

Projection Of Climate Over Cauvery Delta Zone

Aruna S¹, D. Hebsiba Beula²

¹II M.SC., Actuarial Science, PG Department of Actuarial Science, Bishop Heber College (Autonomous), Tiruchirappalli

²Associate Professor, PG Department of Actuarial Science, Bishop Heber College (Autonomous), Tiruchirappalli

Abstract—Extreme weather events and climate change pose a severe danger to socioeconomic and livelihood stability. The Cauvery delta zone (CDZ) was chosen for this study to explore present and future trends in climate variability. Thanjavur, Thiruvarur, Pudukottai, Cuddalore, Ariyalur, Tiruchirappalli and Nagapattinam are the Cauvery delta region of Tamil Nadu's seven major districts. The baseline data sets were provided by the Indian Meteorological Agency (IMD). Using IPCC AR5 RCP4.5 and RCP8.5 scenarios, the maximum and minimum temperatures, as well as precipitation, were investigated. According to the results, the minimum temperature might increase to 2.8 to 4.5oC while the maximum temperature could rise to 1.1 to 3.6oC. Additionally, it was determined that by the turn of the century, rainfall would increase by 15-16%.

Index Terms—Cauvery delta zone, the climate change, the RCP, Tamil Nadu.

I. INTRODUCTION

The spatiotemporal distribution of many meteorological indices, including rainfall, temperature, and pressure, is wholly responsible for the economic, industrial, and agricultural progress of Tamil Nadu. The two most important variables that directly affect a region's climate are rainfall and temperature. An increase in extreme weather events and climatic variability pose a serious threat to socioeconomic and livelihood stability.

For temperature variations and global climate change, the main effects of the large rise in greenhouse gas concentrations caused by human activity particularly industrialization, fossil fuel consumption, changes in land use and land cover, and invading pests were considered. According to reports, India's mean annual temperature has increased by 0.6 oC over the past century. Over the last three decades of the twentieth

century, monsoon rainfall decreased in many parts of the country, but some regions have seen an increase in the observed frequency of heavy rainfall events. The Cauvery Delta Zone (CDZ) was selected for this study's analysis of current and future climatic trends and variability.

Study Region:

We mostly research these areas: Thanjavur is known as the state's rice bowl due to the quantity of alluvial soil and the most fertile stretch in the Cauvery basin. Thanjavur and Nagapattinam, which are in the Cauvery Delta Zone (CDZ), depend largely on canal irrigation for agricultural and are exposed to the whims of the monsoon.[1] Rajeevan M et al., (2008) - The current analysis lends support to the idea that the rising sea surface temperatures and surface latent heat flow over the tropical Indian Ocean may be related to the rising trend of extreme rainfall events over the past five decades.[2] Rajalakshmi D et al., (2015) - The maximum and minimum temperatures were represented spatially, and this revealed a clear rhythm of increase from the coastline to the inland areas. However, there was some variation in the predicted rainfall.

II. METHODOLOGY

The Indian Meteorological Department provided the historical data files (IMD). The study employed daily gridded rainfall data from 1951 to 2020 with a geographic resolution of 0.25 degrees and daily temperature data (maximum and minimum) from 1951 to 2020 with a spatial resolution of 1st degree. Future study on variability has looked at the maximum and minimum temperatures as well as precipitation using the IPCC AR5 RCP4.5 and RCP8.5 scenarios.

Three regional climate models (RCM), namely REMO (from MPI), RCA4 (from SMHI), and CCAM, were used in the research as the ensemble mean (from CSIRO). To reduce model-related uncertainty, the ensemble mean is used, and it has a climate that is more comparable to the observed climate than any one model and spatiotemporal distribution has been used.

$$k_h(r) = \frac{|W|}{n_k(n_k-1)} \sum_{i=1}^{n_h} \sum_{j=1, j \neq i}^{n_h} 1 \{ \{ |s_{ih} - s_{jh}| \leq r \} e_{i_h, j_h}(r) \}, \text{ where}$$

$\{ |s_{ih} - s_{jh}| \}$ - is the distance between the geolocation of two collected tweets at hour h, $|W|$ is the area of the city, n_h is the number of tweets at hour h.

III. RESULTS AND DISCUSSION

The long-term maximum and minimum temperature for Cauvery delta zone from 1951 to 2020. The average annual maximum temperature is 33.2oC. The pre-monsoon season (summer) has the greatest recorded maximum temperature (35.12 oC), while the winter has the lowest recorded maximum temperature (29.2 oC). The zone's typical minimum temperature is 24.47 oC. Both the mean annual lowest temperature and mean annual maximum temperature are rising in the Cauvery delta zone. Rainfall is a haphazard hydrological event that is unevenly distributed in time and space. Due to the disparity in monsoon reception, it is a crucial statistic for in-depth investigation. The Cauvery delta zone experienced an average annual rainfall of 1268.38 mm over a 70-year period, with a range of 544.7 mm to 2098 mm (1951- 2020).

The majority of the zone's annual rainfall roughly 64% comes from the post-monsoon months of October, November, and December. The yearly rainfall is divided into three categories: pre monsoon rainfall (March, April, and May), monsoon rainfall (June, July, August, and September), and winter rainfall (January and February). With 32 of the 62 wet days, the northeast monsoon has brought the most rain to the Cauvery delta region. [3] Yuvaraj RM (2016) - According to the study's findings, rainfall in the study region increases whenever the coefficient of continentality does, and vice versa.[4] Geetha R et al (2019) - Overall index results indicate that Tamil Nadu will experience excessive warming and precipitation by the 2080s (2065– 2095). Such data will serve as a foundation for research on future impact assessments on various sectors, assisting stakeholders and policymakers in developing effective adaptation and

mitigation strategies.[5] Pavithrapriya S et al (2022) - The study's findings will be helpful in developing the agriculture and water industries' climate change adaptation strategies for the Thanjavur delta region.

We mostly research about Thanjavur, Thiruvarur, Pudukottai, Cuddalore, Ariyalur, Tiruchirappalli and Nagapattinam.



Fig 1: Average annual maximum and minimum temperatures (1951 to 2020)

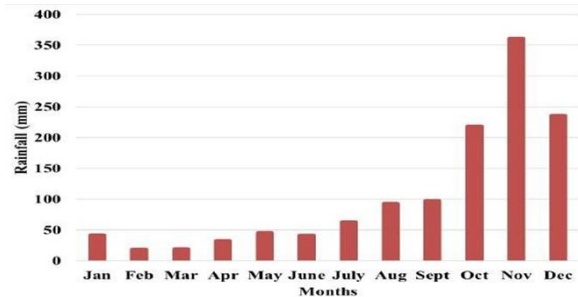
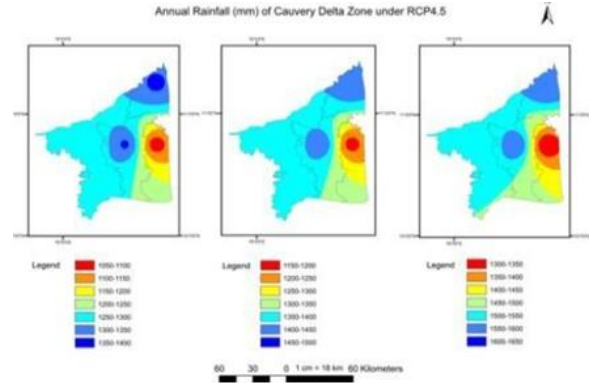


Fig2: Monthly rainfall distributions for Cauvery delta zone (1951-2020)

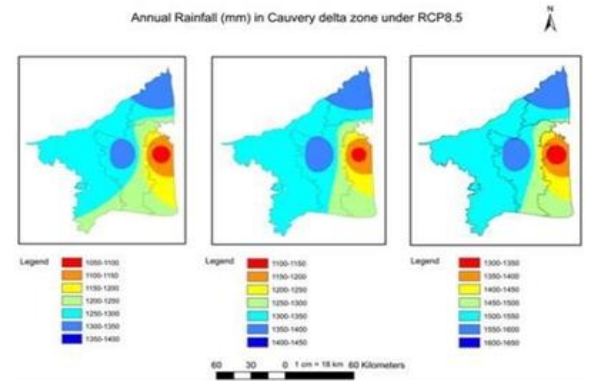
IV. FUTURE PROJECTIONS

According to climate projections for the Cauvery delta zone for the short, mid, and long-terms (2021-2050, 2050-2070, and 2071-2100) relative to the 1951-2020 baseline period, the annual mean maximum temperature could increase by up to 1.1°C to 3.6°C by the end of the century under the RCP4.5 and RCP8.5 scenarios. By the end of the century, these data are predicted to have changed by 1.8°C and 3.6°C, respectively, for RCP4.5 and RCP8.5. Seasonal fluctuations are more noticeable, with the increase being largest from March to May, which is the pre-monsoon season.

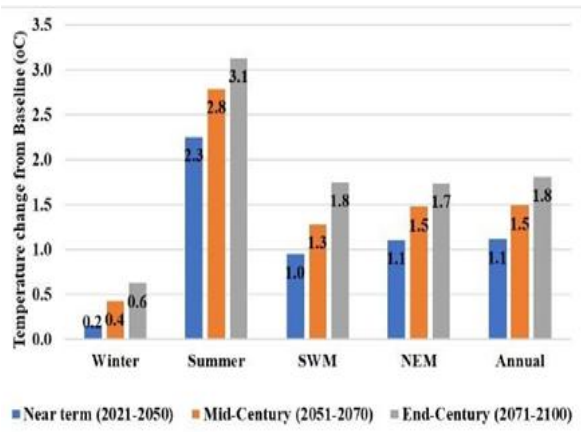
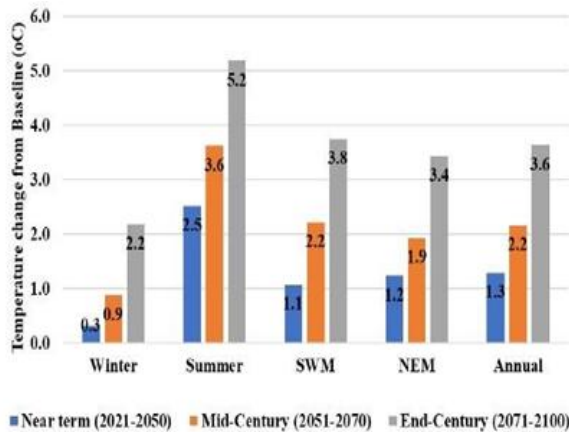
Changes in the minimum average yearly temperature are anticipated to be much more substantial. According to the RCP4.5 and 8.5 scenarios, the average minimum temperature in the zone by the end of the century is predicted to be between 2.8 and 4.5oC. Under the RCP8.5 scenario, average rainfall is projected to decrease slightly by 0.7 percent by mid-century and rise by 16.79 percent by end - century, while it is projected to increase marginally by 5.3 percent by mid-century and rise by approximately 15.78 percent by end-century in the Cauvery delta zone. By the Mid Century and End Century, in comparison to the baseline, rainfall is anticipated to decrease in the summer (pre- monsoon season) while increasing in the other seasons. predicted annual precipitation under RCP4.5 and RCP8.5



Annual rainfall(mm) projected under RCP 8.5



Annual rainfall(mm) projected under RCP4.5



Projected changes with respect to baseline (BL) in seasonal and annual maximum temperature under RCP4.5 (top) and RCP8.5 (bottom)

V. CONCLUSION

The average annual high and low temperatures were 33.2°C and 24.47°C, respectively. The Cauvery delta zone saw an average annual rainfall of 1268.38 mm, with the month of November recording the greatest amounts. The annual mean maximum temperature could increase by up to 3.1 to 5.2 oC during the summer season under RCP4.5 and RCP 8.5 scenarios, according to climate projections for the Cauvery delta zone for the short term (2021-2050), mid-century (2050-2070), and end-of-century (2071-2100) with respect to the base line period (1951-2020). While the annual mean lowest temperature might increase by up to 3.3 to 5.6°C during the North East monsoon, according to the RCP4.5 and RCP8.5 scenarios. Both the RCP4.5 and RCP8.5 scenarios predict an increase in heavy precipitation events by the end of the twenty-first century. As a result, in the future, studies should discuss both waters saving techniques and agricultural adaptation strategies for handling high precipitation risk.

ABBREVIATION

RCP – Representative Concentration Pathway
 IPCC – Intergovernmental Panel on Climate Change
 AR – Assessment Report.

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