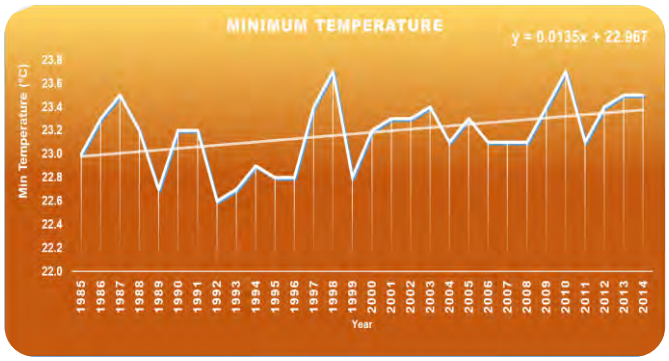

Figure 105 Minimum Temperature Trend of Tiruchirappalli (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.6°C and 3.3°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 150).

Table 150 Maximum Temperature Projections of Tiruchirappalli

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.3	0.5
Mid Century (2051-2080)	1.1	1.7
End Century (2081-2100)	1.6	3.3

Minimum Temperature Projections

Similarly, the projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.0°C and 4.3°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 151).

Table 151 Minimum Temperature Projections of Tiruchirappalli

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.9
Mid Century (2051-2080)	1.4	2.3
End Century (2081-2100)	2.0	4.3

Observed Rainfall

The annual average rainfall of Tiruchirappalli for the baseline period (1985 to 2014) is 782.1 mm. The trend of rainfall indicates an increase of 12mm/year in the period of 1985 -2014 (Figure 106).

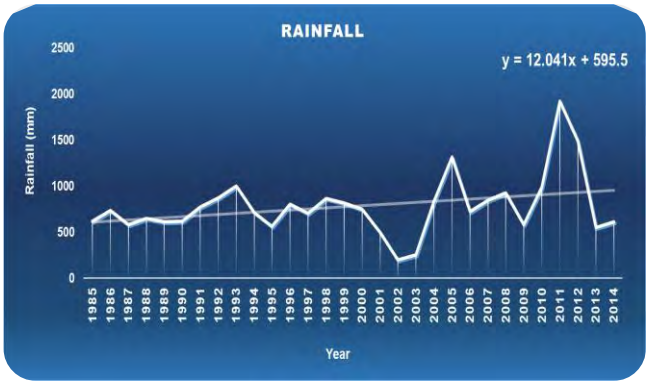

Figure 106 Rainfall Trend of Tiruchirappalli (1985 -2014)

Rainfall Projections

The rainfall projections imply an increase of rainfall of 21.9% and 29.7% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 153).

Table 153 Rainfall Projections of Tiruchirappalli

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	5.3	7.6
Mid Century (2051-2080)	15.6	18.3
End Century (2081-2100)	21.9	29.7

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 7 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Tiruchirappalli district is 57 days per year for the end century (Table 152).

Table 152 Heatwave days of Tiruchirappalli

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	22
Mid Century (2051-2080)	39
End Century (2081-2100)	57

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Tiruchirappalli is expected to increase by 1 day per year by the end of century (Table 154).

Table 154 Intense Rainfall events of Tiruchirappalli

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	0
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF TIRUNELVELI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.30 Climate Profile and Projections of Tirunelveli District

Observed Maximum Temperature

The annual mean maximum temperature of Tirunelveli for the baseline period (1985 to 2014) is 32.3°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 107).

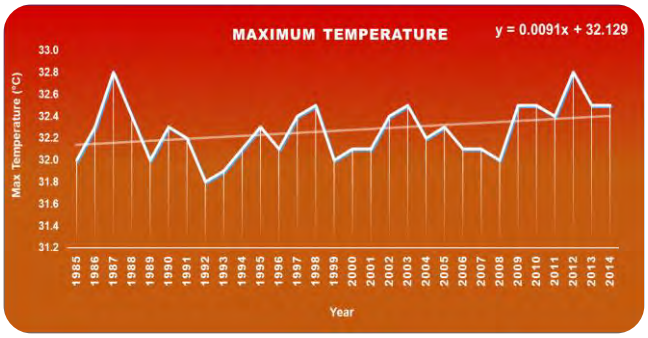

Figure 107 Maximum Temperature Trend of Tirunelveli (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Tirunelveli for the baseline period (1985 to 2014) is 23.2°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 108).

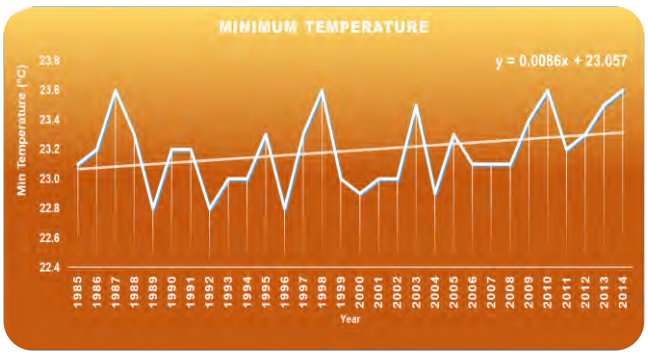

Figure 108 Observed Minimum Temperature Trend of Tirunelveli (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 0.7°C and 1.8°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 155).

Table 155 Maximum Temperature Projections of Tirunelveli

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.2	0.4
Mid Century (2051-2080)	0.5	0.8
End Century (2081-2100)	0.7	1.8

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.1°C and 2.3°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 156).

Table 156 Minimum Temperature Projections of Tirunelveli

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.4	0.5
Mid Century (2051-2080)	0.8	1.2
End Century (2081-2100)	1.1	2.3

Observed Rainfall

The annual average rainfall of Tirunelveli for the baseline period (1985 to 2014) is 790.1mm. The trend of rainfall indicates an increase of 10.8mm/year in the period of 1985 -2014 (Figure 109).

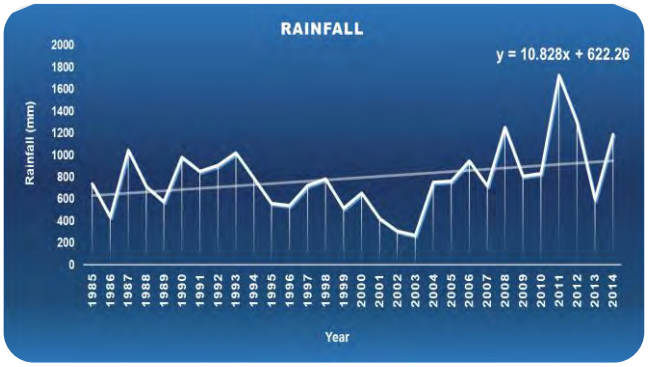

Figure 109 Rainfall Trend of Tirunelveli (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 19.3% and 24.5% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 158).

Table 158 Rainfall Projections of Tirunelveli

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4.2	7.1
Mid Century (2051-2080)	15.4	17.3
End Century (2081-2100)	19.3	24.5

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985-2014).

Projected Heatwave Days

The average projected Heatwave days for the Tirunelveli district is 12 days per year for the end century (Table 157).

Table 157 Heatwave days of Tirunelveli

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	3
Mid Century (2051-2080)	7
End Century (2081-2100)	12

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Tirunelveli is expected to increase by 2 days per year by the end of century (Table 159).

Table 159 Intense Rainfall events of Tirunelveli

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	2
End Century (2081-2100)	2

CLIMATE PROFILE AND PROJECTIONS OF TIRUPATHUR DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.31 Climate Profile and Projections of Tirupathur District

Observed Maximum Temperature

The annual mean maximum temperature of Tirupathur for the baseline period (1985 to 2014) is 32.8°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 110) .

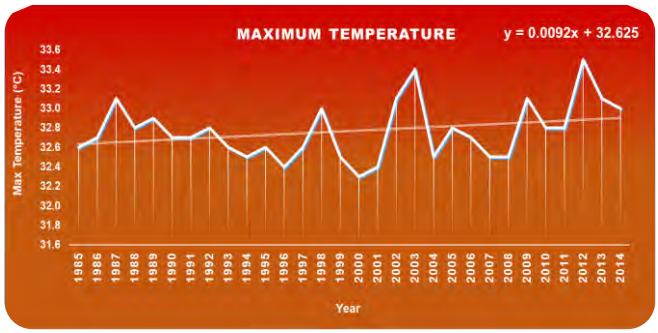

Figure 110 Maximum Temperature Trend of Tirupathur (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Tirupathur for the baseline period (1985 to 2014) is 22.2°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 111).

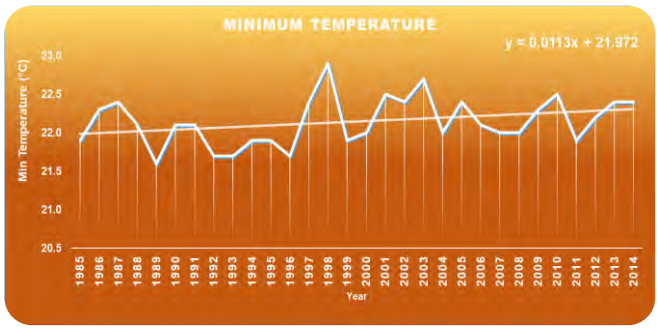

Figure 111 Observed Minimum Temperature Trend of Tirupathur (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.4°C and 4.5°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 160).

Table 160 Maximum Temperature Projections of Tirupathur

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.8
Mid Century (2051-2080)	1.7	2.3
End Century (2081-2100)	2.4	4.5

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.6°C and 5.1°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 161).

Table 161 Minimum Temperature Projections of Tirupathur

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	1.0	1.1
Mid Century (2051-2080)	1.8	2.7
End Century (2081-2100)	2.6	5.1

Observed Rainfall

The annual average rainfall of Tirupathur for the baseline period (1985 to 2014) is 797.4mm. The trend of rainfall indicates a decrease of 1.7mm/year in the period of 1985 -2014 (Figure 112).

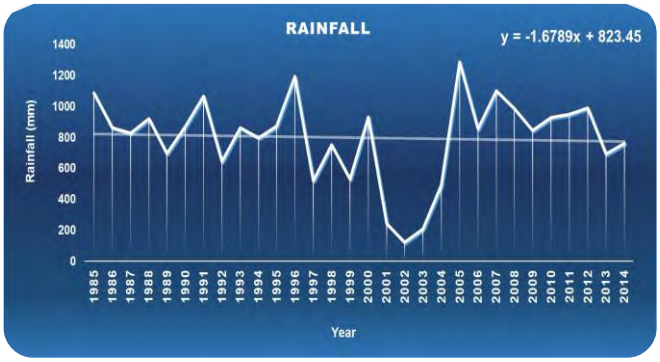

Figure 112 Observed Rainfall Trend of Tirupathur (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 24.3% and 33.6% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 163).

Table 163 Rainfall Projections of Tirupathur

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	7.4	9.7
Mid Century (2051-2080)	17.1	23.6
End Century (2081-2100)	24.3	33.6

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 25 days per year.

Projected Heatwave Days

Average projected Heatwave days for the Tirupathur district is 82 days per year for the end century (Table 162).

Table 162 Heatwave days of Tirupathur

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	44
Mid Century (2051-2080)	64
End Century (2081-2100)	82

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Tirupathur is expected to increase by 1 day per year by the end of century (Table 164).

Table 164 Intense Rainfall events of Tirupathur

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF TIRUPPUR DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.32 Climate Profile and Projections of Tiruppur District

Observed Maximum Temperature

The annual mean maximum temperature of Tiruppur for the baseline period (1985 to 2014) is 30.9°C and the trend indicates an increase in maximum temperature by 0.01°C (Figure 113).

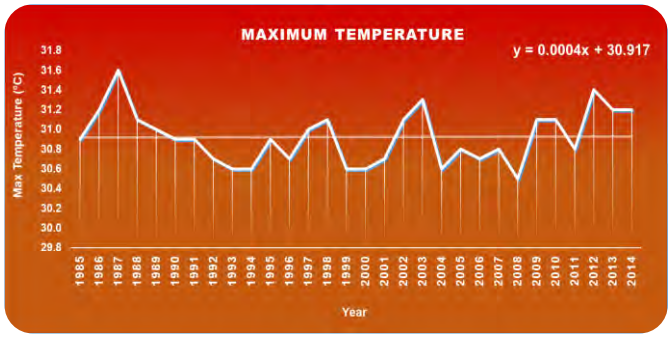

Figure 113 Maximum Temperature Trend of Tiruppur (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Tiruppur for the baseline period (1985 to 2014) is 20.9°C and the trend indicates an increase in minimum temperature by 0.4°C (Figure 114).

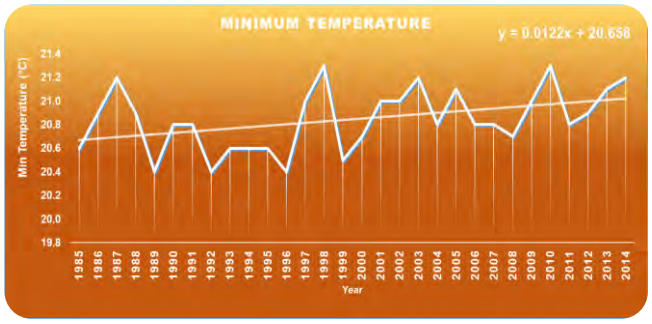

Figure 114 Minimum Temperature Trend of Tiruppur (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.5°C and 3.0°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 165).

Table 165 Maximum Temperature Projections of Tiruppur

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.3	0.4
Mid Century (2051-2080)	1.0	1.4
End Century (2081-2100)	1.5	3.0

Minimum Temperature Projections

Similarly, the projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.7°C and 3.3°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 166).

Table 166 Minimum Temperature Projections of Tiruppur

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.7
Mid Century (2051-2080)	1.2	1.8
End Century (2081-2100)	1.7	3.3

Observed Rainfall

The annual average rainfall of Tiruppur for the baseline period (1985 to 2014) is 816mm. The trend of rainfall indicates a decrease of 0.3mm/year in the period of 1985-2014 (Figure 115).

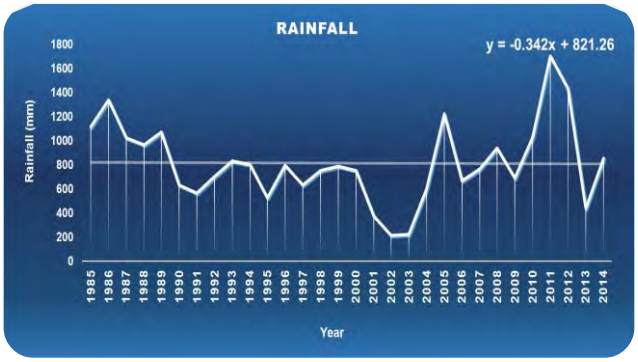

Figure 115 Observed Rainfall Trend (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 11.4% and 21.8% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 168).

Table 168 Rainfall Projections of Tiruppur

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.2	6.1
Mid Century (2051-2080)	10.5	15.6
End Century (2081-2100)	11.4	21.8

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 6 days per year.

Projected Heatwave Days

Average projected Heatwave days for the Tiruppur district is 46 days per year for the end century (Table 167).

Table 167 Heatwave days of Tiruppur

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	19
Mid Century (2051-2080)	39
End Century (2081-2100)	46

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Tiruppur is expected to increase by 1 day per year by the end of century (Table 169).

Table 169 Intense Rainfall events of Tiruppur

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF TIRUVALLUR DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.33 Climate Profile and Projections of Tiruvallur District

Observed Maximum Temperature

The annual mean maximum temperature of Tiruvallur for the baseline period (1985 to 2014) is 33.4°C and the trend indicates an increase in maximum temperature by 0.4°C (Figure 116).

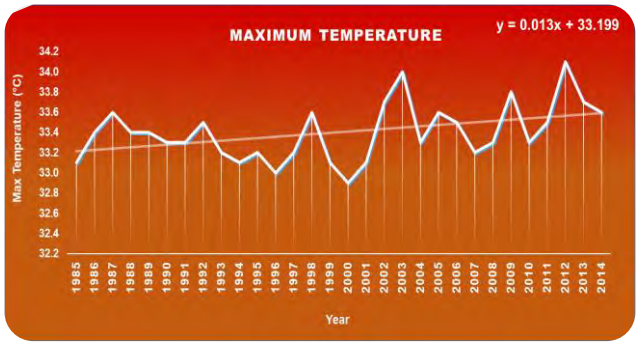

Figure 116 Maximum Temperature Trend of Tiruvallur (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Tiruvallur for the baseline period (1985 to 2014) is 23.1°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 117).

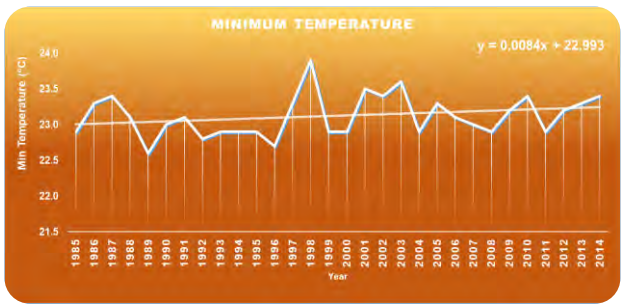

Figure 117 Minimum Temperature Trend of Tiruvallur (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.8°C and 6.2°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 170).

Table 170 Maximum Temperature Projections of Tiruvallur

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.9	1.1
Mid Century (2051-2080)	1.9	3.1
End Century (2081-2100)	2.8	6.2

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 3.0°C and 6.5°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 171).

Table 171 Minimum Temperature Projections of Tiruvallur

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	1.1	1.2
Mid Century (2051-2080)	2.1	3.3
End Century (2081-2100)	3.0	6.5

Observed Rainfall

The annual average rainfall of Tiruvallur for the baseline period (1985 to 2014) is 1193mm. The trend of rainfall indicates a decrease of 5.2mm/year in the period of 1985 -2014 (Figure 118).

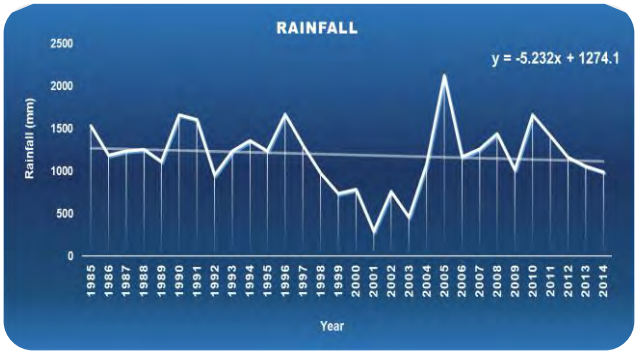

Figure 118 Rainfall Trend of Tiruvallur (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 8.9% and 22.4% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 173).

Table 173 Rainfall Projections of Tiruvallur

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.9	6.1
Mid Century (2051-2080)	7.5	16.6
End Century (2081-2100)	8.9	22.4

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 27 days per year.

Projected Heatwave Days

Average projected Heatwave days for the Tiruvallur district is 127 days per year for the end century (Table 172).

Table 172 Heatwave days of Tiruvallur

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	53
Mid Century (2051-2080)	91
End Century (2081-2100)	127

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 2 days per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Tiruvallur is expected to increase by 3 days per year by the end of century (Table 174).

Table 174 Intense Rainfall events of Tiruvallur

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	3
Mid Century (2051-2080)	3
End Century (2081-2100)	3

CLIMATE PROFILE AND PROJECTIONS OF TIRUVANNAMALAI DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.34 Climate Profile and Projections of Tiruvannamalai District

Observed Maximum Temperature

The annual mean maximum temperature of Tiruvannamalai for the baseline period (1985 to 2014) is 33.2°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 119).

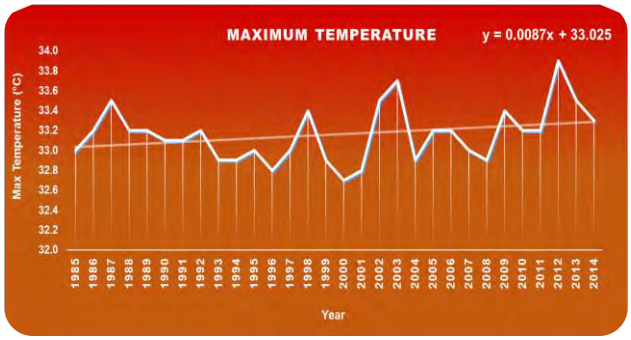

Figure 119 Maximum Temperature Trend of Tiruvannamalai (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Tiruvannamalai for the baseline period (1985 to 2014) is 22.8°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 120).

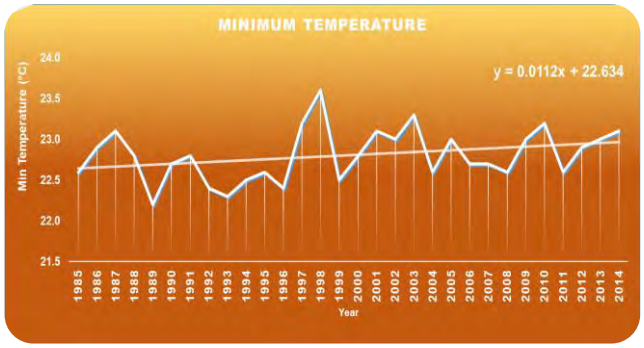

Figure 120 Minimum Temperature Trend of Tiruvannamalai (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.2°C and 4.5°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 175).

Table 175 Maximum Temperature Projections of Tiruvannamalai

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.8
Mid Century (2051-2080)	1.6	2.3
End Century (2081-2100)	2.2	4.5

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.9°C and 5.6°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 176).

Table 176 Minimum Temperature Projections of Tiruvannamalai

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	1.0	1.1
Mid Century (2051-2080)	2.0	2.9
End Century (2081-2100)	2.9	5.6

Observed Rainfall

The annual average rainfall of Tiruvannamalai for the baseline period (1985 to 2014) is 997.5mm. The trend of rainfall indicates an increase of 2.2mm/year in the period of 1985-2014 (Figure 121).

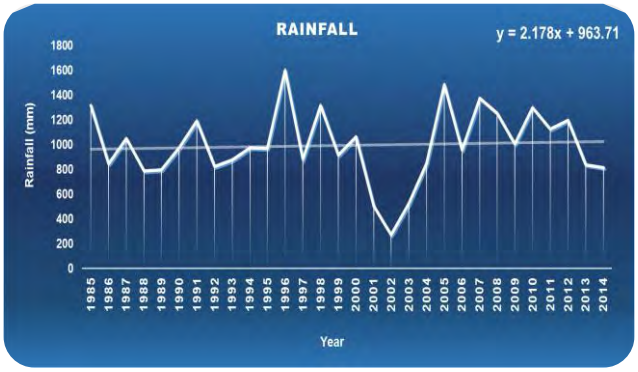

Figure 121 Rainfall Trend of Tiruvannamalai (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 21.1% and 24.0% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 178).

Table 178 Rainfall Projections of Tiruvannamalai

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	4.8	7.2
Mid Century (2051-2080)	12.4	17.3
End Century (2081-2100)	21.1	24.0

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 19 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Tiruvannamalai district is 86 days per year for the end century (Table 177).

Table 177 Heatwave days of Tiruvannamalai

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	44
Mid Century (2051-2080)	64
End Century (2081-2100)	86

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Tiruvannamalai is expected to increase by 1 day per year by the end of century (Table 179).

Table 179 Intense Rainfall events of Tiruvannamalai

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF TIRUVARUR DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.35 Climate Profile and Projections of Tiruvarur District

Observed Maximum Temperature

The annual mean maximum temperature of Tiruvarur for the baseline period (1985 to 2014) is 33.4°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 122).

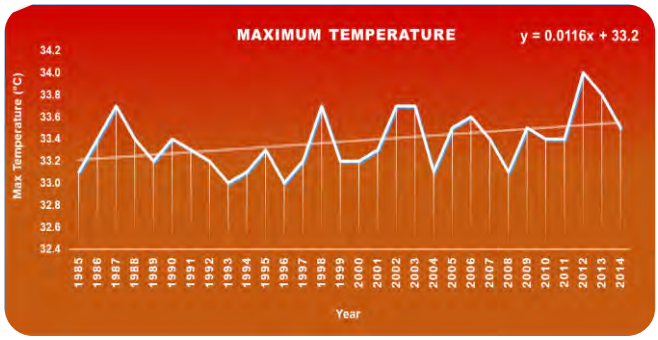

Figure 122 Maximum Temperature Trend of Tiruvarur (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Tiruvarur for the baseline period (1985 to 2014) is 24.1°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 123).

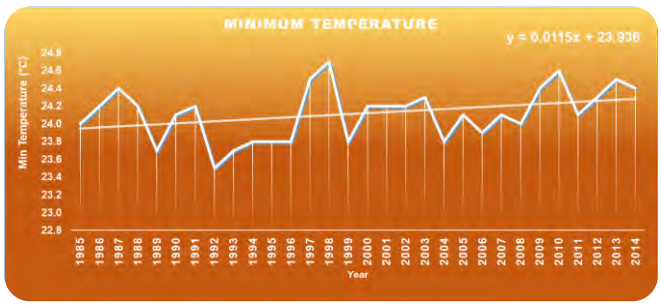

Figure 123 Minimum Temperature Trend of Tiruvarur (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.3°C and 2.4°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 180).

Table 180 Maximum Temperature Projections of Tiruvarur

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.2	0.3
Mid Century (2051-2080)	0.9	1.1
End Century (2081-2100)	1.3	2.4

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.9°C and 3.9°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 181).

Table 181 Minimum Temperature Projections of Tiruvarur

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.7	0.8
Mid Century (2051-2080)	1.3	2.1
End Century (2081-2100)	1.9	3.9

Observed Rainfall

The annual average rainfall of Tiruvarur for the baseline period (1985 to 2014) is 1332.5 mm. The trend of rainfall indicates an increase of 7.1mm/year in the period of 1985 -2014 (Figure 124).

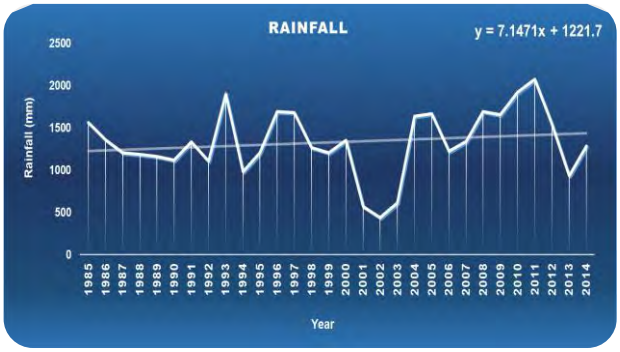

Figure 124 Rainfall Trend of Tiruvarur (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 7.6% and 26.3% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 183).

Table 183 Rainfall Projections of Tiruvarur

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	3.2	7.4
Mid Century (2051-2080)	5.0	17.5
End Century (2081-2100)	7.6	26.3

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 4 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Tiruvarur district is 41 days per year for the end century (Table 182).

Table 182 Heatwave days of Tiruvarur

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	12
Mid Century (2051-2080)	24
End Century (2081-2100)	41

Observed Intense Rainfall Days (above 64.5mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 2 days per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Tiruvarur is expected to increase by 2 days per year by the end of century (Table 184).

Table 184 Intense Rainfall events of Tiruvarur

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	2
Mid Century (2051-2080)	2
End Century (2081-2100)	2

CLIMATE PROFILE AND PROJECTIONS OF VELLORE DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.36 Climate Profile of Vellore District

Observed Maximum Temperature

The annual mean maximum temperature of Vellore for the baseline period (1985 to 2014) is 32.8°C and the trend indicates an increase in maximum temperature by 0.3°C(Figure 125).

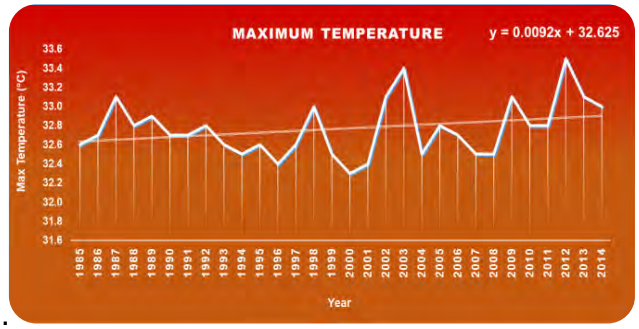

Figure 125 Maximum Temperature Trend of Vellore (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Vellore for the baseline period (1985 to 2014) is 22.2°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 126).

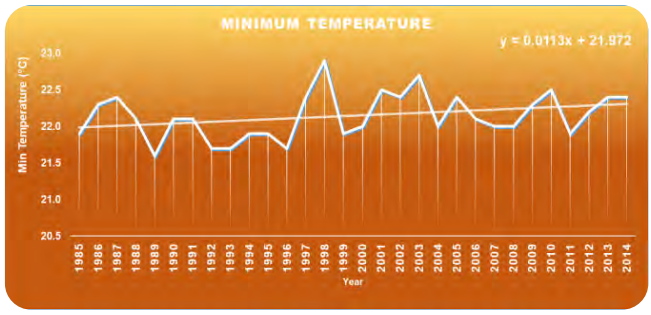

Figure 126 Minimum Temperature Trend of Vellore (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.8°C and 5.6°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 185).

Table 185 Maximum Temperature Projections of Vellore

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.8	1.0
Mid Century (2051-2080)	2.0	2.8
End Century (2081-2100)	2.8	5.6

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.9°C and 6.1°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 186).

Table 186 Minimum Temperature Projections of Vellore

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	1.1	1.2
Mid Century (2051-2080)	2.0	3.1
End Century (2081-2100)	2.9	6.1

Observed Rainfall

The annual average rainfall of Vellore for the baseline period (1985 to 2014) is 979.9mm. The trend of rainfall indicates an increase of 0.2mm/year in the period of 1985 -2014 (Figure 127).

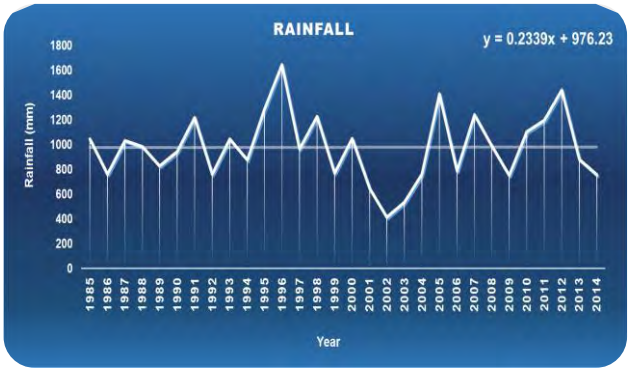

Figure 127 Rainfall Trend of Vellore (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 18.4% and 20.7% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 188).

Table 188 Rainfall Projections of Vellore

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	2.0	5.4
Mid Century (2051-2080)	12.8	14.8
End Century (2081-2100)	18.4	20.7

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 28 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Vellore district is 99 days per year for the end century (Table 187).

Table 187 Heatwave days of Vellore

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	51
Mid Century (2051-2080)	73
End Century (2081-2100)	99

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Vellore is expected to increase by 1 day per year by the end of century (Table 189).

Table 189 Intense Rainfall events of Vellore

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	1
End Century (2081-2100)	1

CLIMATE PROFILE AND PROJECTIONS OF VILLUPPURAM DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.37 Climate Profile and Projections of Viluppuram District

Observed Maximum Temperature

The annual mean maximum temperature of Viluppuram for the baseline period (1985 to 2014) is 33.2°C and the trend indicates an increase in maximum temperature by 0.2°C (Figure 128).

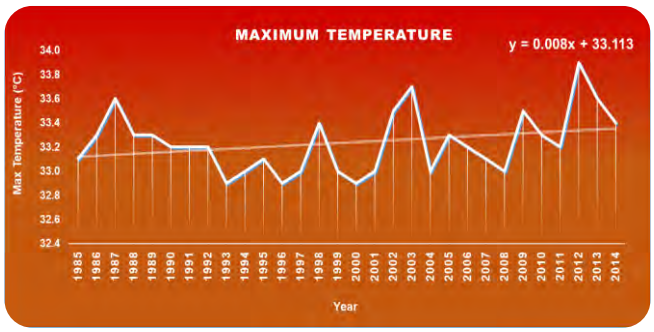

Figure 128 Maximum Temperature Trend of Viluppuram (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Viluppuram for the baseline period (1985 to 2014) is 23.2°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure129).

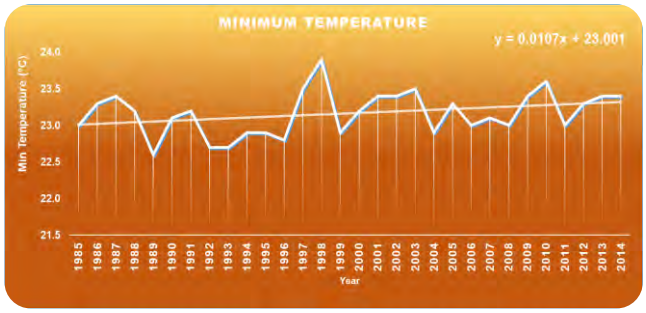

Figure 129 Minimum Temperature Trend Trend of Viluppuram (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 2.1°C and 4.3°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 190).

Table 190 Maximum Temperature Projections of Viluppuram

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.7
Mid Century (2051-2080)	1.5	2.1
End Century (2081-2100)	2.1	4.3

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 2.7°C and 5.1°C under SSP2-4.5 and SSP5-8.5 scenarios respectively(Table 191).

Table 191 Minimum Temperature Projections of Viluppuram

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.9	1.1
Mid Century (2051-2080)	1.8	2.7
End Century (2081-2100)	2.7	5.1

Observed Rainfall

The annual average rainfall of Viluppuram for the baseline period (1985 to 2014) is 1034.1 mm. The trend of rainfall indicates an increase of 6.5mm/year in the period of 1985 -2014 (Figure 130).

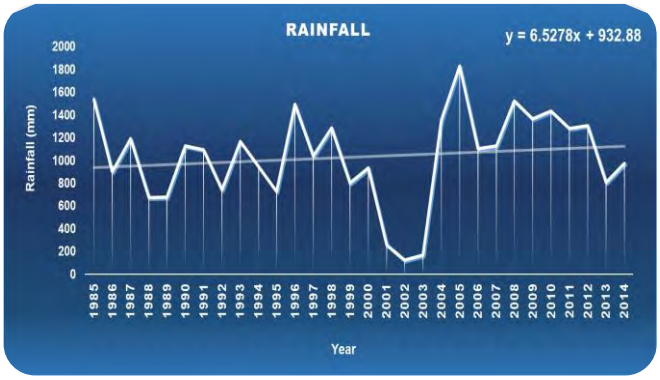

Figure 130 Rainfall Trend of Viluppuram (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 8.2% and 22.5% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 193).

Table 193 Rainfall Projections of Viluppuram

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	2.5	6.2
Mid Century (2051-2080)	6.3	16.8
End Century (2081-2100)	8.2	22.5

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The heatwave days during the baseline period (1985 – 2014) is 17 days per year.

Projected Heatwave Days

The average projected Heatwave days for the Viluppuram district is 89 days per year for the end century (Table 192).

Table 192 Heatwave days of Viluppuram

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	38
Mid Century (2051-2080)	62
End Century (2081-2100)	89

Observed Intense Rainfall Days (above 64.5 mm)

The intense rainfall above 64.5mm of the district for the baseline period (1985-2014) is 1 day per year.

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Viluppuram is expected to increase by 2 days per year by the end of century (Table 194).

Table 194 Intense Rainfall of Viluppuram

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	2
End Century (2081-2100)	2

CLIMATE PROFILE AND PROJECTIONS OF VIRUDHUNAGAR DISTRICT

CLIMATE MODELING

Climate Studio - CCCDM

4.38 Climate Profile and Projections of Virudhunagar District

Observed Maximum Temperature

The annual mean maximum temperature of Virudhunagar for the baseline period (1985 to 2014) is 31.9°C and the trend indicates an increase in maximum temperature by 0.3°C (Figure 131).

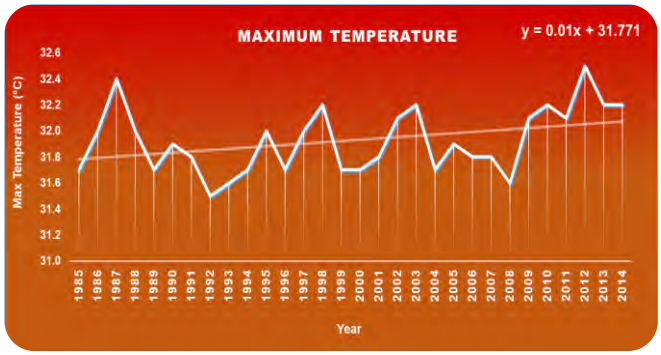

Figure 131 Maximum Temperature Trend of Virudhunagar (1985 -2014)

Observed Minimum Temperature

The annual mean minimum temperature of Virudhunagar for the baseline period (1985 to 2014) is 22.7°C and the trend indicates an increase in minimum temperature by 0.3°C (Figure 132).

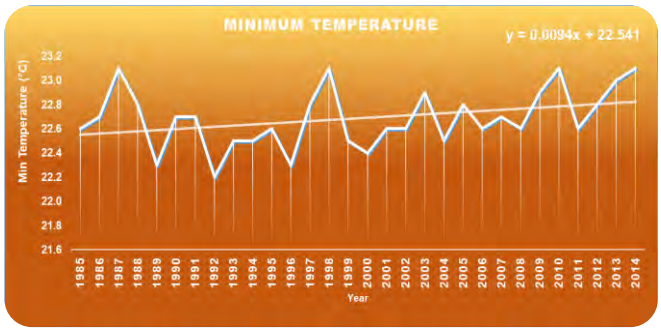

Figure 132 Minimum Temperature Trend of Virudhunagar (1985-2014)

Maximum Temperature Projections

The Projections of Maximum temperature imply that by the end of century there will be an increase in maximum temperature by 1.0°C and 2.4°C under SSP2-4.5 and SSP5-8.5 scenario respectively (Table 195).

Table 195 Maximum Temperature Projections of Virudhunagar

Projection Period	Increase in Annual Average Maximum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.2	0.4
Mid Century (2051-2080)	0.7	1.2
End Century (2081-2100)	1.0	2.4

Minimum Temperature Projections

The projections of minimum temperature imply that by the end of century there will be an increase in minimum temperature by 1.4°C and 2.8°C under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 196).

Table 196 Minimum Temperature Projections of Virudhunagar

Projection Period	Increase in Annual Average Minimum Temperature (°C)	
	SSP2-4.5	SSP5-8.5
Near Century (2021-2050)	0.6	0.7
Mid Century (2051-2080)	1.0	1.6
End Century (2081-2100)	1.4	2.8

Observed Rainfall

The annual average rainfall of Virudhunagar for the baseline period (1985 to 2014) is 889.9mm. The trend of rainfall indicates an increase of 11.5mm/year in the period of 1985-2014 (Figure 133).

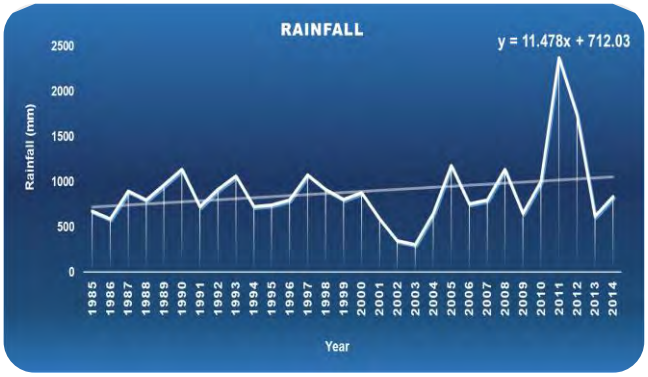

Figure 133 Rainfall Trend of Virudhunagar (1985 -2014)

Rainfall Projections

The rainfall projections implies an increase of rainfall of 15.5% and 21.9% by the end of century under SSP2-4.5 and SSP5-8.5 scenarios respectively (Table 198).

Table 198 Rainfall Projections of Virudhunagar

Projection Period	Percentage Change in Annual Average Rainfall(%)	
	SSP2-4.5 Scenario	SSP5-8.5 Scenario
Near Century (2021-2050)	2.6	5.7
Mid Century (2051-2080)	11.9	15.8
End Century (2081-2100)	15.5	21.9

CLIMATE EXTREMITIES

Observed Heatwave Days (4.5°C above Normal)

The district has not experienced the heatwave days during the baseline period of (1985-2014).

Projected Heatwave Days

The average projected Heatwave days for the Virudhunagar district is 12 days per year for the end century (Table 197).

Table 197 Heatwave days of Virudhunagar

Projection Period	Heatwaves SSP2-4.5 (days/year)
Near Century (2021-2050)	6
Mid Century (2051-2080)	10
End Century (2081-2100)	12

Observed Intense Rainfall Days (above 64.5 mm)

The district has not experienced intense rainfall above 64.5mm for the baseline period (1985-2014).

Projected Intense Rainfall Days

The future projections of Intense Rainfall above 64.5mm in Virudhunagar is expected to increase by 2 days per year by the end of century (Table 199).

Table 199 Intense Rainfall events of Virudhunagar

Projection Period	Intense Rainfall SSP2-4.5 (days/year)
Near Century (2021-2050)	1
Mid Century (2051-2080)	2
End Century (2081-2100)	2

5 WAY FORWARD

Tamil Nadu recurrently witness climate extremes, from long lasting severe drought to super cyclones, which intensifies in frequency and intensity, specifically observed after 2015. The state has recently witnessed an unanticipated extreme downpour of precipitation (900 mm) in 24 hours at Kayalpatinam municipality in Thoothukudi district on Dec 2023. Albeit major causality, repercussion of the extreme event left the state questioned with the unforeseen effects of climate change, and the adaptation strategies to withstand the perturbations without moderately affecting the daily life.

The effect of climate change varies within the districts, which is vindicative in need of high-resolution climate data at cadastral-level of 10x10 km. This high-resolution climate data can be deployed in the AI tools, for the development of multi-criteria dimension analysis decision support system for recommending adaptation strategies to make the districts resilient and sustainable for the changing climate

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Vision

The CCCDM to be the Centre for Excellence to address challenges of Climate Change and Disaster Management

Mission

CCCDM shall contribute to the sustainable development by

- **Promoting climate science and disaster risk reduction research**
- **Disseminating Knowledge of regional climate risks and cadastral level climate resilient actions to cope up with changing climate**
- **Strengthening the capacity for climate change adaptation, mitigation and disaster risk reduction**

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