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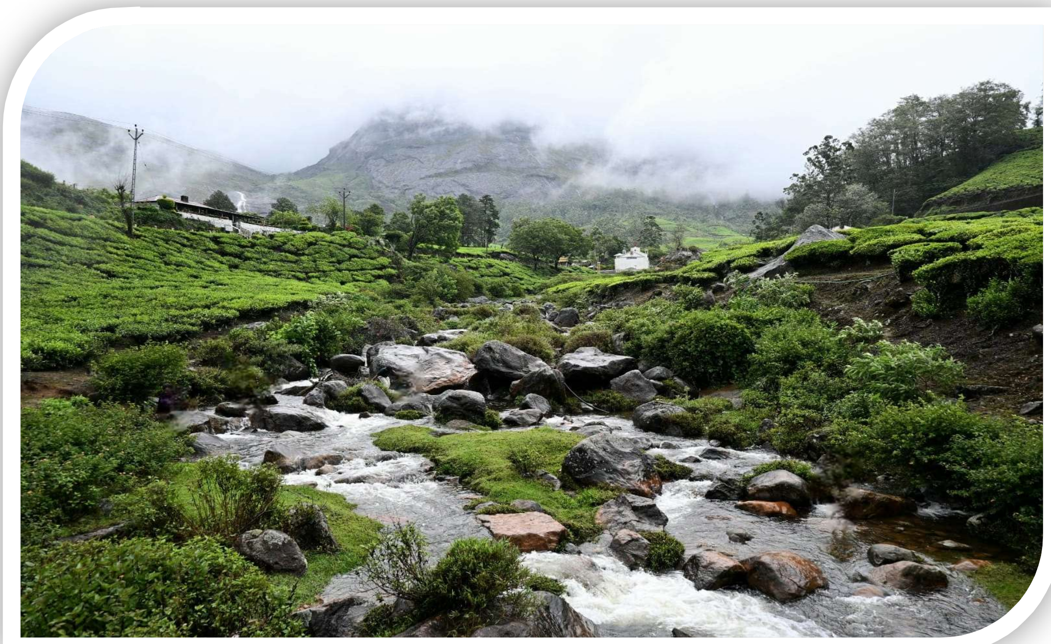
National River Conservation Directorate
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

Climatologic Data Status of Periyar River Basin



March 2025

cPeriyar

IIT PALAKKAD

cGanga

Climatologic Data Status of Periyar River Basin

National River Conservation Directorate (NRCD)

The National River Conservation Directorate, functioning under the Department of Water Resources, River Development & Ganga Rejuvenation, and Ministry of Jal Shakti providing financial assistance to the State Government for conservation of rivers under the Centrally Sponsored Schemes of 'National River Conservation Plan (NRCP)'. National River Conservation Plan to the State Governments/ local bodies to set up infrastructure for pollution abatement of rivers in identified polluted river stretches based on proposals received from the State Governments/ local bodies.

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Centres for Periyar River Basin Management and Studies (cPeriyar)

The Center for Periyar River Basin Management and Studies (cPeriyar) is a Brain Trust dedicated to River Science and River Basin Management. Established in 2024 by IIT Palakkad and NIT Calicut, under the supervision of cGanga at IIT Kanpur, the center serves as a knowledge wing of the National River Conservation Directorate (NRCD). cPeriyar is committed to restoring and conserving the Periyar River and its resources through the collation of information and knowledge, research and development, planning, monitoring, education, advocacy, and stakeholder engagement.

www.cPeriyar.org

Centres for Ganga River Basin Management and Studies (cGanga)

cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this, it is also responsible for introducing new technologies, innovations, and solutions into India.

www.cganga.org

Acknowledgment

This report is a comprehensive outcome of the project jointly executed by IIT Palakkad (Lead Institute) and NIT Calicut (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRCD) in 2024. We gratefully acknowledge the individuals who provided information and photographs for this report.

Disclaimer

This report is a preliminary version prepared as part of the ongoing Condition Assessment and Management Plan (CAMP) project. The analyses, interpretations and data presented in the report are subject to further validation and revision. Certain datasets or assessments may contain provisional or incomplete information, which will be updated and refined in the final version of the report after comprehensive review and verification.

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List of Abbreviations

PRB	Periyar River Basin
IMD	Indian Meteorological Department
CMIP6	Coupled Model Intercomparison Project-6
DSP	Data Supply Portal
SPEI	Standardized Precipitation Evapotranspiration Index
GCM	Global Climate Models
SSP	Shared Socioeconomic Pathway
MK	Mann–Kendall
CWS	Crop Weather Station
SWM	Southwest Monsoon
NEM	Northeast Monsoon
GDD	Growing Degree Days

CLIMATOLOGIC DATA COLLECTION

1. Introduction

Climatological data forms the fundamental basis for understanding hydroclimatic variability, trend analysis, and extreme event assessment over a river basin. Reliable and long-term climatic observations are essential for evaluating changes in rainfall patterns, temperature variability, drought occurrence, and flood susceptibility. In this study, multiple climatic datasets, including precipitation, temperature, and drought indices, were collected from reliable resources.

2. Applications of climatological data

2.1 Rainfall data

The rainfall data has a wide range of applications in areas like environmental, agricultural, and hydrological applications also play a critical role in understanding the Earth's hydrological and atmospheric systems. Used in the analysis of long-term precipitation trends to assess regional and global climate variability and change. Rainfall records contribute to the development of drought and flood indices for monitoring and assessing the conditions. They also aid in the calibration and validation of climate models. It can be considered as the major input for flood forecasting and early warning systems. In water resource management, rainfall data support the planning and operation of reservoirs, irrigation systems, and groundwater recharge estimation.

2.2 Temperature data

Analysing long-term trends in temperature helps to identify global warming and regional climate shifts. Daily maximum temperature data are used to define and monitor heatwaves and their intensities. In agriculture, temperature data support the estimation of Growing Degree Days (GDD), crop suitability assessments. In hydrology, temperature influences evaporation, snowmelt, and runoff, making it important for water resource modeling. By integrating temperature data with other meteorological variables, it helps to generate climate indices, validate climate models, and develop accurate forecasts and early warning systems, thereby supporting informed decision-making in climate adaptation and mitigation strategies.

2.3 Evaporation and Relative Humidity

Evaporation and relative humidity are critical parameters in understanding the Earth's hydrological and atmospheric processes. These variables are important to assessing water loss from surfaces, plant-water relations, and the moisture content of the atmosphere. These datasets can be used to estimate evapotranspiration, which is used for hydrological modeling, irrigation scheduling, and agricultural planning.

2.4 Wind Velocity

Wind velocity, which consists of both wind speed and direction, is a crucial meteorological parameter in climate studies and environmental monitoring. In climate modeling, wind data is essential for understanding energy transfer, evaporation rates, and atmospheric mixing processes. Wind velocity is also critical in estimating potential evapotranspiration, which influences drought assessment and water resource management.

2.5 Sunshine duration and weather phenomenon

Sunshine duration data reflect the amount of solar radiation received at a location, which directly affects surface temperature, evaporation, and photosynthetic activity. Observed weather phenomena (eg, rain, fog, thunderstorms, hail, dust storms) provide direct insights into short-term climate variability and help in developing early warning systems for extreme events. These observations are critical for validating weather forecasts and understanding seasonal patterns in a region.

3. Data sources

Table 1 summarizes the types of climatic data and their corresponding sources utilized in the present study.

Table 1. Data types and sources

Sl No.	Type of Data	Source of Data
1	Historical Climate Data	Indian Meteorological Department (IMD)
2	GCM Data	Bias-corrected climate projections for South Asia from Coupled Model Intercomparison Project-6 (CMIP6) *Reference:* Mishra, V., Bhatia, U., & Tiwari, A. D. (2020). *Bias-corrected climate projections for South Asia from Coupled Model Intercomparison Project-6*. Scientific Data, 7, 338. https://doi.org/10.1038/s41597-020-00681-1

4. Historical climate data collection

Historical daily and hourly climate data collected from the IMD Data DSP, which provides access to station-level meteorological observations. The data were obtained for multiple observatory stations within and around the Periyar River Basin (PRB).

Data types available at IMD DSP are listed below.

1. Rainfall
2. Surface
3. Autographic
4. Agromet
5. Upper Air
6. Radiation

The dataset spans multiple decades, with daily records available from the early 1900s and hourly data for recent years (depending on station and parameter).

4.1 Names of IMD stations in the PRB

The Indian Meteorological Department (IMD) maintains a network of meteorological observatories across India. Among these, the stations located within and around the PRB were selected for data collection. Table 2 presents the details of these IMD stations, including district, station name, station number, and geographic coordinates (latitude and longitude) from which the data were primarily obtained.

Table 2. Location details of IMD stations in PRB

Sl No.	District	Station Name	Station Number	Latitude	Longitude
1	Ernakulam	Cochin International Airport (CIAL)	43336	10.15	76.4
		Alwaye pwd	101107603	10.1167	76.35
		CIAL Kochi (obsy)	101107653	10.15	76.40
		Ernakulam	101097623	9.98	76.28
		Kochi fort (obsy)	101097631	9.97	76.23
		Malayattur	101107601	10.20	76.52
		Muvattupuzha	101097603	9.97	76.58
		NAS Kochi (obsy)	101097627	9.95	76.27

		Neriamangalam	101107620	10.05	76.77
		Parur	101107602	10.15	76.21
		Perumpavur	101107619	10.12	76.48
		Piravam	101097639	9.8	76.47
		Kochi NAS	43353	9.96	76.23
2	Idukki	Chinnar	101097714	9.87	77.10
		Devikulam	101107712	10.07	77.10
		Idukki	101097641	9.83	76.92
		Karikode	101097625	9.83	76.6667
		Kumily	101097719	9.58	77.17
		Marayur	302107711	10.27	77.15
		Munnar (kseb)	101107717	10.10	77.07
		Myladumpara agri	101097745	9.13	77.03
		Peermade (to)	101097630	9.57	76.98
		Thodupuzha	101097642	9.82	76.67
		Vandanmettu	101097718	9.72	77.13
		Velloor	101097632	9.90	76.83
		Mayiladumpara	43396	9.13	77.03
3	Thrissur	Vellanikara	43357	10.53	76.28
		Vellanikara (CWS station)	43398	10.52	76.22
4	Pathanamthitta	Adur	101097618	9.15	76.73
		Konni	101097616	9.22	76.85
		Kurudamannil	101097646	9.33	76.73
		Pathanamthitta	101097614	96.27	76.77
5	Coimbatore (Tamil Nadu)	Coimbatore	A-43321	11.03	77.05
		Coimbatore	43319	--	--
		Valparai	43341	10.28	77
6	Kottayam	Kottayam	43335	9.53	76.6

Figure 1 illustrates the spatial distribution of IMD stations within and around the PRB.

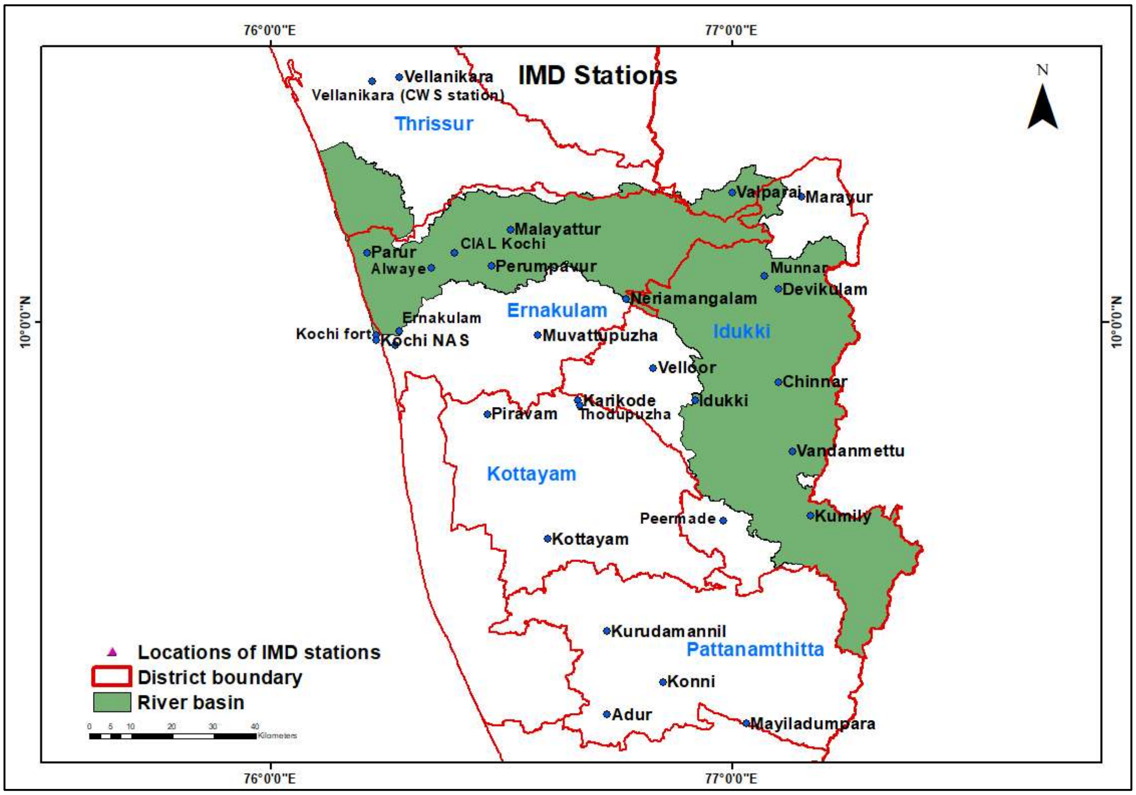


Figure 1. Locations of IMD stations in PRB

4.2 IMD Rainfall data details

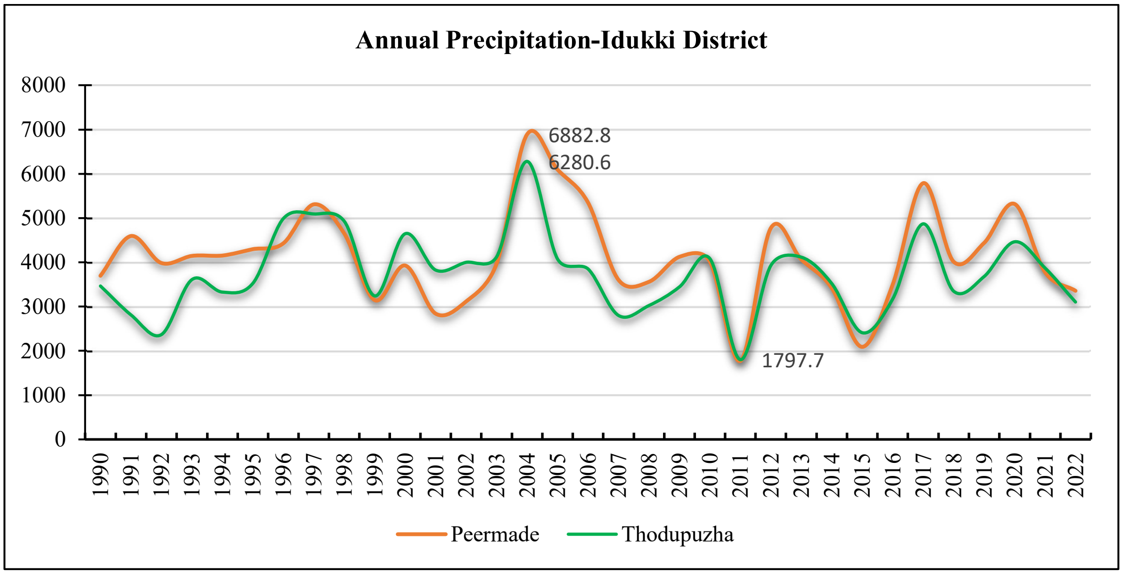
Table 3 presents the details of rainfall data collected from IMD stations. The dataset includes both daily and hourly rainfall records, with long-term observations extending from as early as 1905 to 2023, depending on the station.

Table 3. IMD Rainfall data details

Data	District	Station	Available Year	Frequency	Unit	Accessed Date
Rainfall	Ernakulam	Alwaye pwd [101107603]	1990-2023	Daily	mm	19/09/2024
		Cial kochi (obsy) [101107653]	2000-2023			
		Ernakulam [101097623]	2013-2023			
		Kochi fort (obsy)[101097631]	1996, 2009, 2010			
		Malayattur [101107601]	Data Unavailable			
		Muvattupuzha [101097603]	Data Unavailable			
		Nas kochi (obsy) [101097627]	1990-2023			
		Neriamangalam [101107620]	2023			
		Parur [101107602]	1990-2000, 2005, 2009, 2023			
		Perumpavur [101107619]	1990-2023			
		Piravam [101097639]	1990-2023			
		Kochi NAS – 43353 (Autographic)	1969-2015	Hourly	mm	22/10/2024
		CIAL – 43336 (Autographic)	2006-2020			
	Idukki	Chinnar [101097714]	1908-1985	Daily	mm	13/09/2024

		Devikulam [101107712]	1905-2005			
		Idukki [101097641]	1990-2023			
		Karikode [101097625]	1901-1989			
		Kumily [101097719],	1908-1983			
		Marayur [302107711]	1916-1988			
		Munnar (kseb) [101107717]	1916-2023			
		Myladumparaagri [101097745]	2013-2023			
		Peermade (to) [101097630]	1901-2023			
		Thodupuzha [101097642]	1991-2023			
		Vandanmettu [101097718]	1929-1987			
		Velloor [101097632]	1952-1983			
	Pathanamthitta	Adur [101097618]	1901-1999	Daily	mm	10-08-2024
		Konni [101097616]	1905-2023			
		Kurudamannil [101097646]	2013-2023			
		Pathanamthitta [101097614]	1905-1986			
		Thiruvalla [101097612]	1901-2013			
	Coimbatore	Valparai-43341 (Autographic)	2010, 2012	Hourly	mm	22/10/2024
		Coimbatore-43321 (Autographic)	1969-2023			

- Daily precipitation records from four stations in Idukki district were used to analyze and plot the annual precipitation trends in the river basin for the period 1990–2023.



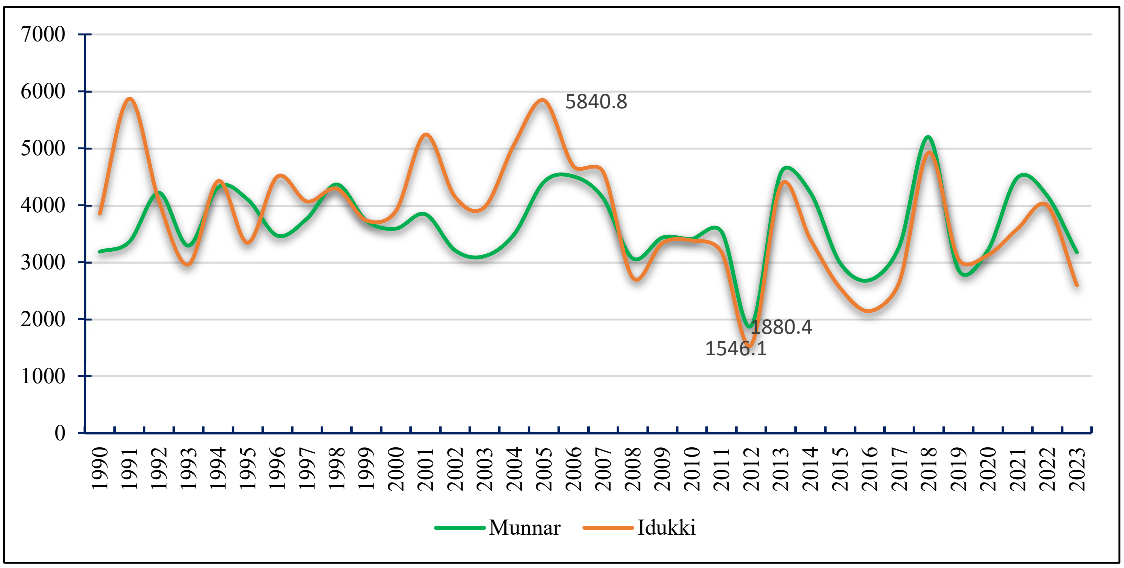


Fig. 2 Annual precipitation graph of Idukki district

- All four stations exhibit large year-to-year variations.
- In the early period, most stations recorded higher and more consistent rainfall.
- All stations showed a noticeable reduction in annual rainfall during 2006 -2015, with the lowest rainfall recorded during 2012.
- From 2015 to 2023, the fluctuation is greater. All four stations in Idukki district show a clear pattern of moderate rainfall in 2015–2016, followed by a sharp increase in 2017–2018, with 2018 emerging as one of the wettest years across the region.

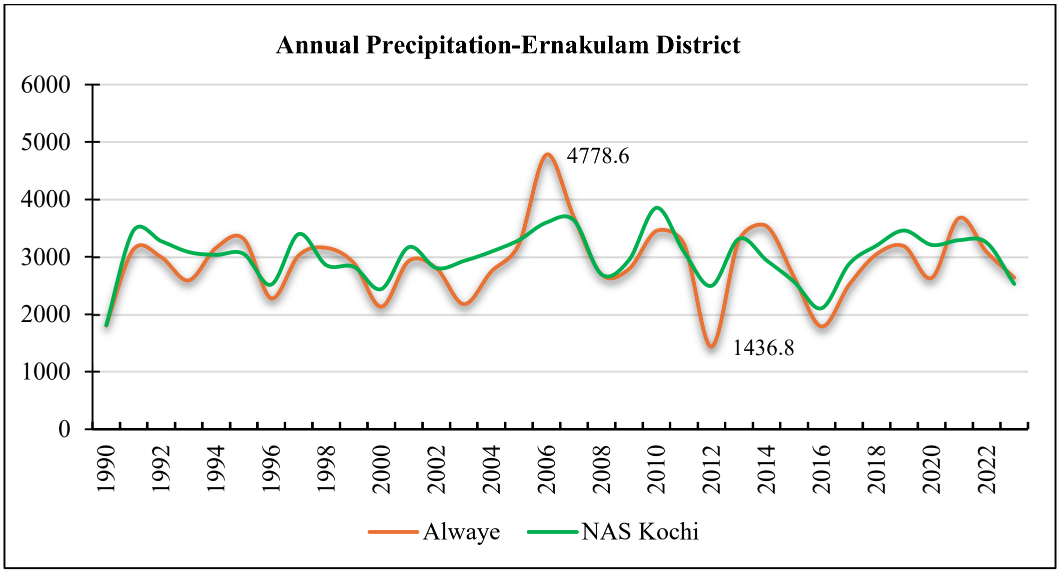


Fig. 3 Annual precipitation graph of Ernakulam district

- The annual rainfall exhibits high inter-annual variability, indicating strong year-to-year fluctuations in monsoon intensity.
- Both stations are located close to the Periyar discharge region along the Arabian Sea coast and therefore reflect similar coastal monsoon influences.
- The extreme peak in 2005 represents the highest recorded rainfall in the dataset, showing a sharp positive anomaly when compared to the surrounding years.
- The significant drop in 2012 highlights a drought-like condition, where both stations recorded substantially lower rainfall than the long-term average.

4.3 IMD Surface data details

IMD Surface Data refers to the meteorological observations recorded at the Earth's surface by observatory stations. This dataset comprises parameters including minimum and maximum temperature, rainfall, sunshine duration, evaporation, and weather phenomena.

Table 4. IMD Surface data details

Data Type	District	Station	Available Year	Unit	Accessed Date
Surface: 1. Minimum Temperature 2. Maximum Temperature 3. Rainfall 4. Sunshine duration 5. Evaporation 6. Weather phenomenon	Ernakulam	CIAL-43336	2004 2006-2024	Temperature- °C(Daily) Rainfall- mm (Hourly) Sunshine duration (Hourly) Evaporation-mm (Hours)	13/09/2024
	Thrissur	Vellanikara-43357	2001-2024		
	Coimbatore	Coimbatore A-43321	1969-2024		
		Coimbatore-43319	1969-1991		
		Valparai-43341	2004-2023		
	Kottayam	Kottayam-43355	1970-2024		

4.4 IMD Autographic data details

IMD autographic data consists of high-resolution, continuous records obtained from self-recording meteorological instruments such as hygrographs, thermographs, and anemographs. Table 5 provides valuable points on the details of the autographic dataset.

Table 5. IMD Autographic data details

Data Type	District	Station	Available Year	Frequency	Unit	Accessed Date
Relative Humidity (Hygrograph)	Ernakulam	NAS-43353	1969, 1972-2013	Hourly	%	29-04-2024
		CIAL-43336	2006, 2009-2020	Hourly	%	10-01-2024
Temperature (Thermograph)	Ernakulam	NAS-43353	1969, 1970, 1987, 2002-2011	Hourly	°C	10-01-2024
		CIAL-43336	2000, 2007-2020	Hourly	°C	10-01-2024

Wind	Ernakulam	NAS-43353	1990-1997	Hourly	kmph &In 16 points of compass of compass code	10-01-2024
Marine: RH, Wind, Cloud	For the River Basin		1990-2023	IMMT1 Format		25-09-2024

4.5 IMD Agromet data details

The IMD Agrometeorological (Agromet) data consist of climate variables specifically observed for agricultural and land–atmosphere interaction studies. As shown in Table 6, Agromet Crop Weather Station (CWS) data were collected from stations located in Idukki, Kottayam, Thrissur, and Coimbatore.

Table 6. IMD Agromet data details

Data Type	District	Station	Available Year	Frequency	Unit	Accessed Date
Agromet - CWS: Vapor pressure, Relative Humidity, Wind velocity and direction, Sunshine hours, Evaporation	Idukki	Mayiladumpara-43396	2003-2014	Daily	Vapor pressure of Hg Relative Humidity-% Wind velocity and direction- kmph & 16 points of compass Sunshine hours-Hours Evaporation-mm	24/04/2024
	Kottayam	Kumarakom-43251	2017-2022			
		Kottayam-43394	1969-2022			
	Thrissur	Vellanikara-43398	1991-2022			
	Coimbator e	Coimbatore-43265	1948-1972, 1981-2022			
Agromet - SM: Rainfall, Evaporation, Relative Humidity, Temperature (Max, Min, Mean)	Thrissur	Vellanikara-43398	1991-2013	Daily	Raunfall-mm Evaporation-mm Relative Humidity-% Temperature (Max, Min, Mean)-°C	27/09/2024

4.6 IMD Upper air data details

Upper air meteorological data provide valuable information on the vertical structure of the atmosphere, which is essential for understanding large scale wind circulation, atmospheric stability, and weather system development. In this study, Pilot Balloon (PIBAL) data were downloaded for the Kochi NAS station (43353), located in Ernakulam district.

- Pilot Balloon data for the station, Kochi NAS – 43353 – Ernakulam District, is downloaded.
- **Parameters Available:** Wind direction in degrees east of north.
  Wind Speed in Whole meters per second.
- **Available Year:** 1956-1958, 1963-2012
- **Frequency:** Daily
- **Accessed Date:** 24/0/2024

5. Projected climate data collection

The future climate projections were acquired from bias-corrected Global Climate Model (GCM) outputs under the Coupled Model Intercomparison Project Phase 6 (CMIP6). These datasets, developed specifically for South Asia by Mishra et al. (2020), are statistically bias-corrected to improve consistency with observed climatic conditions. The CMIP6 projections provide high-resolution future climate under different emission scenarios.

Reference: Mishra, V., Bhatia, U. & Tiwari, A.D. Bias-corrected climate projections for South Asia from Coupled Model Intercomparison Project-6. *Sci Data* 7, 338 (2020).

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CMIP6 GCMs that are used for bias-corrected projections and their resolution details are given in Table 7.

Table 7. Names and resolution details of models used.

S. No.	Model name	Latitude resolution (degree)	Longitude resolution (degree)
1	ACCESS-CM2	1.25	1.875
2	ACCESS-ESM1-5	1.25	1.875
3	BCC-CSM2-MR	1.1215	1.125
4	CanESM5	2.7906	2.8125
5	EC-Earth3	0.7018	0.703125
6	EC-Earth3-Veg	0.7018	0.703125
7	INM-CM4-8	1.5	2
8	INM-CM5-0	1.5	2
9	MPI-ESM1-2-HR	0.9351	0.9375
10	MPI-ESM1-2-LR	1.8653	1.875
11	MRI-ESM2-0	1.1215	1.125
12	NorESM2-LM	1.8947	2.5
13	NorESM2-MM	0.9424	1.25

- **Scenarios:** Historical, SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5
- **Variables:** 1. Daily Precipitation
  2. Maximum Temperature
  3. Minimum Temperature
- **Resolution:** 0.25^0 x 0.25^0
- **Time Period:** Historic: 1951-2014
  Projected: 2015-2100
- Basin Coverage: The dataset covers 18 major Indian sub-continental river basins, with the Periyar River Basin included under the South Coast region.
- The location details of grid points inside and near the basin are given below.

The bias-corrected CMIP6 dataset used in this study includes simulations under one historical scenario and four future Shared Socioeconomic Pathway (SSP) scenarios, namely SSP1–2.6, SSP2–4.5, SSP3–7.0, and SSP5–8.5. These scenarios represent a wide range of future greenhouse gas emissions, from low-emission sustainable development pathways to very high-emission fossil-fuel–driven growth scenarios. Three primary climatic variables - daily precipitation, maximum temperature, and minimum temperature were extracted from the dataset. The historical period spans from 1951 to 2014, while the future projection period extends from 2015 to 2100. The dataset spatially covers 18 major river basins of the Indian subcontinent, with the PRB included under the South Coast region. For the present study, grid points located within and near the PRB were extracted to ensure an accurate representation of basin-scale climatic variability. The geographic coordinates of the selected grid points for the analysis are presented in Table 8.

Table 8. Location of climate model grid points in PRB

Sl no.	Latitude	Longitude
1	10.125	76.375
2	10.125	76.625
3	10.125	76.875
4	10.125	77.125
5	9.875	77.125
6	9.625	77.125
7	9.625	77.375
8	9.375	77.375
9	9.625	76.875
10	9.875	76.875

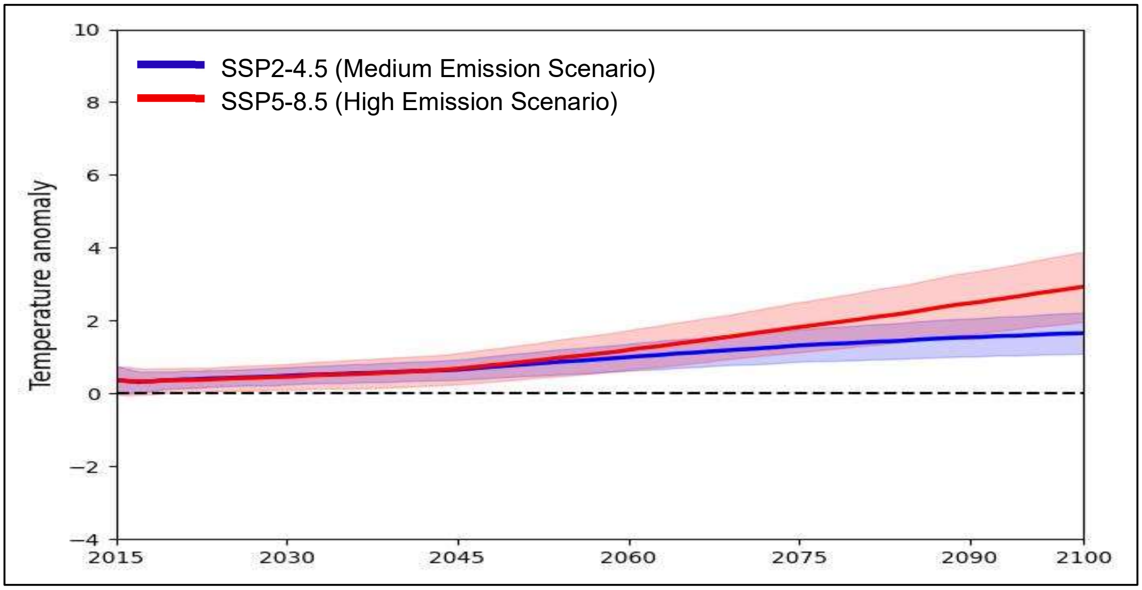

Fig.4 Temperature anomaly

- The graph shows a consistent and steady increase in temperature anomalies from 2015 to 2100, indicating a clear long-term warming signal regardless of scenario.
- Up to 2045, both scenarios track closely, but the divergence becomes increasingly significant afterward, with the high-emission pathway warming much faster.
- Both scenarios stay well above the baseline throughout the projection, emphasizing an irreversible shift from historical climate conditions.

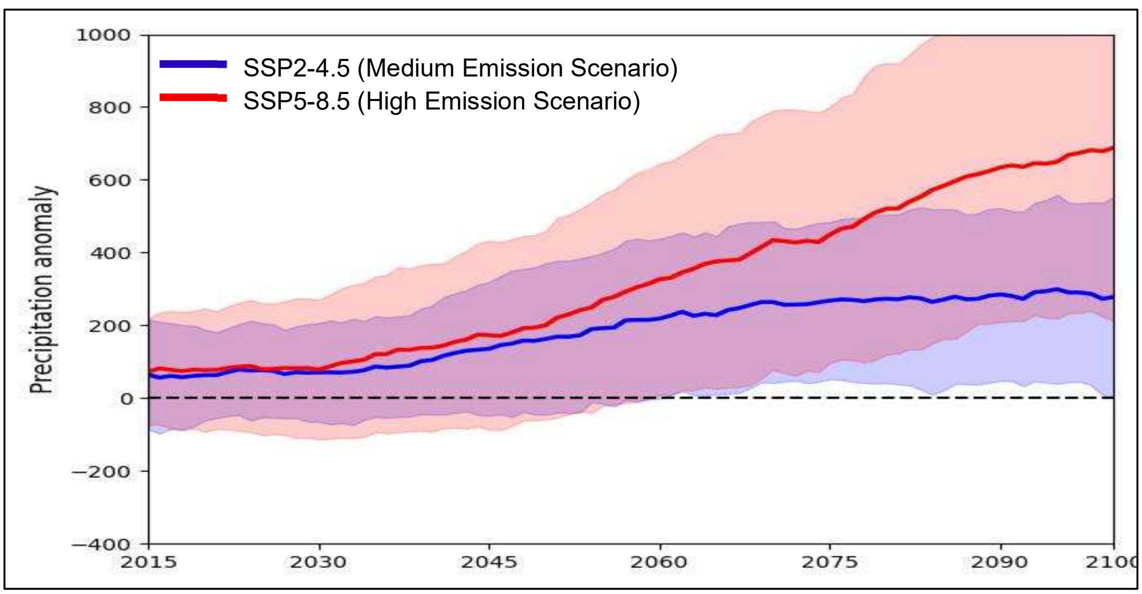

Figure 5. Precipitation Anomaly

- The figure shows a strong upward trend in precipitation anomalies from 2015 to 2100, indicating a shift toward wetter future conditions under both climate scenarios.

- The high-emission scenario (red line) exhibits a much faster and stronger increase in precipitation, reaching anomalies above 600–700 mm by the end of the century.
- The low-emission scenario (blue line) remains lower, rising slowly toward 250–300 mm.
- Both scenarios move well above this baseline, illustrating the shift towards wetter climatic conditions relative to the past.

5.1 Uncertainties in using GCM data

GCMs developed in various regions across the world are widely used for future climate conditions. These are crucial to understanding the potential impacts of climate change and for mitigation. Although the GCMs simulate the physical processes of the climate system, their results can carry significant uncertainty. These uncertainties are due to limitations in accurately representing the complex climate system, unknown greenhouse gas emission scenarios and initial conditions, and downscaling methods (Woldemeskel et al., 2014). So, there is a need for real time measurements which give up-to-date information about the climate and weather at the moment of recording and help to improve validation and calibration, enhancing accuracy.

6. Drought data

The PRB, draining the southern Western Ghats, has recently been subjected to severe drought (2016) and devastating flood (2018); each leading to huge economic and ecological loss (Saranya et al., 2020). The spatial distribution of monsoon rainfall directly influences river discharge, reservoir storage, groundwater recharge, agricultural productivity, and drinking water supply.

In this study, drought conditions over the PRB are quantified using the Standardized Precipitation Evapotranspiration Index (SPEI). SPEI incorporates both precipitation and potential evapotranspiration to evaluate moisture deficits. The latitude and longitude coordinates of the SPEI grid points are presented in Table 8 (Varghese & Mitra, 2025).

Table 9. Spatial location of SPEI grid points

Location	Latitude	Longitude	Location	Latitude	Longitude
1	10.46	76.49	15	9.96	77.49
2	10.46	76.74	16	9.71	76.49
3	10.46	76.99	17	9.71	76.74
4	10.46	77.24	18	9.71	76.99
5	10.46	77.49	19	9.71	77.24
6	10.21	76.49	20	9.71	77.49
7	10.21	76.74	21	9.46	76.49
8	10.21	76.99	22	9.46	76.74
9	10.21	77.24	23	9.46	76.99
10	10.21	77.49	24	9.46	77.24
11	9.96	76.49	25	9.46	77.49
12	9.96	76.74	26	9.21	76.99
13	9.96	76.99	27	9.21	77.24
14	9.96	77.24	28	9.21	77.49

To examine the long-term trend in drought characteristics over the Periyar River Basin, the non-parametric Mann–Kendall (MK) trend test was applied to SPEI time series at 28 spatial locations distributed across the basin. The magnitude of the identified trend was further quantified using Sen's slope estimator. Figure 6 represents the spatial distribution of SPEI trends over the PRB based on the Mann-Kendall test and Sen's slope analysis. The size of the circles represents the magnitude of the Sen's slope, indicating the rate of change in SPEI across the basin.

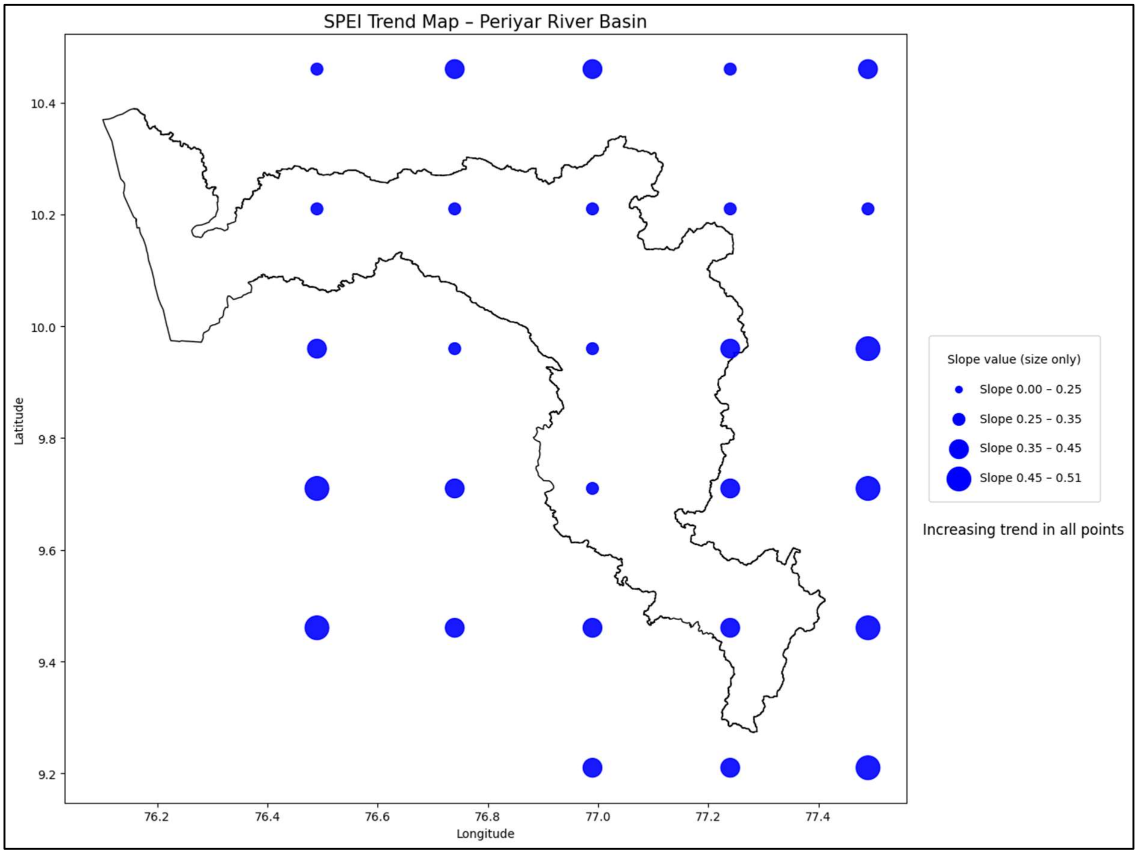

Figure 6. SPEI Trend map of PRB

The MK test results indicate a statistically significant increasing trend in SPEI at all 28 locations across the basin. The corresponding p-values are approximately zero ($p \approx 0$) for all locations, further confirming that the observed trends are not due to random variability. The Sen's slope values range between 0.30 and 0.51, indicating a moderate to strong rate of change in SPEI across the basin. An increasing trend in SPEI generally indicates a shift toward wetter conditions over time. The basin-wide positive SPEI trend reveals increasing hydroclimatic variability.

7. Historic climatic extreme events in PRB

The historic climate events in PRB, mainly in the form of severe droughts and devastating floods, have caused major disruptions to water resources, agriculture, infrastructure, ecosystems, and livelihoods. Although the PRB lies in a high-rainfall region, it has witnessed several moderate to severe droughts due to prolonged monsoon failures.

- **2016 Drought**: One of the most intense droughts in the PRB marked by widespread rainfall deficiency and severe water scarcity, with a 34% reduction in Southwest

Monsoon (SWM) rainfall and a 32% reduction in Northeast Monsoon (NEM) rainfall (Saranya et al., 2020).

- **2018 Drought:** The PRB experienced severe drought conditions soon after the extreme flood event of 2018 (KSDMA, 2018).

Figure 7. Periyar riverbed at Neriamangalam - 2018 September

- The condition of the Periyar riverbed is shown in Figure 7 during the drought-impacted September, whereas only three months earlier, the river had overflowed its banks by nearly 500 m, highlighting the contrasting condition.
- **2024 Drought:** Kerala experienced the worst drought conditions in the past 40 years, during which the temperature in Idukki rose to 33°C, the highest ever recorded in its history.

Figure 8. Idukki reservoir with 37% storage – May 2024

- **1924 Great Flood of Kerala:** The most catastrophic flood in the recorded history of the state. Extreme rainfall triggered massive landslides, river overflows, and the destruction of infrastructure across the Periyar Basin. The event lasted three weeks, and even the high-altitude Munnar town was completely flooded. Munnar received 485 mm of rainfall.
- **2018 Extreme Flood**: In August 2018, the state of Kerala witnessed large-scale flooding, which affected millions of people and caused 400 or more deaths. Extreme rainfall and almost full reservoirs resulted in a significant release of water in a short span of time (Mishra et al., 2018).

Figure 9. 2018 Flooding in Periyar River

- **2019 Flood:** A mesoscale mini cloudburst event occurred over Kerala on August 8, 2019, that caused the minor flood of 2019 (Vijaykumar et al. 2021). This year water level was seen rising in the Periyar river due to the rainfall in Ernakulam district, which led to opening of shutters of the Bhoothathankettu barrage after the release of water from Idamalayar dam (KSDMA, 2019).

8. Summary

This report presents a comprehensive assessment of the climatic data availability, sources, applications, and climatic extremes of the PRB. The study compiles both historical observed datasets and future climate projections to support climate variability, drought, and extreme event analysis. Historical climate data were collected primarily from the Indian Meteorological Department (IMD) Data Supply Portal (DSP). Multiple types of IMD datasets—rainfall, surface, autographic, agromet, and upper-air data—were compiled from stations located both within and near the Periyar River Basin, covering parts of Ernakulam, Idukki, Thrissur, Pathanamthitta, Kottayam, and Coimbatore districts. Several stations contain records extending back to the early 1900s, enabling long-term climate trend analysis. For future climate assessment, the study uses bias-corrected CMIP6 climate projections developed by Mishra et al. (2020). The dataset includes five scenarios (Historical, SSP1–2.6, SSP2–4.5, SSP3–7.0, SSP5–8.5), at a 0.25° × 0.25° resolution, covering the period 1951–2100. The analysis of temperature and precipitation anomalies indicates a steady rise in future temperature and a strong increase in projected precipitation, especially under high-emission scenarios, signifying increasing climate extremes. Drought conditions in the basin are assessed using the Standardized Precipitation Evapotranspiration Index (SPEI) at 28 spatial grid points. The Mann–Kendall trend test and Sen's slope estimator reveal a statistically significant increasing trend in SPEI across all locations. Overall, the study highlights that the PRB has already faced hydroclimatic instability, characterized by rapid alternation between extreme droughts and floods. The findings strongly emphasize the need for climate-resilient river basin management, improved drought flood preparedness, real-time climate monitoring, and sustainable reservoir operation strategies.

9. Reference

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