

LIST OF FIGURES

Figure No.	Figure Title	Page No.
Figure 1.1	Global Annual Average Temperature Trends, 1880-2023, Baseline 1951-1980	2
Figure 1.2	Temperature Anomalies over Land and Ocean, 1880-2023, Baseline 1951-1980	4
Figure 1.3	Global Annual Rainfall: 30-Year Running Average from 1960 to 1990.	5
Figure 1.4	Annual Rainfall Anomaly Over Land Worldwide, Baseline: 1901-2000	6
Figure 1.5	Flowchart of the Methodology Adopted	16
Figure 2.1	Geographical Location of Gujarat and its adjacent States	22
Figure 2.2	Distinct Physiographic Regions of Gujarat	25
Figure 2.3	Average Annual Rainfall Distribution in Gujarat (1961-2020, mm)	28
Figure 2.4	Seasonal Distribution of Rainfall in Gujarat.	29
Figure 2.5	Average Temperature Distribution in Gujarat (1961-2020, °C).	30
Figure 2.6	Average Monthly Distribution of Rainfall and Temperature in Gujarat (1961-2020).	32
Figure 2.7	Forest Cover Distribution in Gujarat	33
Figure 2.8	Changes in Forest Cover of Gujarat Since 1991	33
Figure 2.9	Land Use and Land Cover Map of Gujarat (2015-16), Scale 1:250,000	34
Figure 2.10	Gujarat's Geomorphology Map, 2005 at 1:50,000 Scale Using Resourcesat-1 LISS-III.	35
Figure 2.11	River Network of Gujarat: Streams Ranked 4 th Order and Above.	36
Figure 2.12	Population Growth Trends in India Over Decades	37
Figure 2.13	Decadal Trends in Population Growth for Gujarat.	38
Figure 2.14	Population Density Trends in India and Gujarat Over Decades.	38
Figure 2.15	Trends in Sex Ratio and Child Sex Ratio in India and Gujarat Over Decades.	39
Figure 2.16	Decadal Changes in (a) Sex Ratio and (b) Child Sex Ratio for Gujarat.	40
Figure 2.17	Growth of Literacy Rates in Gujarat and India Over the Decades.	41
Figure 2.18	Gender Disparity in Literacy Rates Over Decades in Gujarat and India.	41
Figure 2.19	Changing Urban Demography of Gujarat and India over Decades	42
Figure 2.20	Female Literacy and Sex Ratio Across Urban and Rural Gujarat Over Decades	42
Figure 2.21	Age Group Distribution Across Rural and Urban Areas of Gujarat.	43
Figure 2.22	Gujarat's Contribution to India's GDP, 2019-20, and Employment Exchange Placements as a Percentage of Total Registrations in Gujarat, 2020.	44
Figure 2.23	Gujarat's Contribution to All-India Trade Exports, 2019-20, and Contribution to India's Industrial Output, 2019-20.	44

Figure 2.24	Crude Birth and Death Rates in Gujarat and India Across Decades	45
Figure 2.25	Life Expectancy at Birth in Gujarat and India overall	46
Figure 2.26	Proportion of Main and Marginal Workers in Gujarat's Workforce	47
Figure 2.27	Changes in Occupation Patterns Among Main Workers Over Decades in Gujarat	48
Figure 4.1	Average Monthly Distribution of Rainfall and Temperature (T_{\min} and T_{\max}) Across the Physiographic Regions of Gujarat (1961-2020).	79
Figure 4.2	Spatiotemporal Variability of Rainfall and Temperature (T_{\max} and T_{\min}) Across the Physiographic Regions of Gujarat.	81
Figure 4.3	Spatiotemporal Variations in (a) T_{\max} , (b) T_{\min} , and (c) Rainfall Across Gujarat's Physiographic Regions (1961-2020)	83
Figure 4.4	Annual Variability of Rainy Days Across the Physiographic Regions of Gujarat.	86
Figure 4.5	Decadal changes in Rainy Days Across the Physiographic Regions of Gujarat.	87
Figure 4.6	Spatiotemporal Distribution of Rainfall Anomalies Across Physiographic Regions	88
Figure 4.7	Regional Variability and Intensity Patterns of Rainfall Across Gujarat.	89
Figure 4.8	Analysis of SPCI Variability Among Gujarat's Physiographic Regions. Comparative Analysis of SPCI Values Across Distinct Regions of Gujarat.	91
Figure 4.9	Decadal Variations in SPCI Statistics Across Distinct Regions of Gujarat	92
Figure 4.10	Gujarat	
Figure 4.11	Frequency of Extreme Heat and Cold Events Across Physiographic Regions.	94
Figure 4.12	Analysis of DMI and ONI Trends (1961-2020).	95
Figure 4.13	Annual Variability of Rainfall Departures (%) and Temperature Anomalies ($^{\circ}\text{C}$) from Normal Levels in Gujarat (1961–2020)	97
Figure 4.14	Annual Rainfall Departure (%) from Normal Levels Across Gujarat's Physiographic Regions (1961–2020).	98
Figure 4.15	Annual Temperature Anomaly ($^{\circ}\text{C}$) from Normal Levels Across Gujarat's Physiographic Regions (1961–2020).	99
Figure 4.16	Impact of El Niño Phase Intensity on the Frequency of Extreme Heat Events in Gujarat (2011-2020)	101
Figure 5.1	Flowchart of the Methodology Adopted.	106
Figure 5.2	Sen's ITA Graph with Percentile Ranges.	109
Figure 5.3	Spatio-Temporal Analysis of Seasonal Rainfall, T_{\min} , and T_{\max} Trends Using the MK Test Across Physiographic Regions of Gujarat.	110

Figure 5.4	Spatio-Temporal Analysis of Seasonal Rainfall, T_{\min} , and T_{\max} Trends Using the ITA Test Across Physiographic Regions of Gujarat.	111
Figure 5.5	Spatio-Temporal Analysis of Seasonal Trend Magnitudes for Rainfall, T_{\min} , and T_{\max} Using SSE Across Physiographic Regions of Gujarat.	113
Figure 5.6	Comparative Analysis of SSE and ITA Slope Statistics Across Regions.	114
Figure 5.7	Spatio-Temporal Analysis of Monthly Rainfall Trends Identified by the MK Test.	116
Figure 5.8	Spatio-Temporal Analysis of Monthly Rainfall Trends Identified by the ITA Test.	116
Figure 5.9	Spatio-Temporal Variations in Monthly Rainfall Trend Magnitudes Using SSE Test.	118
Figure 5.10	Spatio-Temporal Analysis of Monthly T_{\min} Trends Identified by the MK Test.	119
Figure 5.11	Spatio-Temporal Analysis of Monthly T_{\min} Trends Identified by the ITA Test	119
Figure 5.12	Spatio-Temporal Variations in Monthly T_{\min} Trend Magnitudes Using SSE Test.	121
Figure 5.13	Spatio-Temporal Analysis of Monthly T_{\max} Trends Identified by the MK Test.	122
Figure 5.14	Spatio-Temporal Analysis of Monthly T_{\max} Trends Identified by the ITA Test.	122
Figure 5.15	Spatio-Temporal Variations in Monthly T_{\max} Trend Magnitudes Using SSE Test.	124
Figure 5.16	Annual Assessment of Heat Event Trends Using the MK Test.	125
Figure 5.17	Annual Assessment of Cold Event Trends Using the MK Test.	127
Figure 5.18	Frequency Assessment of Rainy Days on a Seasonal Scale Using the MK Test.	129
Figure 5.19	Frequency Assessment of Rainy Days on an Annual Scale Using the MK Test.	129
Figure 5.20	Annual Assessment of Trends in Rainfall Intensity Events Using the MK Test.	131
Figure 6.1	Flowchart of the Methodology Adopted.	136
Figure 6.2	ACF and PACF Plots of Annual Rainfall Across Physiographic Regions of Gujarat: Comparative Analysis Before and After First-Order Differencing.	141
Figure 6.3	ACF and PACF Plots of Annual T_{\max} Across Physiographic Regions of Gujarat: Comparative Analysis Before and After First-Order Differencing.	142

Figure 6.4	ACF and PACF Plots of Annual T _{min} Across Physiographic Regions of Gujarat: Comparative Analysis Before and After First-Order Differencing.	143
Figure 6.5	Mean Monthly Rainfall Forecasts (2021-2050) and Deviations from Observed Averages Across Gujarat's Physiographic Regions: Projected Variability in Rainfall Patterns.	147
Figure 6.6	Mean Monthly T _{max} Forecasts (2021-2050) and Deviations from Observed Averages Across Gujarat's Physiographic Regions: Projected Variability in T _{max} Patterns.	148
Figure 6.7	Mean Monthly T _{min} Forecasts (2021-2050) and Deviations from Observed Averages Across Gujarat's Physiographic Regions: Projected Variability in T _{min} Patterns.	149
Figure 6.8	Comparative Analysis of Mean Monthly Differences in Forecasted and Observed for Rainfall, T _{max} , and T _{min} Across Physiographic Regions of Gujarat.	150
Figure 6.9	Average Annual Rainfall for Observed and Forecasted Periods Across Regions.	152
Figure 6.10	Average Annual Temperature Anomalies Compared to the 1961-2020 Observed Mean.	154
Figure 6.11	Annual Cycle of Observed and Forecasted PET and Mean Monthly Differences Between Forecasted and Observed PET Across Physiographic Regions of Gujarat.	155
Figure 6.12	Projected Water Balance (2021-2050) Across Physiographic Regions of Gujarat.: Assessment of Potential Surpluses and Deficits.	157
Figure 6.13	Mean Monthly Water Balance Forecast (2021-2050) for Gujarat's Physiographic Regions: Analysis of Water Surpluses and Deficits.	158
Figure 6.14	Decadal Changes in Projected Water Balance Across Physiographic Regions of Gujarat: Mean Monthly Analysis of Surpluses and Deficits	159
Figure 7.1	Comparison of Average Annual Rainfall, and Mean Monthly Rainfall Between Observed and Forecasted Periods Across Gujarat's Physiographic Regions.	164
Figure 7.2	Comparative Analysis of Average Annual T _{max} and T _{min} Between Observed and Forecasted Periods Across Gujarat's Physiographic Regions.	165