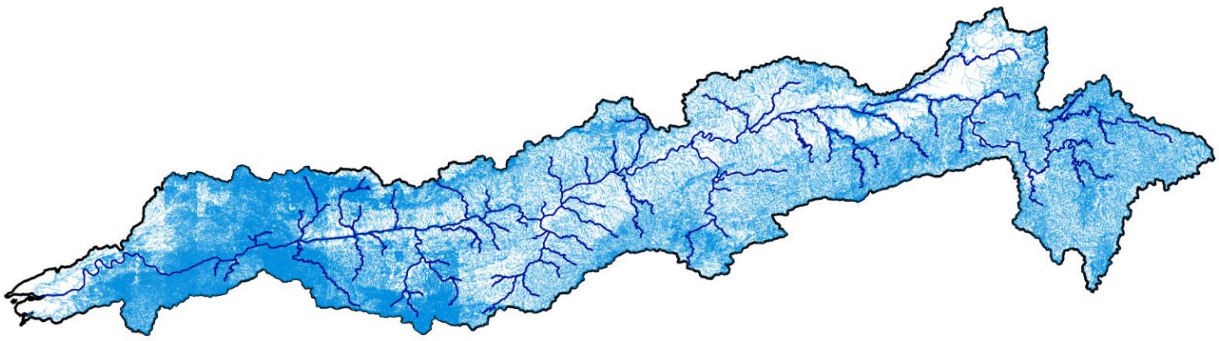
National River Conservation Directorate
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

HYDROLOGICAL STATUS OF NARMADA RIVER BASIN



DECEMBER 2024

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.

www.nrcd.nic.in

Centres for Narmada River Basin Management Studies (cNarmada)

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

www.cnarmada.org

Centre 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 Gandhinagar (Lead Institute) and IIT Indore (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.

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Preface

In an era of unprecedented environmental change, understanding our rivers and their ecosystems has never been more critical. This report aims to provide a comprehensive overview of our rivers, highlighting their importance, current health, and the challenges they face. As we explore the various facets of river systems, we aim to equip readers with the knowledge necessary to appreciate and protect these vital waterways.

Throughout the following pages, you will find an in-depth analysis of the principles and practices that support healthy river ecosystems. Our team of experts has meticulously compiled data, case studies, and testimonials to illustrate the significant impact of rivers on both natural environments and human communities. By sharing these insights, we hope to inspire and empower our readers to engage in river conservation efforts.

This report is not merely a collection of statistics and theories; it is a call to action. We urge all stakeholders to recognize the value of our rivers and to take proactive steps to ensure their preservation. Whether you are an environmental professional, a policy maker, or simply someone who cares about our planet, this guide is designed to support you in your efforts to protect our rivers.

We extend our heartfelt gratitude to the numerous contributors who have generously shared their stories and expertise. Their invaluable input has enriched this report, making it a beacon of knowledge and a practical resource for all who read it. It is our hope that this report will serve as a catalyst for positive environmental action, fostering a culture of stewardship that benefits both current and future generations.

As you delve into this overview of our rivers, we invite you to embrace the opportunities and challenges that lie ahead. Together, we can ensure that our rivers continue to thrive and sustain life for generations to come

Centers for Narmada River Basin
Management and Studies (cNarmada)
IIT Gandhinagar, IIT Indore

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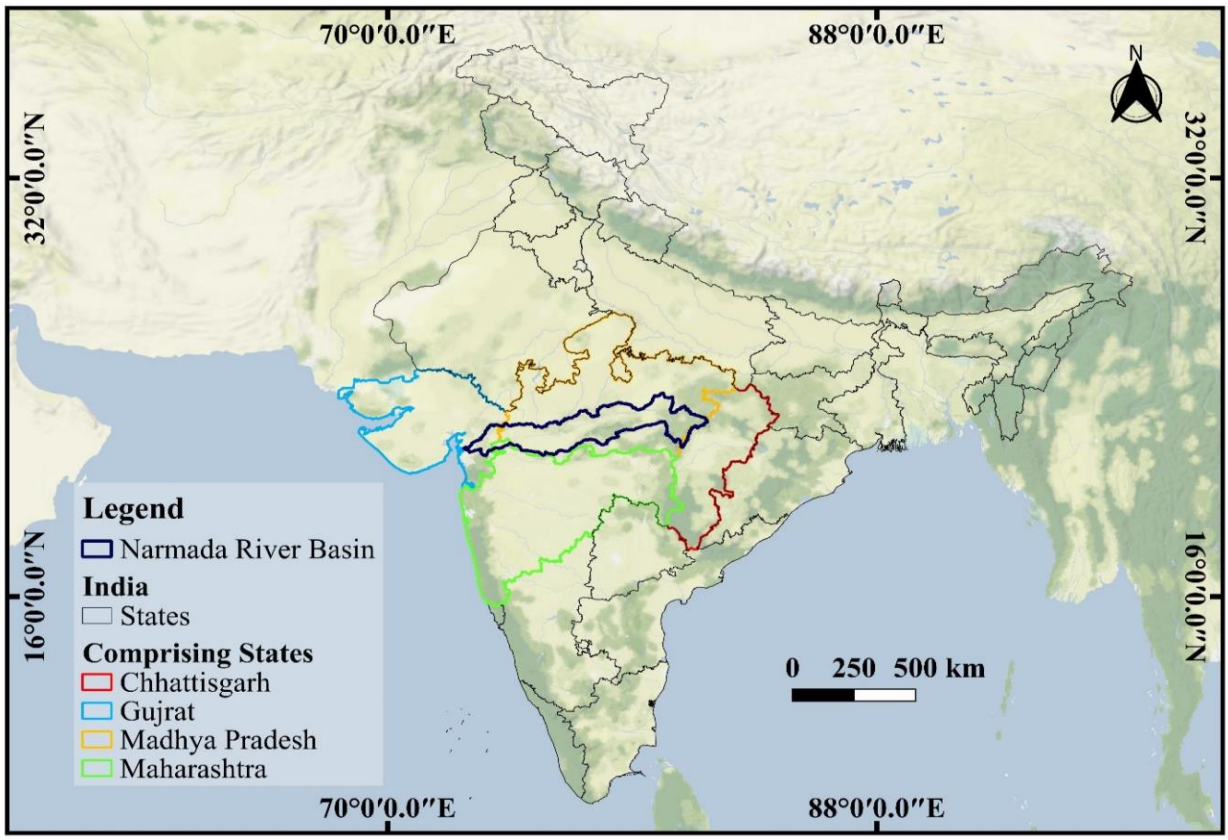
ABBREVIATIONS AND ACRONYMS

UN	Upper Narmada
MN	Middle Narmada
LN	Lower Narmada
GJA	Gujarat State Authority
MPA	Madhya Pradesh State Authority
CG	Chhattisgarh
CWC	Central Water Commission
MP	Madhya Pradesh
GJ	Gujarat
MP	Madhya Pradesh

1. INTRODUCTION

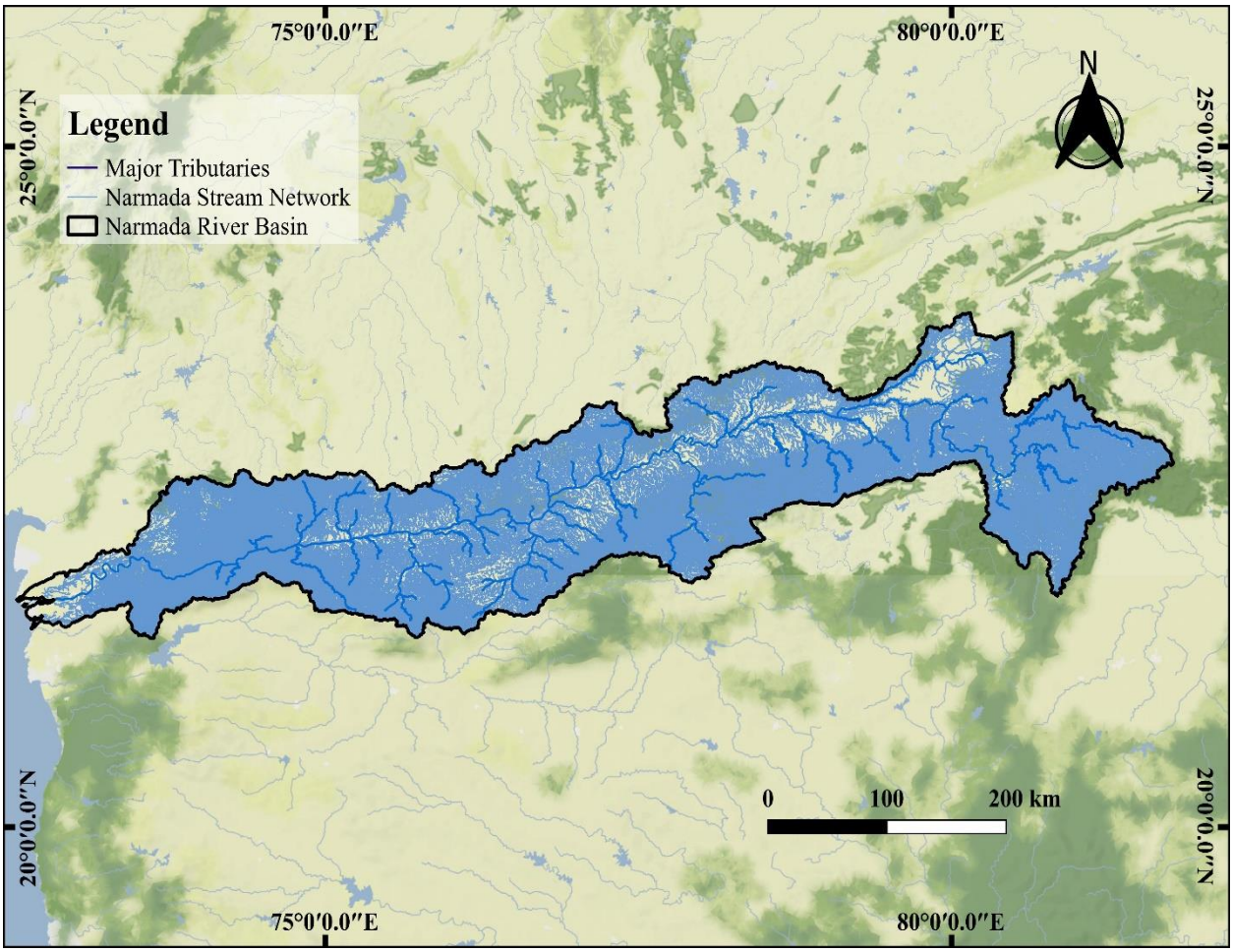
India's vibrant and diverse landscapes are intricately linked to its remarkable river systems, which span from the towering Himalayas to the coastal ranges of the Western and Eastern Ghats. These rivers are vital, providing life-sustaining water for agriculture, drinking, and energy production while shaping the country's terrain and supporting its ecosystems. They also hold immense cultural and spiritual importance, making them central to India's traditions and economy.

Among these, the Narmada River stands out as a westward-flowing marvel and the fifth-longest river in the country. Flowing primarily through Madhya Pradesh and Gujarat, it is often referred to as the "Lifeline" of these states for its crucial contributions to irrigation, drinking water, and hydropower. The river is revered in Hindu mythology, with numerous temples and sacred sites along its banks, underscoring its spiritual significance.



Map 1. Geographical location map

The Narmada originates from the Amarkantak Plateau in Madhya Pradesh and travels a winding journey of over 1,312 kilometers before emptying into the Arabian Sea. Along its course, it serves as a natural boundary between northern and southern India, fostering fertile lands and supporting diverse populations. The river basin, which spans parts of four states, is essential for agriculture, biodiversity, and water management, covering nearly 3% of India's total land area.



Map 2. Stream network map of Narmada River basin

1.1 Narmada River Stream Network and Flow Dynamics

The drainage network of the Narmada is extensive, encompassing 19 major tributaries and 41 smaller streams. The intricate network supports the hydrological balance of the region, facilitating water conveyance and sediment transport. The Narmada River rises at an elevation of 1,057 meters

and flows westward for 1,312 kilometers. The river's flow is segmented into upper, middle, and lower sub-basins, reflecting variations in topography and hydrology.

The Narmada River system is monitored by a network of gauging stations that measure streamflow, sediment load, and water quality. Major stations include Mandleshwar, Hoshangabad, and Navagam, strategically located to capture data on the river's flow dynamics across varying terrains. These stations play a critical role in hydrological modeling and flood forecasting, aiding water resource management and disaster mitigation. The Narmada stream network along with the major tributaries is depicted in Fig. 2.

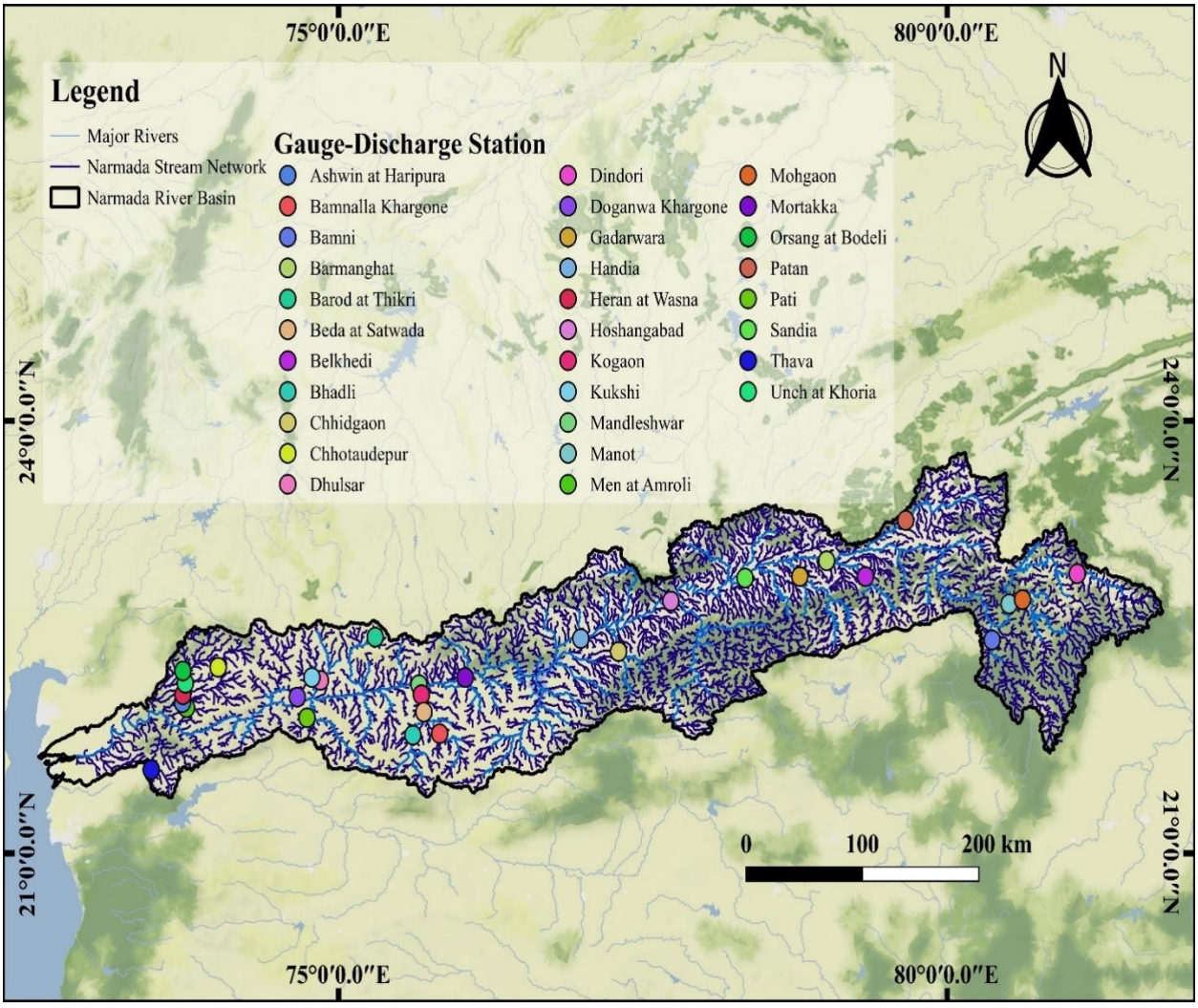
Table 1: Sub-basin wise river monitoring stations

River Basin	Total Stations	Number of Manual Stations	Number of Telemetric Stations
Narmada	97	93	4
Narmada Lower	17	15	2
Narmada Middle	35	34	1
Narada Upper	45	44	1

2. River Monitoring Stations

The monitoring of the Narmada River system is supported by a comprehensive network of gauging stations distributed across its sub-basins. Table 1 provides an overview of the sub-basin-wise distribution of river monitoring stations. The entire Narmada Basin hosts a total of 97 stations, of which 93 are manual, while 4 are equipped with telemetric capabilities for real-time data collection and transmission

This well-distributed network of monitoring stations enables comprehensive coverage across the river's length, supporting precise hydrological modeling, flood management, and water resource planning. The integration of telemetric systems enhances the efficiency and reliability of data collection, particularly in critical regions, thereby facilitating timely interventions and informed decision-making. The locations of the gauge-discharge and water level gauge stations on the Narmada River are illustrated in Fig. 3 and Fig. 4.

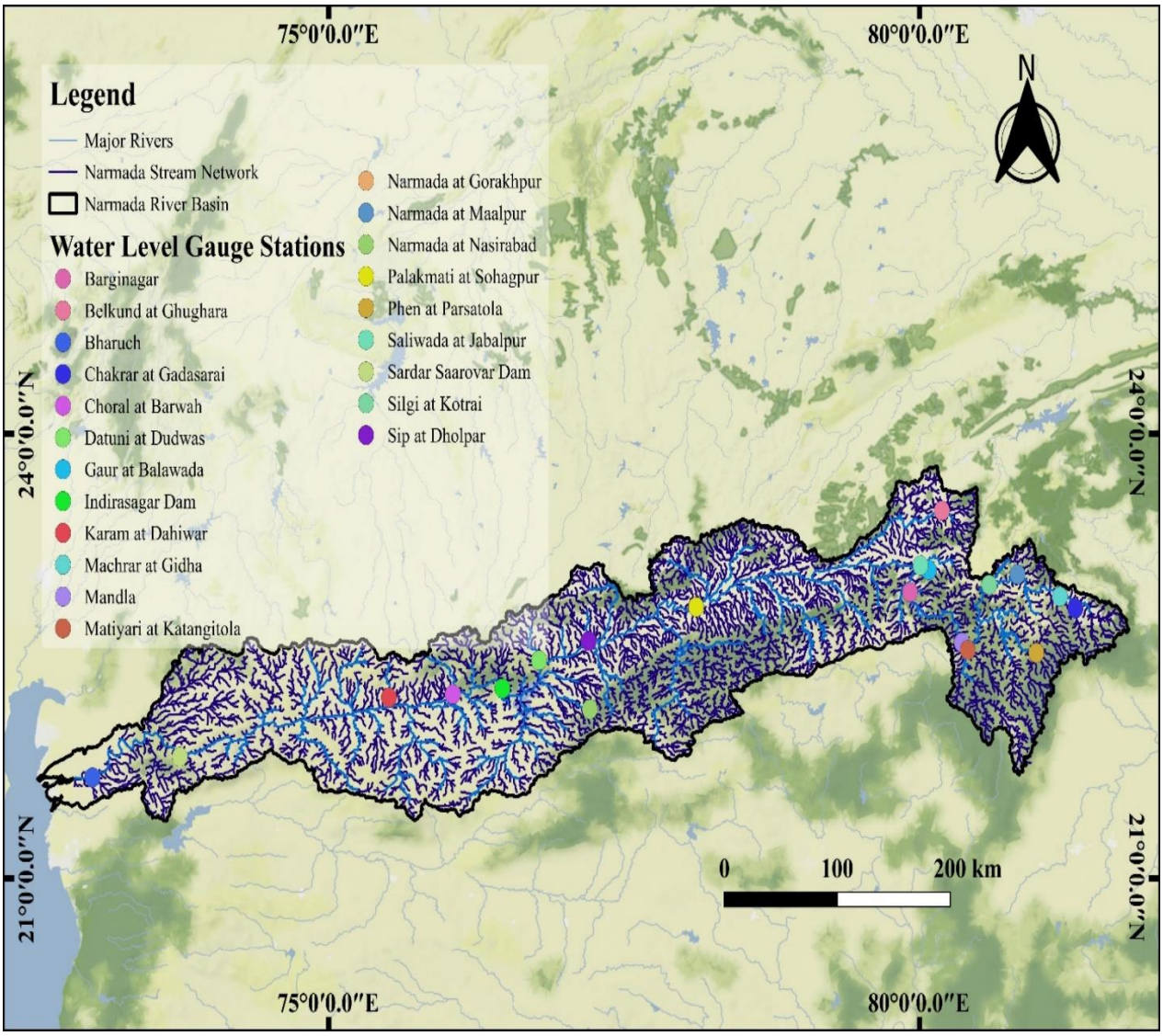


Map 3. Gauge-discharge station locations within the Narmada River Basin

Fig. 3 illustrates the gauge-discharge stations, strategically positioned to monitor both water levels and discharge across the river and its major tributaries. These stations, located at key points such as Mandleshwar, Hoshangabad, and Navagam, are vital for tracking flow dynamics and ensuring effective flood control, irrigation planning, and hydroelectric power generation. Their spatial distribution highlights the emphasis on capturing data across diverse terrains, from upstream hilly regions to downstream plains.

Fig. 4 complements this with a depiction of water level gauge stations, which focus exclusively on monitoring water levels to provide real-time information essential for flood warnings and sustainable water use. These stations are strategically placed to offer coverage in critical areas prone to hydrological variability, ensuring comprehensive monitoring across the upper, middle,

and lower sub-basins. Notable sites such as Indirasagar Dam and the Sardar Sarovar Dam are included, reflecting their significance in water storage and flow regulation.



Map 4. Water level gauge station locations within the Narmada River Basin

Together, these maps underscore the integrated approach to managing the Narmada River's water resources. By combining the functions of gauge-discharge and water level gauge stations, this network not only facilitates precise hydrological modeling but also supports disaster management and long-term planning for sustainable development in the basin. The visualization of these stations highlights their pivotal role in monitoring the river's behavior and ensuring equitable and efficient utilization of its resources.

Table 2: Sub-basin-wise Distribution and Characteristics of Hydrological Monitoring Stations in the Narmada River Basin

Sl. No	Name	Source	State	Station Type	Lat (°)	Long (°)	Zero of Gauge (m)	Max Level (m)	Min Level (m)	Average Level (m)	Max Discharge (cumecs)	Min Discharge (cumecs)	Average Discharge (cumecs)	Sub-basin
1	Thava	GJA	GJ	Manual	21.58	73.46	-	914.59 (25 Mar 2022)	0.00 (21 May 2022)	145.91	100.00 (1 Sep 2017)	50.00 (1 Oct 2017)	82.81	LN
2	Men at Amroli	GJA	GJ	Manual	22.01	73.75	-	672.910 (18 Apr 2022)	0.00 (19 Jun 2022)	96.28	29.16 (1 Aug 2017)	19.44 (1 Sep 2017)	24.30	LN
3	Ashwin at Haripura	GJA	GJ	Manual	22.045	73.716	-	954.29 (11 May 2022)	0.00 (9 Sep 2017)	57.75	39.00 (1 Sep 2017)	13.00 1 Oct 2017)	26.00	LN
4	Heran at Wasna	GJA	GJ	Manual	22.1	73.72	-	835.050 (10 Jul 2022)	0.00 (4 Jan 2022)	66.57	76.35 (1 Aug 2017)	2.38 (1 Nov 2017)	35.60	LN
5	Unch at Khoria	GJA	GJ	Manual	22.18	73.74	-	106.870 (15 May 2022)	0.00 (19 Jan 2022)	90.14	43.94 (1 Sep 2017)	3.62 (1 Oct 2017)	19.42	LN
6	Orsang at Bodeli	GJA	GJ	Manual	22.265	73.72	-	7364.00 (28 Jul 2019)	7.140 (29 Jun 2020)	72.25	12.42 (1 Sep 2017)	5.67 (1 Oct 2017)	8.37	LN
7	Chhotaudepur	GJA	GJ	Manual	22.29	74.01	-	954.67 (24 May 2022)	0.00 (16 Sep 2021)	122.37	6.20 (1 Aug 2017)	1.48 (1 Oct 2017)	4.30	LN
8	Doganwa at Khargone	MPA	MP	Manual	22.0833	74.66	-	147.450 (13 Jul 2016)	146.300 (4 Jun 2016)	146.60	239.40 (13 Jul 2016)	0.00 (4 Jun 2016)	42.31	MN
9	Pati	CWC	MP	Manual	21.94	74.74	187	290.00 (27 Jul 2019)	18.48 (17 Jun 2020)	189.50	2395.03 (9 Sep 2010)	0.00 (30 Apr 2002)	12.57	MN
10	Dhulsar	CWC	MP	Manual	22.2	74.85	151	663.900 (13 Aug 2019)	151.00 (3 Jul 2020)	152.00	1094.27 (8 Sep 2014)	0.00 (1 Nov 2011)	4.39	MN
11	Kukshi	MPA	MP	Manual	22.22	74.78	-	156.30 (4 Aug 2016)	154.50 (20 Oct 2016	155.06	193.03 (4 Aug 2016)	0.00 (20 Oct 2016)	19.08	MN
12	Barod at Thikri	CWC	MP	Manual	22.5	75.3	-	163.74 (15 Feb 2022)	162.09 (13 Apr 2021)	162.79	1.45 (25 Apr 2021)	1.45 (25 Apr 2021)	1.45	MN

13	Mandleshwar	CWC	MP	Manual	22.17	75.66	138	1141.56 (22 Sep 1976)	13.93 (21 Aug 2020)	140.21	48200.00 (6 Sep 1994)	0.00 (1 Jul 2018)	1005.33	MN
14	Kogaon	CWC	MP	Manual	22.1	75.68	151	287.94 (19 Jun 2020)	50.00 (15 Aug 2020)	153.43	8300.00 (23 Aug 1990)	0.00 (10 Jun	38.47	MN
15	Beda at Satwada	CWC	MP	Manual	21.98	75.7	-	199.700 (26 Sep 2021)	95.55 (15 Jan 2019)	197.58	9.41 (15 Apr 2021)	9.40 (18 Apr 2021)	9.41	MN
16	Bamnalla_Khargone	MPA	MP	Manual	21.83	75.83	-	233.65 (4 Oct 2016)	233.15 (8 Jul 2016)	233.36	9.44 (2 oct 2016)	0.00 (8 Jul 2016	1.73	MN
17	Mortakka	CWC	MP	Manual	22.22	76.04	153	169.60 (30 Aug 2020)	144.07 (13 Aug 2019)	156.71	19300.00 (10 Aug 1999)	2.00 (21 Nov 2003)	829.66	MN
18	Bhadli	MPA	MP	Manual	21.82	75.61	-	229.50 (30 Jun 2016)	228.00 (4 Jun 2016)	228.61	266.88 (30 Jun 2016)	0.00 (4 Jun 2016)	57.22	MN
19	Handia	CWC	MP	Manual	22.49	76.99	258	26103.00 (2 Nov 2018)	26.52 (19 Jun2021)	261.73	31879.90 (24 Aug 2013)	11.96 (1 Jun 1989)	769.28	MN
20	Chhidgaon	CWC	MP	Manual	22.4	77.3	287	301.81 (8 Jul 2007)	0.370 (26 Mar 2022)	287.75	9625.00 (8 Jul 2007)	0.00 (30 May 1979)	33.45	MN
21	Hoshangabad	CWC	MP	Manual	22.75	77.73	282	4422.00 (17 Jul 2016)	222.65 (21 Sep 2018)	285.47	31600.00 (30 Aug 1973)	0.00 (19 Jun 2011)	672.28	MN
22	Sandia	CWC	MP	Manual	22.91	78.34	297	299560.00 (27 May 2018)	29.500 (21 Jun 2021)	300.48	25288.18 (10 Sep 2009)	0.00 (8 May 2018)	464.17	UN
23	Gadarwara	CWC	MP	Manual	22.92	78.79	321	32267.00 (25 Jul 2019)	32.34 (3 Jul 1978)	323.34	10138.00 (26 Oct 2016)	0.00 (8 May 2018)	47.95	UN
24	Barmanghat	CWC	MP	Manual	23.03	79.01	306	1152.65 (23 Jul 2020)	31.24 (28 Sep 2020)	309.244	21500.00 (19 Sep 1999)	1.000 (17 Mar 2014)	368.53	UN
25	Belkhedi	CWC	MP	Manual	22.92	79.33	340	359.95 (21 Jul 1994)	0.00 (12 Dec 2018)	341.44	7600.00 (21 Jul 1994)	0.00 (12 Dec 2018)	25.00	UN
26	Bamni	CWC	MP	Manual	22.48	80.37	-	493.42 (6 Jun 2020)	0.310 (2 Jan 2017)	440.68	2094.60 (28 Aug 2020)	0.00 (8 May 2016)	26.14	UN

27	Manot	CWC	MP	Manual	22.73	80.51	442	1191.00 (23 Jul 2020)	48.83 (24 Oct 2020)	443.67	6806.05 (31 Jul 2006)	0.00 (24 May 2018)	91.44	UN
28	Mohgaon	CWC	MP	Manual	22.76	80.62	447	467.300 (8 Aug 2004)	43.65 (20 Aug 2020)	449.96	11600.00 (8 Aug 2004)	0.00 (30 May 1979)	71.26	UN
29	Dindori	CWC	MP	Manual	22.94	81.07	660	1480.09 (13 Jul 2020)	307.91 (8 Jun 2020)	663.09	4710.00 (23 Aug 1991)	0.00 (1 Nov 2011)	40.75	UN
30	Patan	CWC	MP	Manual	23.31	79.66	341.5	1275.65 (5 Oct 2019)	0.00 (28 May 2022)	342.88	2202.29 (20 Aug 2013)	0.00 (2 Aug 1979)	51.48	UN

Table 2 provides a detailed overview of the hydrological monitoring stations in the Narmada River Basin, segmented across the Upper (UN), Middle (MN), and Lower (LN) sub-basins, highlighting key metrics like water levels, discharge rates, and geographic locations. Notable findings include the maximum discharge capacity recorded at Mandleshwar in the Middle Sub-basin (MN), with a peak flow of 48,200 cubic meters per second, underscoring its critical role in measuring and supporting the management of high-flow events during peak monsoon periods. Stations in the Upper Sub-basin (UN), such as Dindori and Mohgaon, showcase significant water level variations, with Dindori reaching a maximum recorded level of 1,480.09 meters, reflecting the dynamic hydrological conditions influenced by upstream catchments. In contrast, the Lower Sub-basin (LN), represented by stations like Thava and Men at Amroli, shows relatively lower maximum water levels, ranging between 914.59 and 672.91 meters, and discharge capacities, with maximum flows between 100 and 239 cubic meters per second, indicating the subdued flow characteristics as the river approaches its outlet into the Arabian Sea. Seasonal extremes are evident, such as at Sandia in the Upper Sub-basin, where water levels fluctuate drastically, from a maximum of 299,560 cubic meters per second to near zero, emphasizing the station's importance in tracking such variability for flood and drought

preparedness. The geographic spread of these stations across the states of Madhya Pradesh and Gujarat ensures comprehensive monitoring, with notable examples including Hoshangabad (MN) for middle-basin flow dynamics and Barmanghat (UN) for upstream data. This dataset provides crucial insights into the river's hydrological behavior, enabling accurate measurement and supporting effective resource management, flood mitigation, and sustainable planning across the Narmada Basin.

Table 3: Sub-basin-wise Distribution and Characteristics of Flow Measurement Stations in the Narmada River Basin

Station Name	Source	State	Station Type	Lat (°)	Long (°)	Zero of Gauge (m)	Max Level (m)	Min Level (m)	Avg Level (m)	Sub-basin
Awalighat	CWC	MP	Manual	22.83	77.48	-	285.84 (16 Aug 2021)	0.030 (27 Jul 2019)	215.64	MN
Barginagar	CWC	MP	Manual	22.93	79.92	-	421.75 (10 Aug 2019)	41.75 (27 Jun 2019)	417.79	UN
Belkund at Ghughara	CWC	MP	Manual	23.48	80.19	-	376711.00 (26 Sep 2021)	357.52 (22 Apr 2022)	376.82	UN
Bharuch	CWC	MP	Telemetric	21.68	73	-	10.720 (1 Sep 2020)	0.050 (13 May 2018)	1.787	LN
Chakrar at Gadasarai	CWC	MP	Manual	22.82	81.32	-	724.55 (24 Jul 2021)	287.38 (17 Jan 2022)	719.68	UN
Choral at Barwah	CWC	MP	Manual	22.24	76.05	-	172.72 (24 Sep 2021)	162.77 (27 Nov 2021)	170.56	MN
Datuni at Dudwas	CWC	MP	Manual	22.47	76.78	-	663.43 (22 Jan 2022)	0.00 (3 Feb 2019)	142.15	MN
Gaur at Balawada	CWC	MP	Manual	23.08	80.08	-	389.38 (16 Sep 2021)	382.72 (9 Mar 2022)	388.08	UN
Indirasagar Dam	CWC	MP	Manual	22.28	76.47	-	2254.17 (31 Jul 2019)	26.72 (19 Sep 2020)	254.27	MN
Kaner at Medhikheda	CWC	MP	Manual	22.4	76.21	-	212.97 (24 Sep 2021)	171.04 (25 Oct 2021)	211.15	MN
Karam at Dahiwar	CWC	MP	Manual	22.22	75.51	-	16578.00 (27 Sep 2021)	162.61 (13 Oct 2021)	165.56	LN
Maan at Gopalpura	CWC	MP	Manual	22.27	75.1	-	192.89 (11 Jun 2021)	159.55 (24 Jul 2021)	192.52	MN

Machrar at Gidha	CWC	MP	Manual	22.9	81.19	-	694.34 (15 Sep 2021)	0.00 (28 May 2022)	690.48	UN
Mandla	CWC	MP	Manual	22.59	80.36	432.13	1413.23 (29 Dec2019	43.03 (13 Oct 2020)	433.33	UN
Matiyari at Katangitola	CWC	MP	Manual	22.54	80.41	-	737.72 (13 Jun 2021)	436.00 (17 Jun 2022)	438.92	UN
Mortakka	CWC	MP	Manual	22.22	76.04	153	169.60 (30 Aug 2020)	144.07 (13 Aug 2019)	156.65	MN
Narmada at Gorakhpur	CWC	MP	Manual	22.77	22.77	-	743.72 (24 Jul 2021)	373.51 (08 Mar 2022)	736.68	UN
Narmada at Maalpur	CWC	MP	Manual	23.05	80.83	-	610.85 (24 Jul 2021)	0.020 (28 Jul 2019)	603.56	UN
Narmada at Nasirabad	CWC	MP	Manual	22.14	77.21	-	737.59 (5 Feb 2022)	88.71 (11 Dec 2019)	291.13	MN
Palakmati at Sohagpur	CWC	MP	Manual	22.83	78.11	-	438.96 (17 Nov 2021)	92.95 (11 Dec 2019)	321.68	UN
Phen at Parsatola	CWC	MP	Manual	22.52	80.99	-	583.91 (28 Jul 2021)	0.00 (28 May 2022)	578.48	UN
Sardar Saarovar Dam	CWC	MP	Manual	21.82	73.74	-	11942.00 (9 Aug 2020)	12.78 (8 Jun 2021)	155.58	LN
Silgi at Kotrai	CWC	MP	Manual	22.98	80.59	-	513.83 (5 Jun 2021)	0.00 (11 Aug 2019)	508.52	UN
Sip at Dholpar	CWC	MP	Manual	22.6	77.2	-	276.68 (5 Sep 2021)	0.00 (3 Feb 2019)	192.91	MN
Kolat at Mahgaon	CWC	MP	Manual	22.83	77.35	-	462.01 (11 Sep 2020)	0.00 (3 Feb 2019)	197.16	MN
Machna at Shahpur	CWC	MP	Manual	22.19	77.89	-	397.15 (12 Jul 2021)	0.00 (11 Apr 2019)	241.13	UN
Barna Dam	CWC	MP	Manual	23.05	78.06	-	33825.00 (8 Jul 2019)	34.28 (19 Jun 2021)	344.21	UN
Saner a Chargaon	CWC	MP	Manual	23.05	79.59	-	373.77 (19 Apr 2022)	343.72 (16 Apr 2022)	344.39	UN
Tenduni at Maheshwar	CWC	MP	Manual	22.97	78.32	88	310.200 (6 Aug 2021)	208.20 (25 Jul 2021)	303.87	UN
Imar at Imaliya	CWC	MP	Manual	22.9	79.79	-	356.05 (8 Aug 2020)	255.30 (28 Jun 2021)	355.23	UN
Pariyat at Matamar	CWC	MP	Manual	23.23	80.04	-	737.65 (1 Jan 2022)	38.74 (22 Jan 2022)	382.83	UN
Halon at Bartola	CWC	MP	Manual	22.6	80.7	-	512443.00 (30 Jul 2021)	413.97 (5 Mar 2022)	513.82	UN

Table 3 further expands on the hydrological monitoring network in the Narmada River Basin, presenting station-specific data that captures the basin's diverse water level dynamics. Stations in the UN, such as Barginagar and Belkund at Ghughara, record substantial maximum water levels, with Belkund at Ghughara reaching 376.82 meters on 26 September 2021, reflecting the upstream region's significant water retention capacity. Similarly, Dindori and Halon at Bartola exhibit high variability in water levels, with Halon at Bartola recording a maximum of 512.44 meters on 30 July 2021 and Dindori reaching 1480.09 meters on 13 July 2020, indicating the dynamic nature of flow in the mountainous regions. These stations provide critical data for understanding upstream contributions to the river's overall discharge.

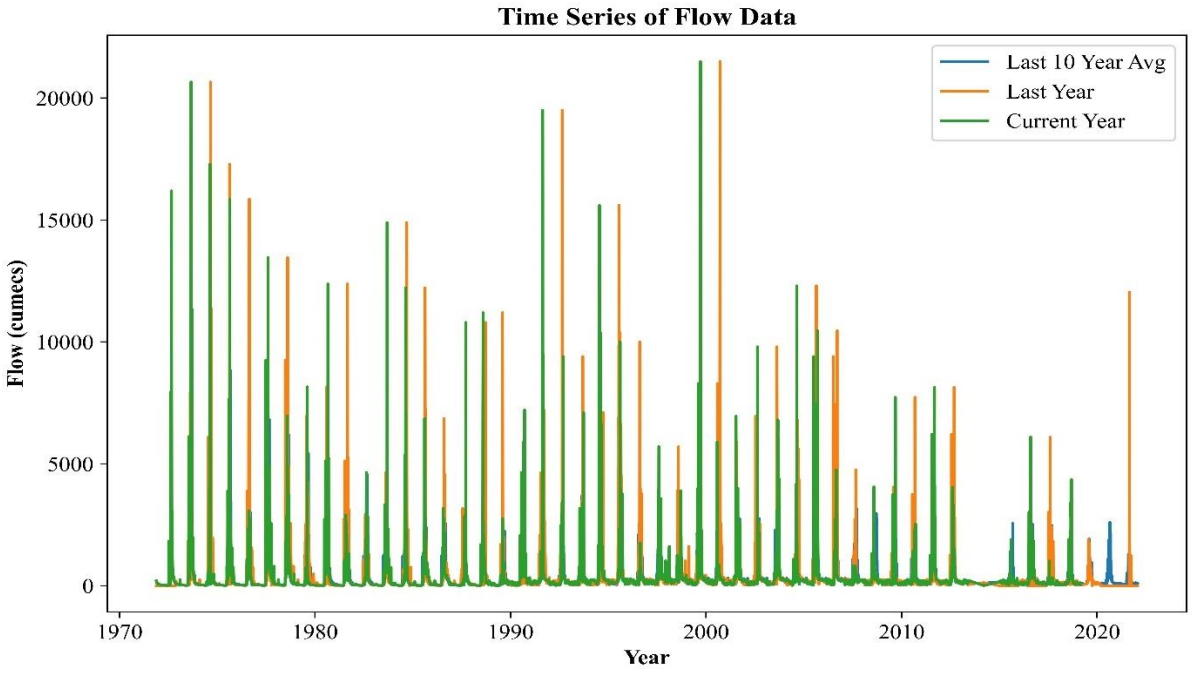
The Middle Sub-basin (MN) stations, such as Indirasagar Dam and Nasirabad, play a pivotal role in monitoring midstream flow dynamics. Indirasagar Dam, one of the major infrastructure points, recorded a maximum water level of 254.27 meters on 31 July 2019, demonstrating its importance in water regulation and storage. Mortakka, another notable station, recorded a maximum level of 169.60 meters on 30 August 2020, offering insight into the transitional hydrology between upstream and downstream regions.

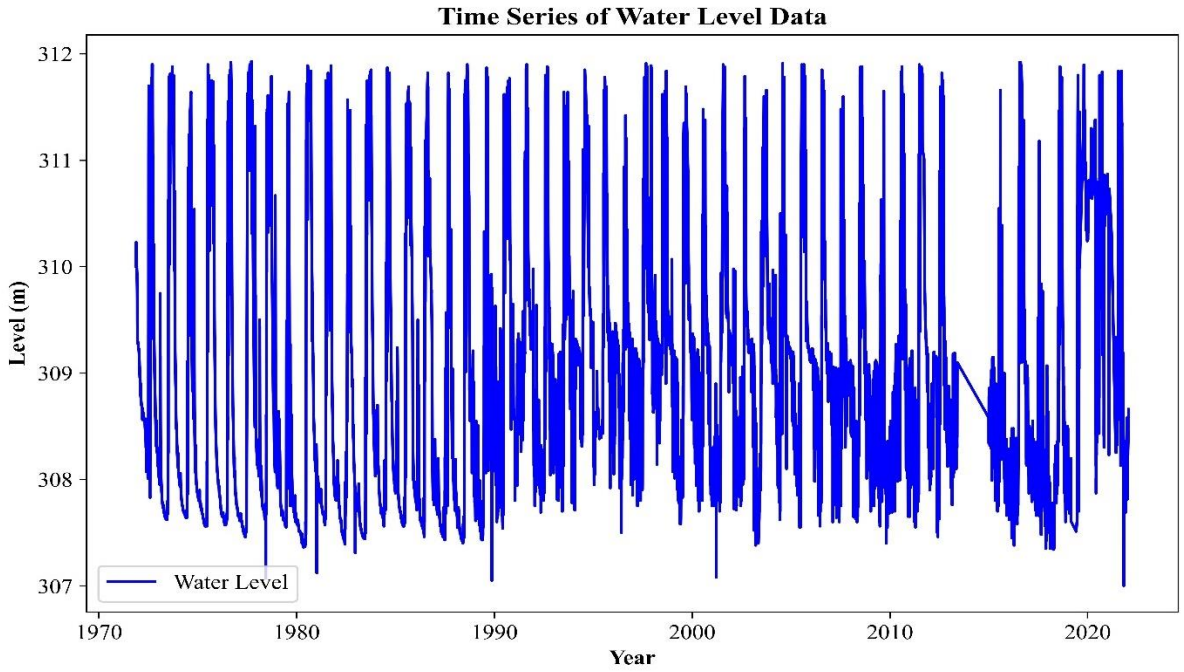
In the Lower Sub-basin (LN), stations like Bharuch and Sardar Sarovar Dam highlight the subdued yet critical hydrological patterns as the river approaches its mouth. Sardar Sarovar Dam, a key infrastructure point, recorded a maximum water level of 155.58 meters on 9 August 2020, underscoring its role in downstream water management and flood control. Meanwhile, Bharuch recorded a maximum level of 10.72 meters on 1 September 2020, reflecting its monitoring role in the river’s terminal flow.

This detailed dataset not only provides a comprehensive understanding of the river’s hydrological variability but also reinforces the importance of these monitoring stations in collecting precise and actionable data. The inclusion of major infrastructure like dams and the range of seasonal water level variations captured in the table emphasize the network’s capability to support water resource management, flood mitigation, and sustainable development across the basin. This seamless continuation builds upon the previous analysis, offering an in-depth view of the monitoring efforts in the Narmada Basin.

3. Time Series Data of Discharge and Water Level

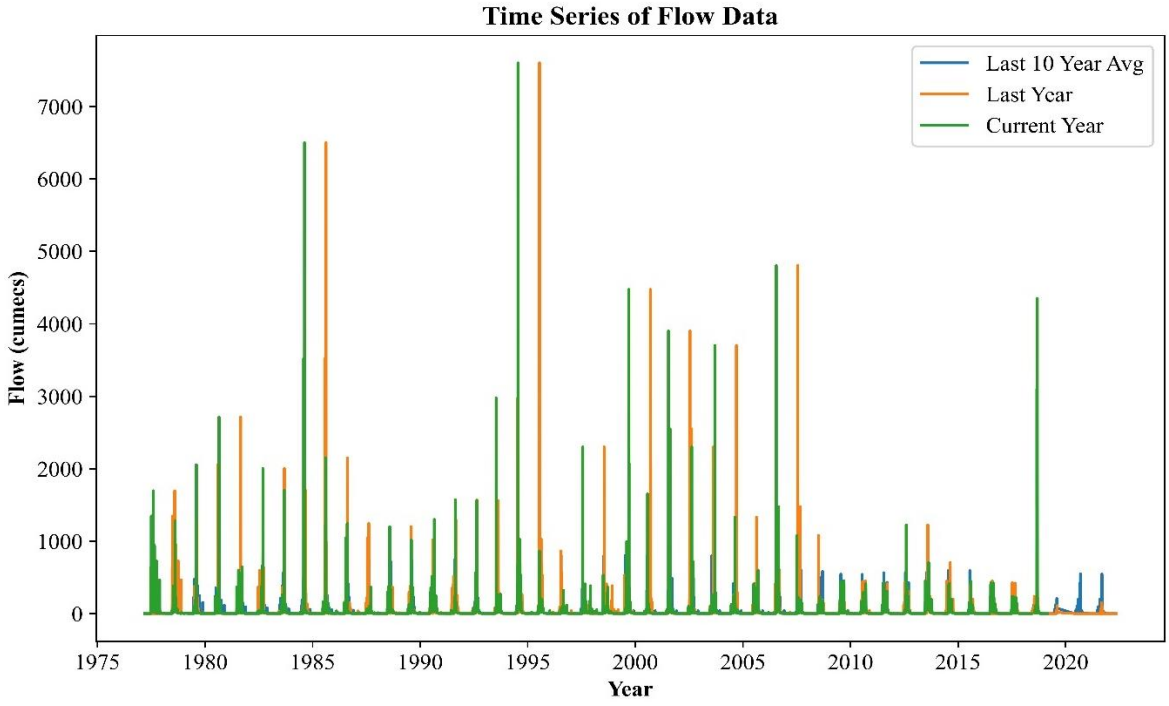
Station Name: Barmanghat

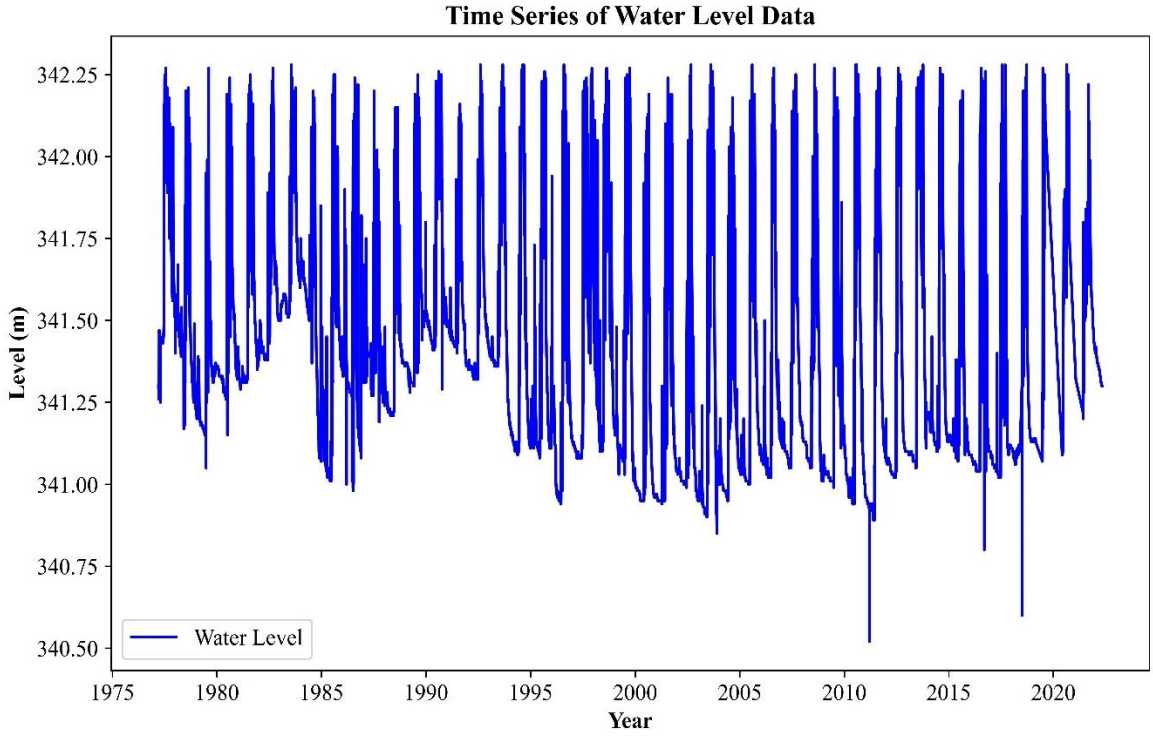




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

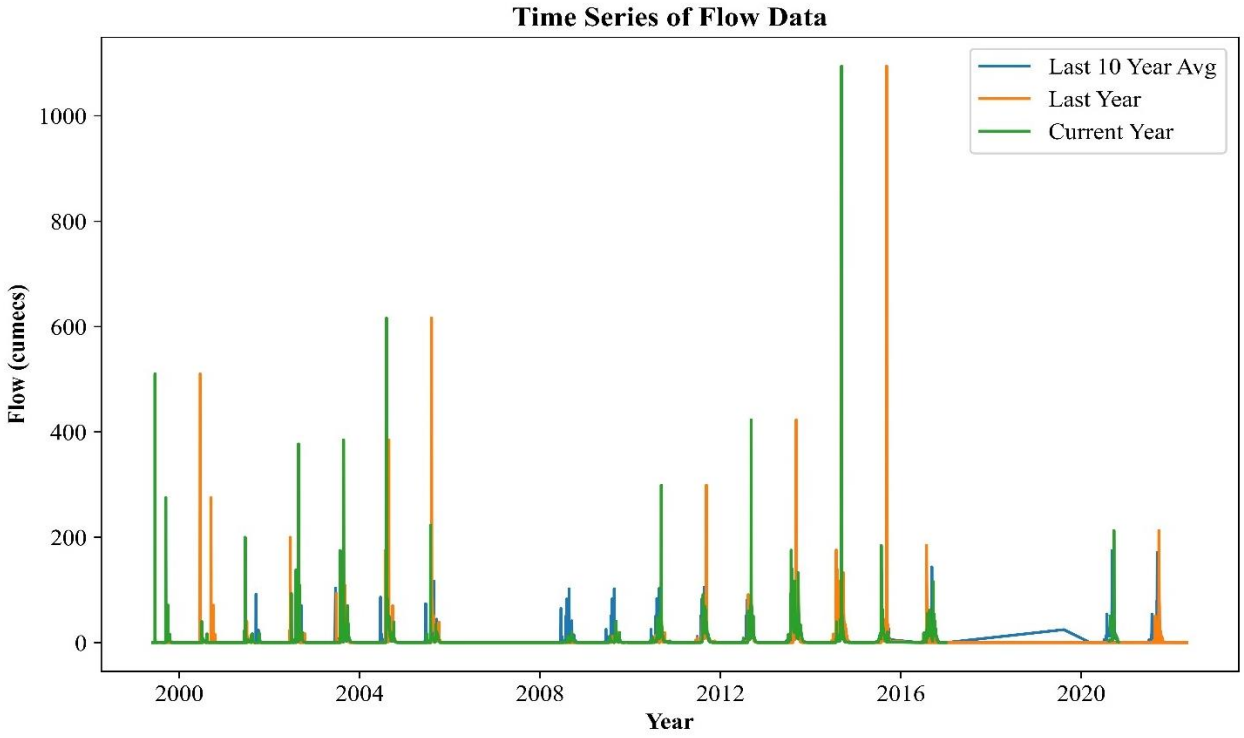
Station Name: Belkhedi

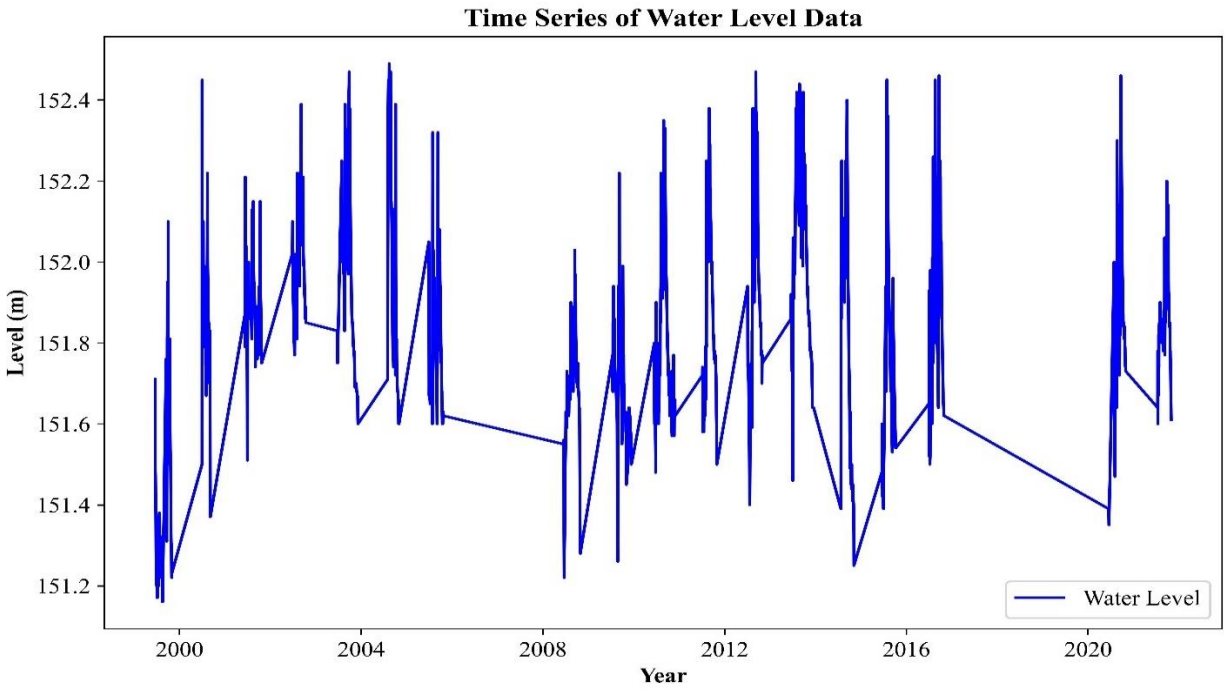




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

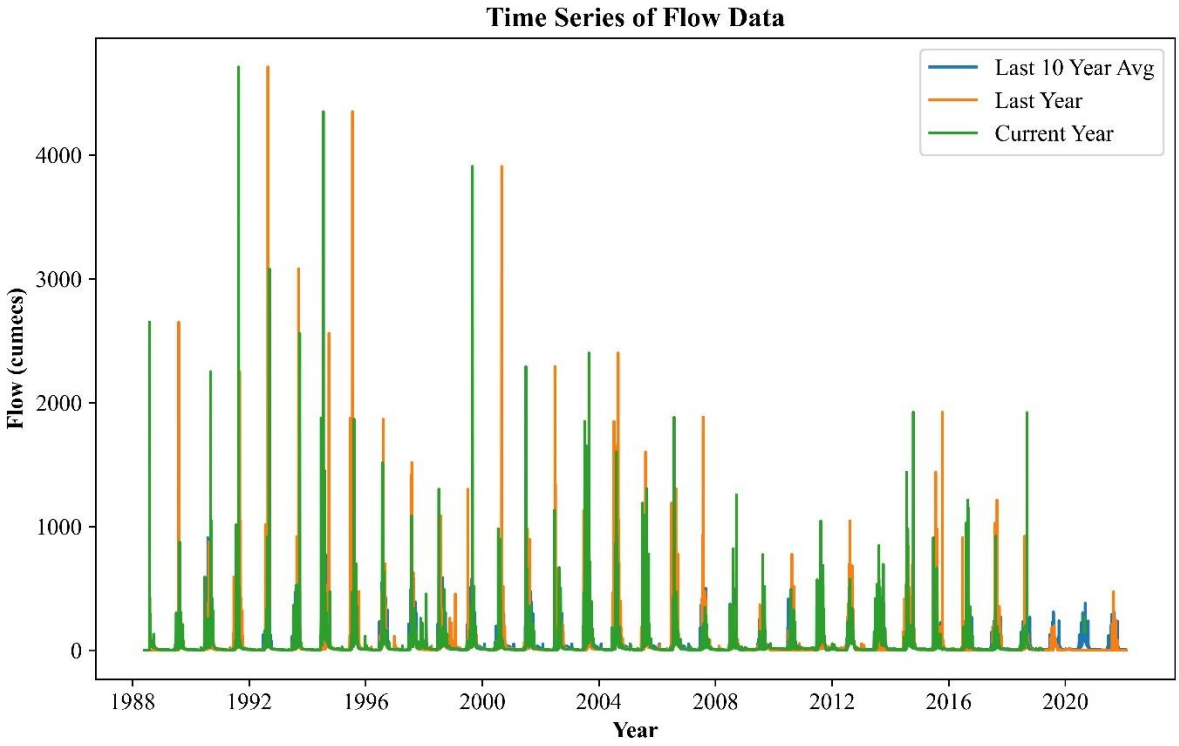
Station Name: Dhulsar

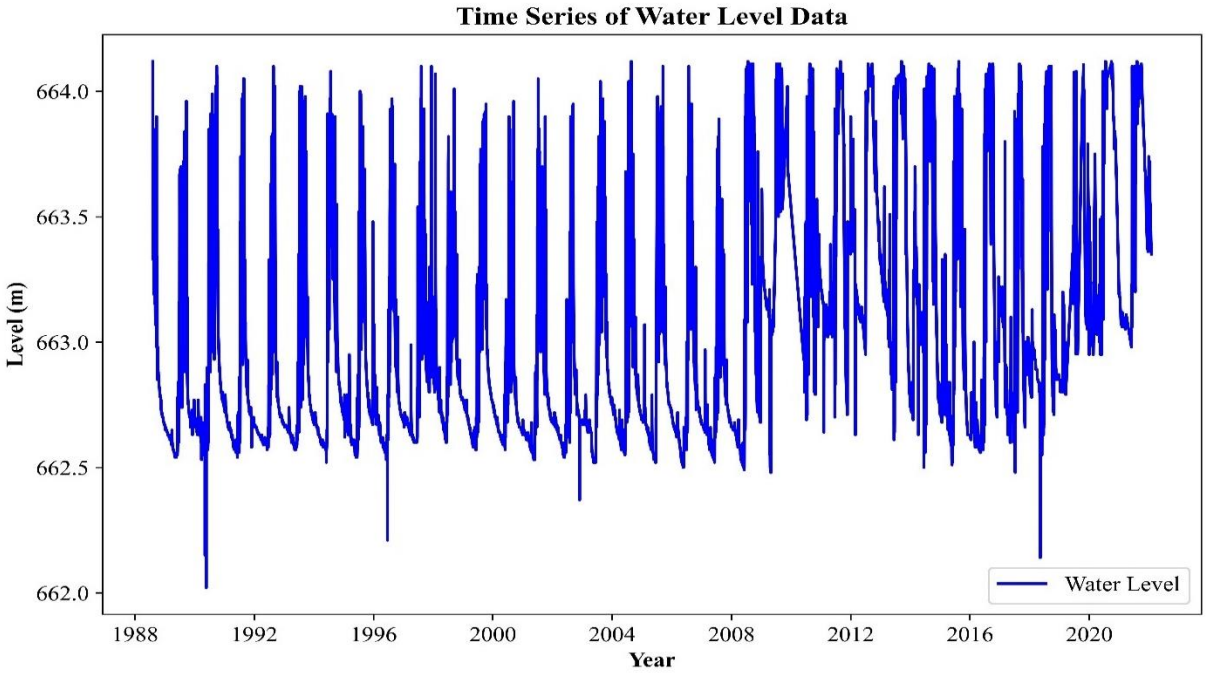




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

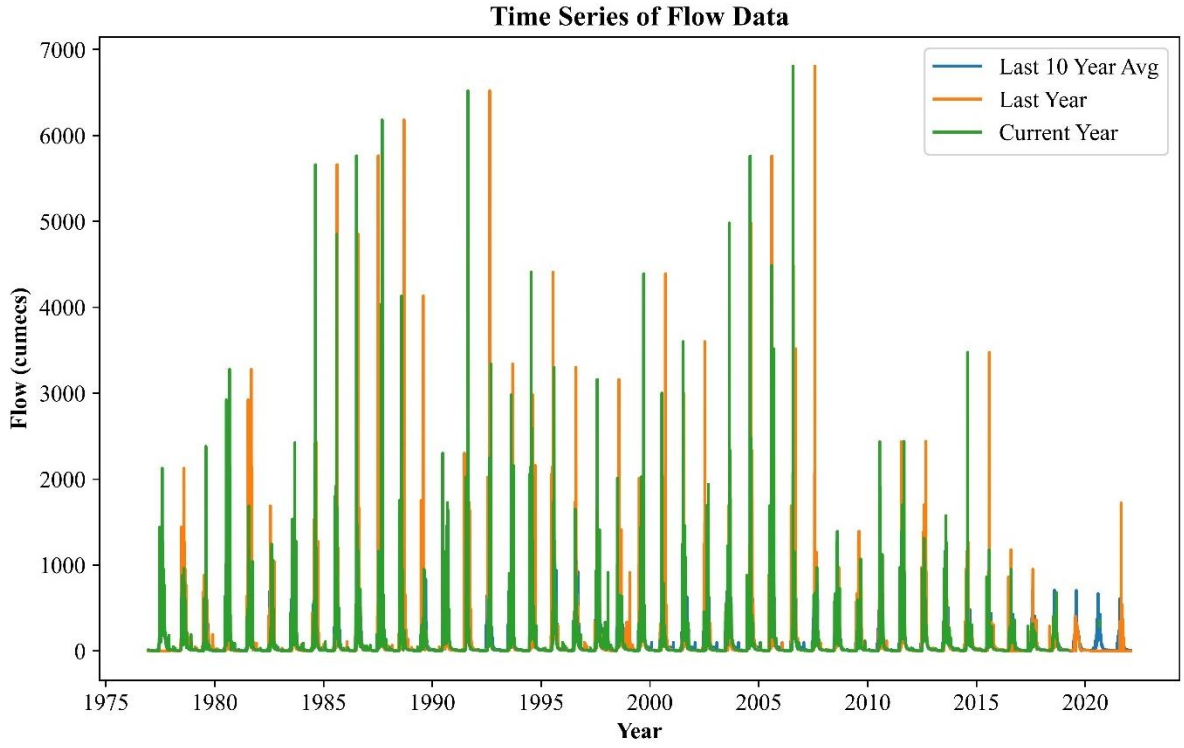
Station Name: Dindori

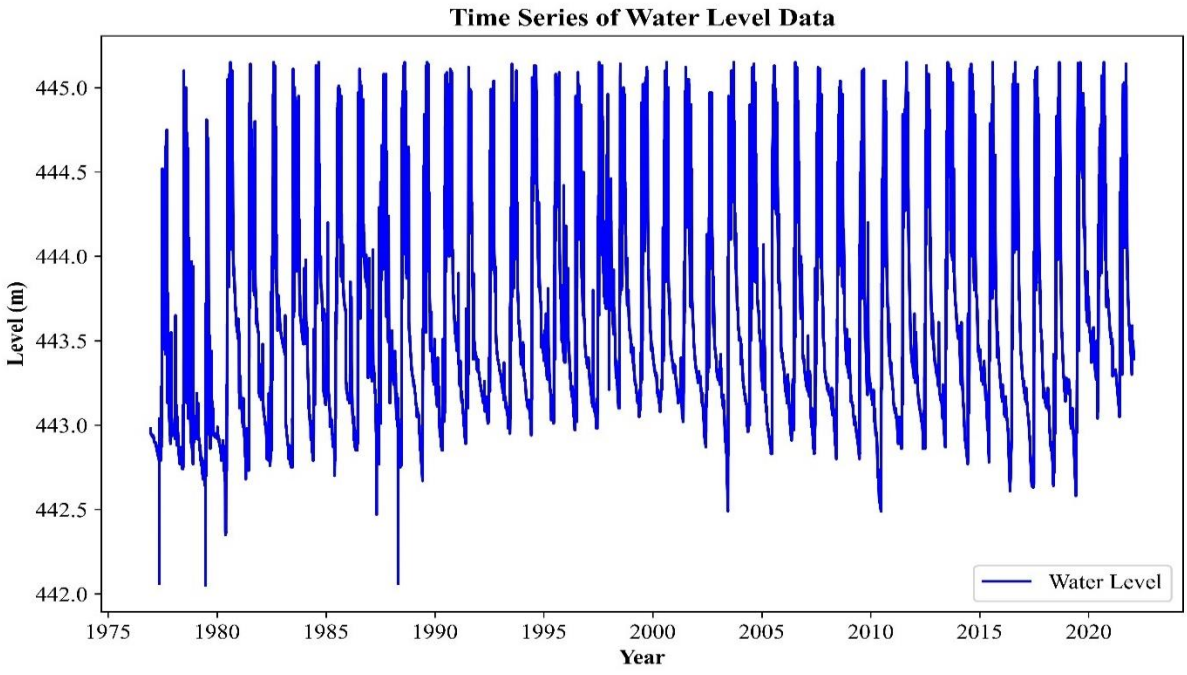




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

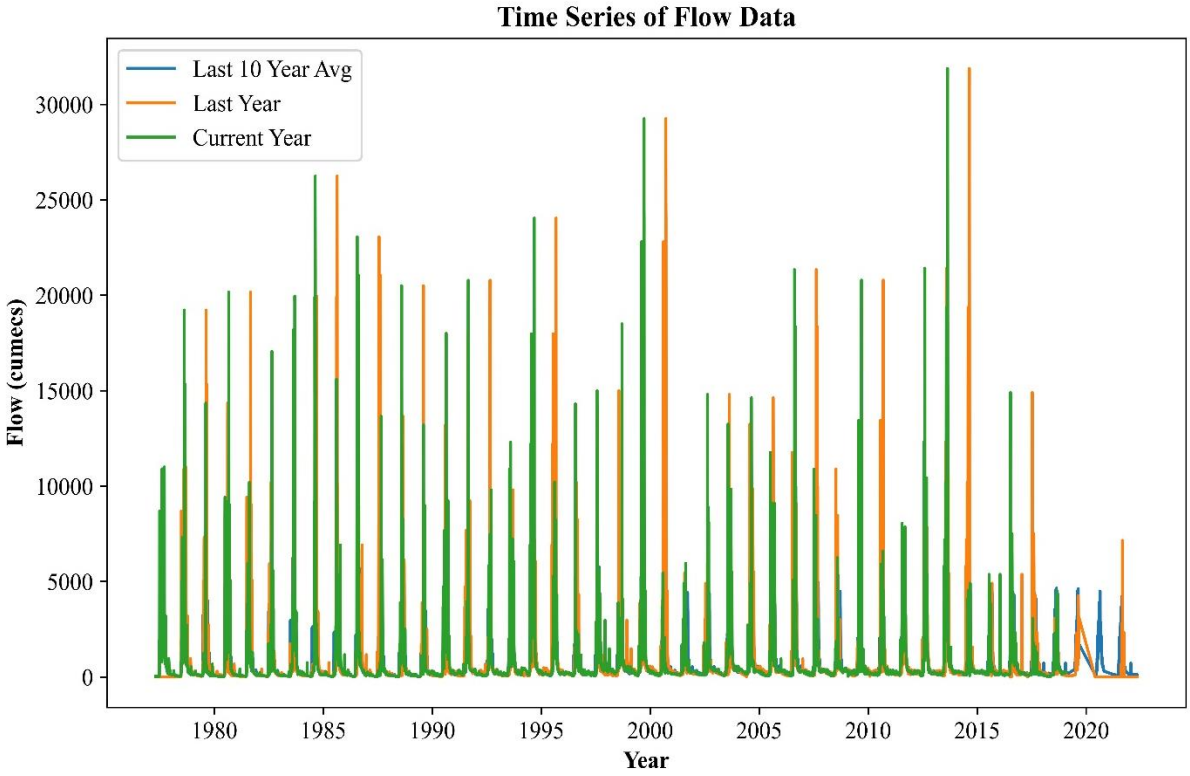
Station Name: Mandla

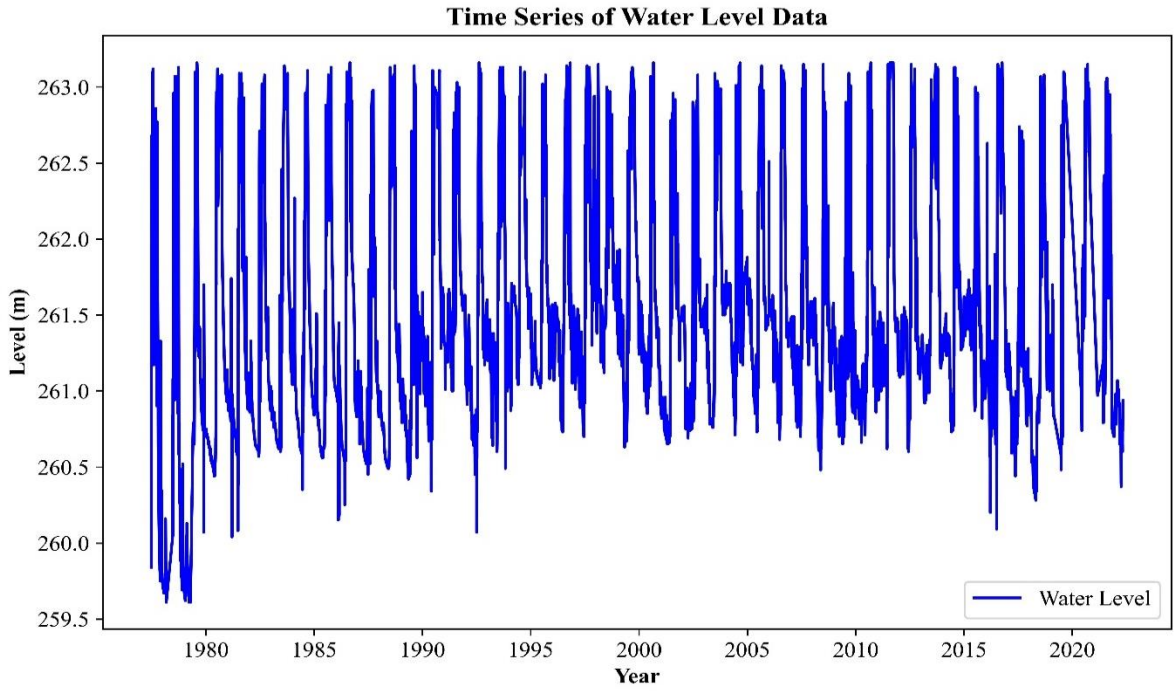




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

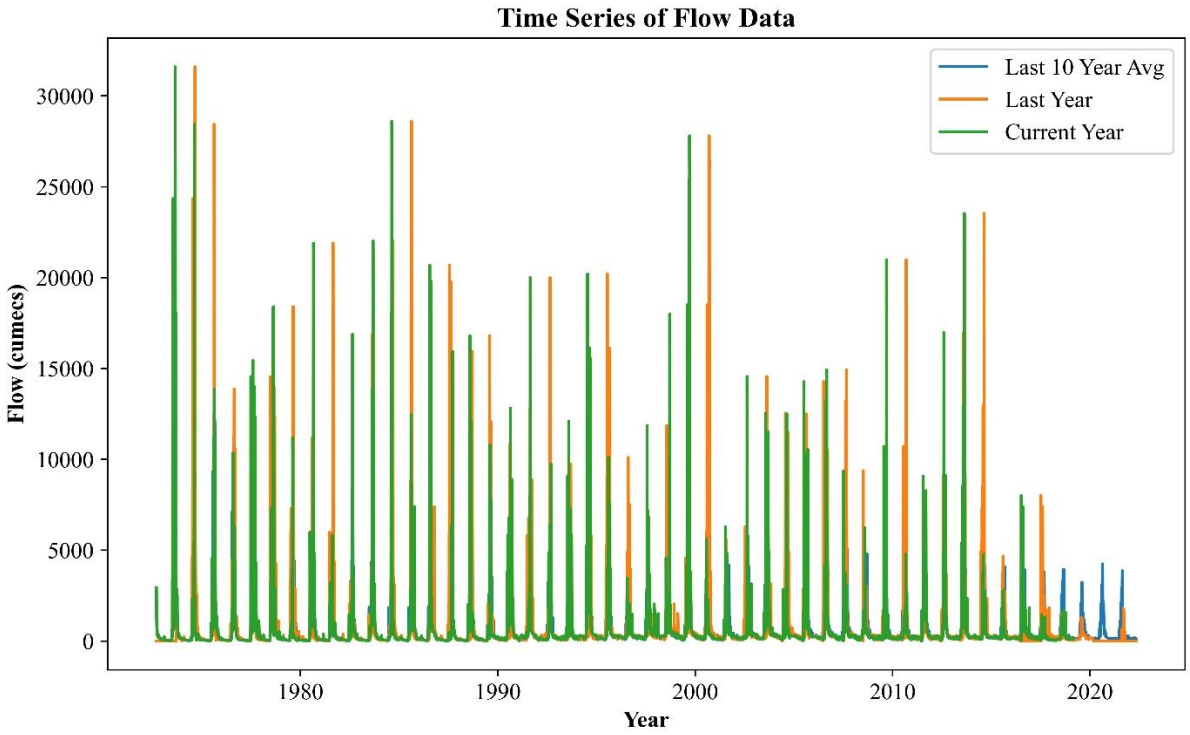
Station Name: Handia

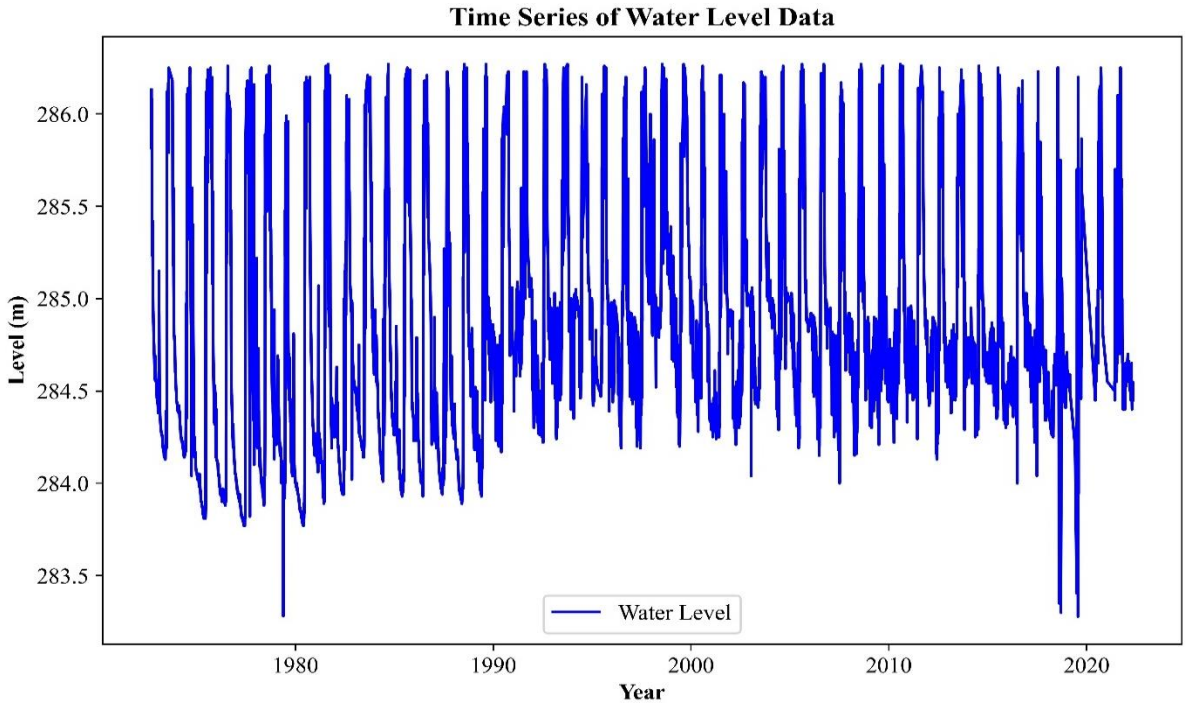




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

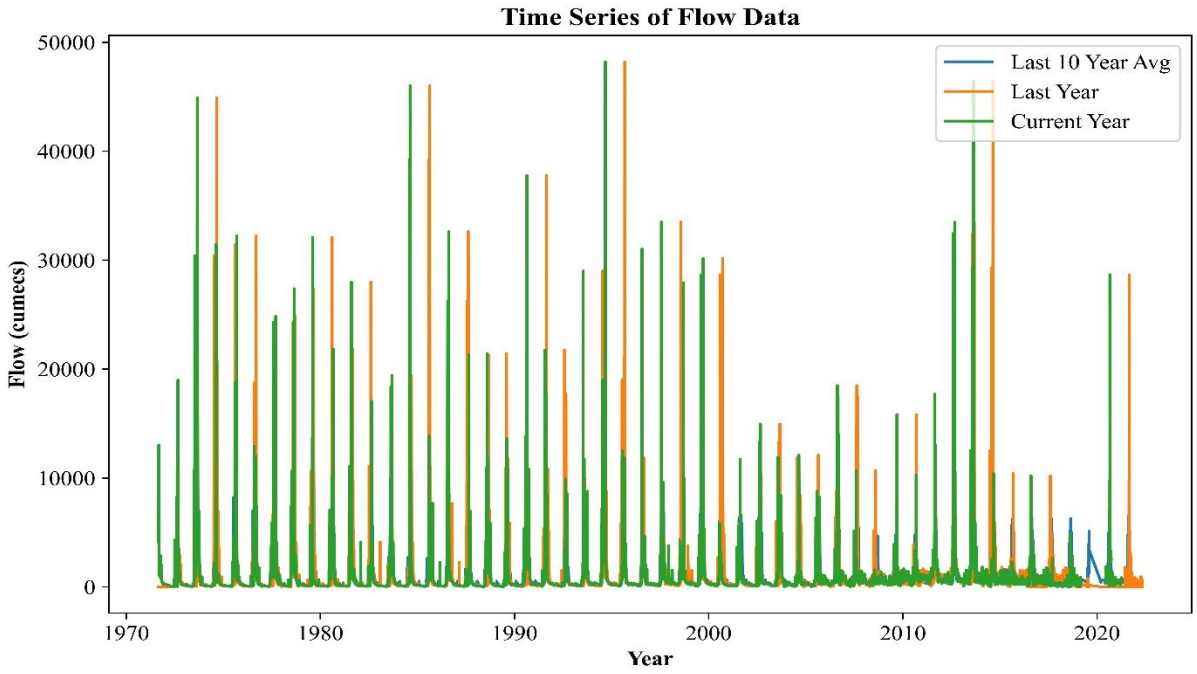
Station Name: Hoshangabad

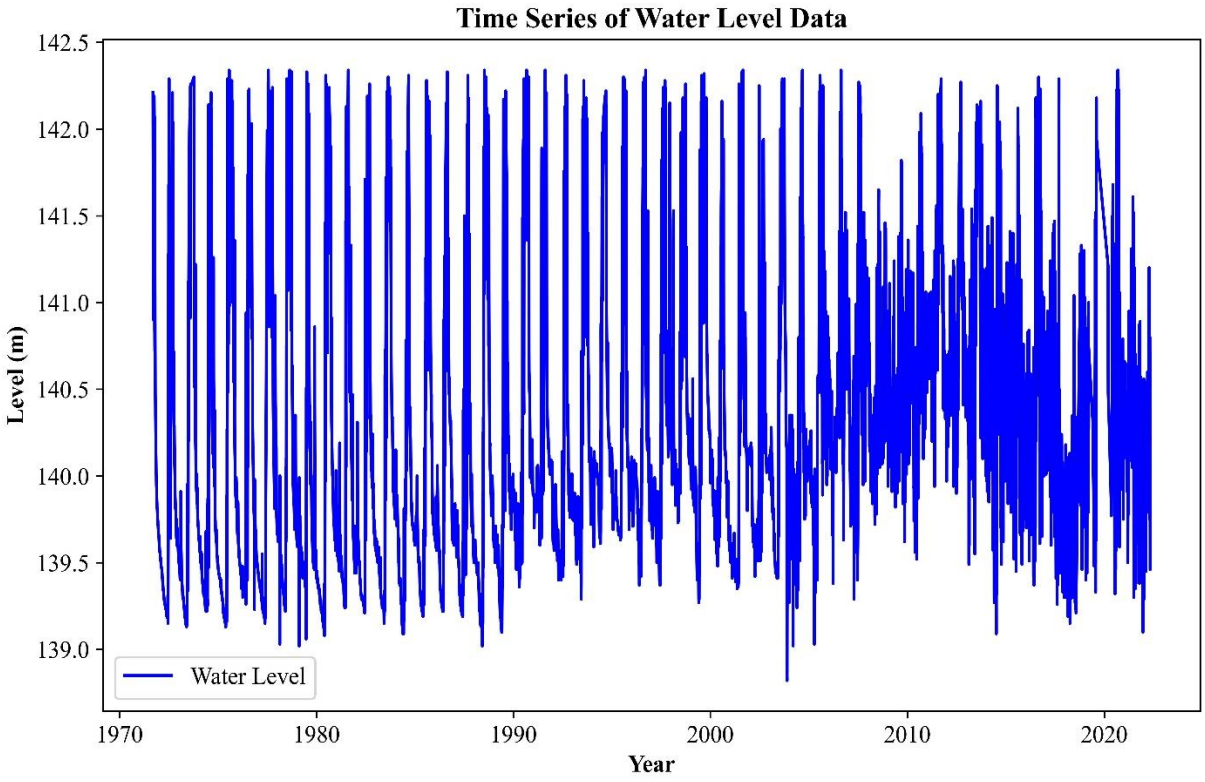




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

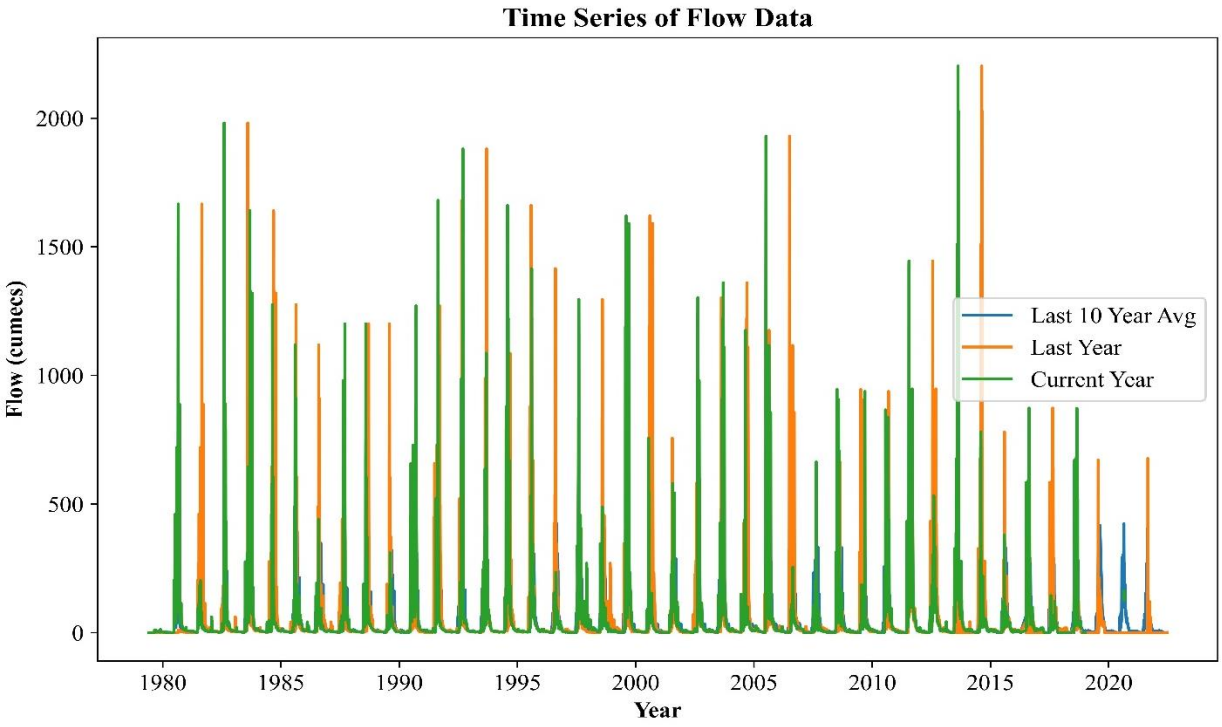
Station Name: Mandleshwar

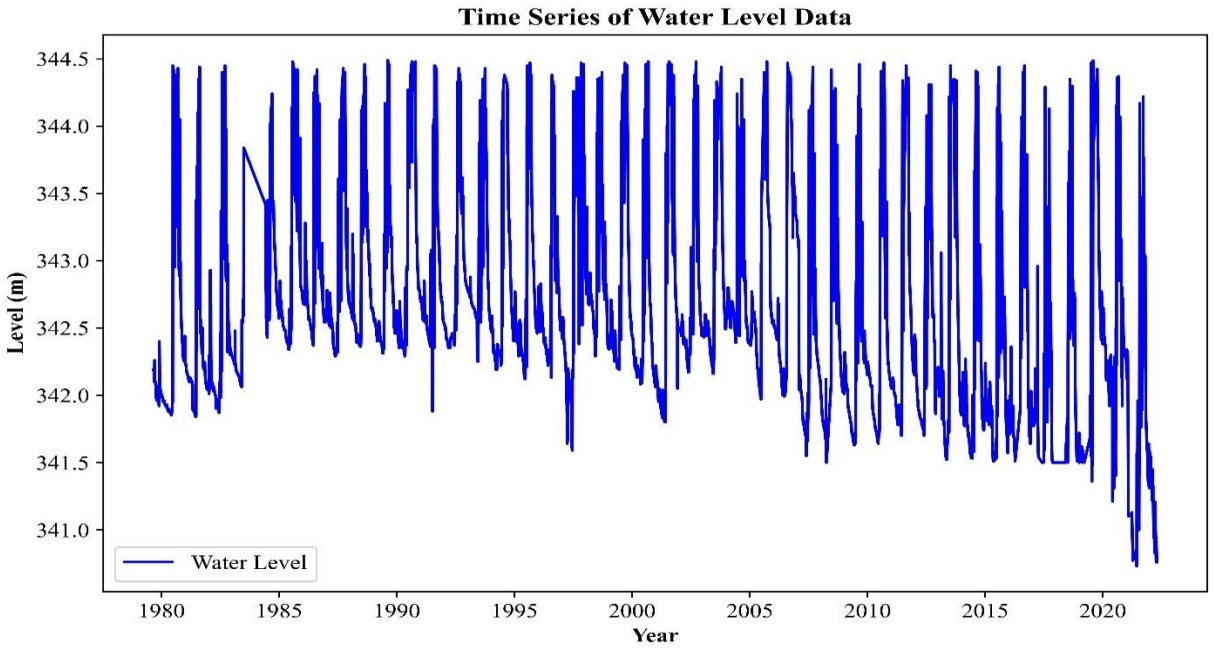




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

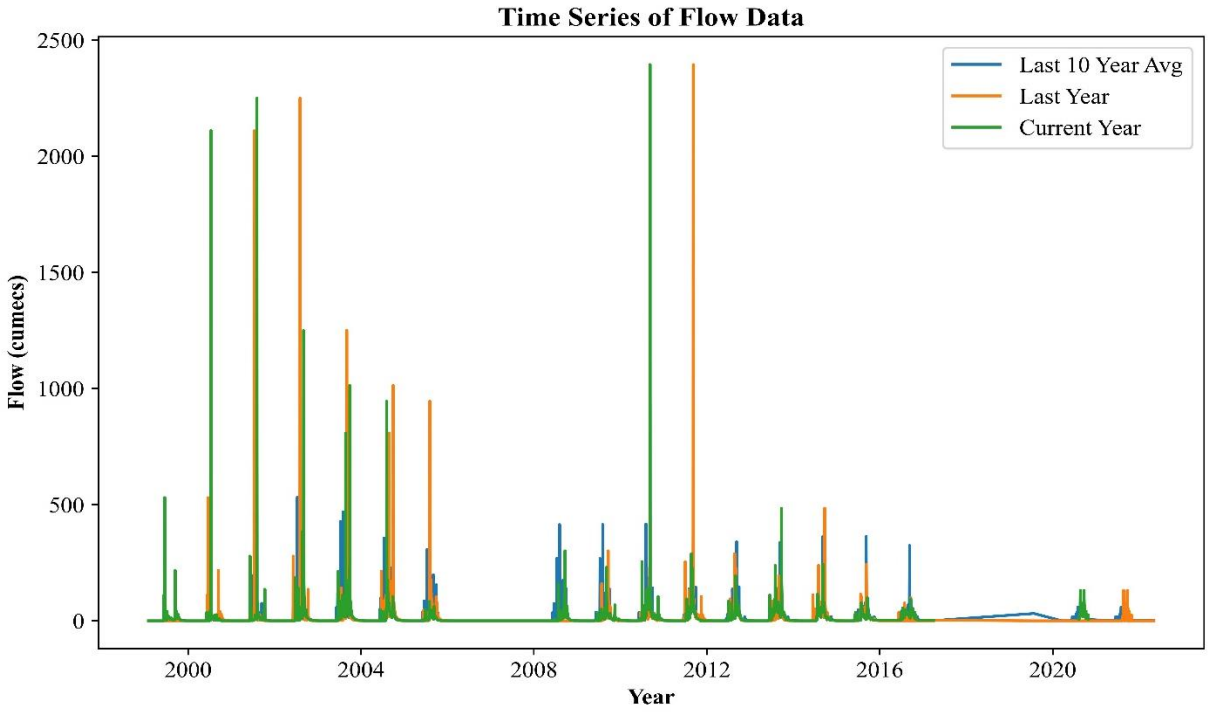
Station Name: Patan

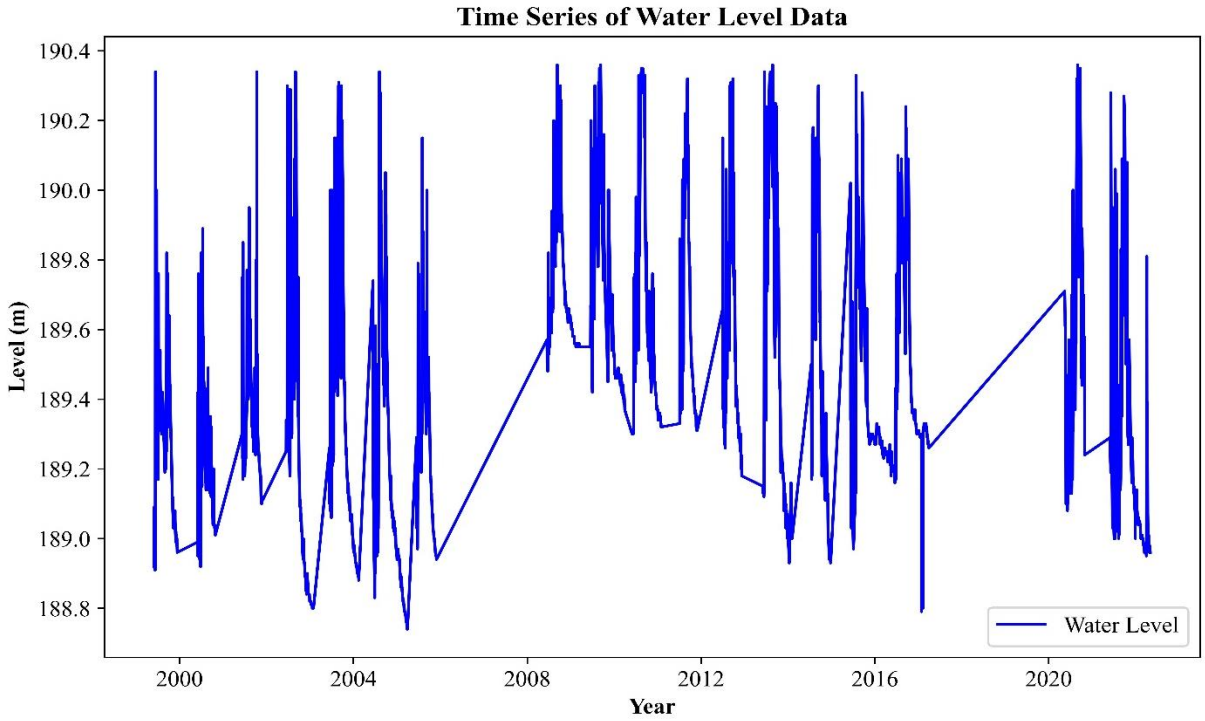




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

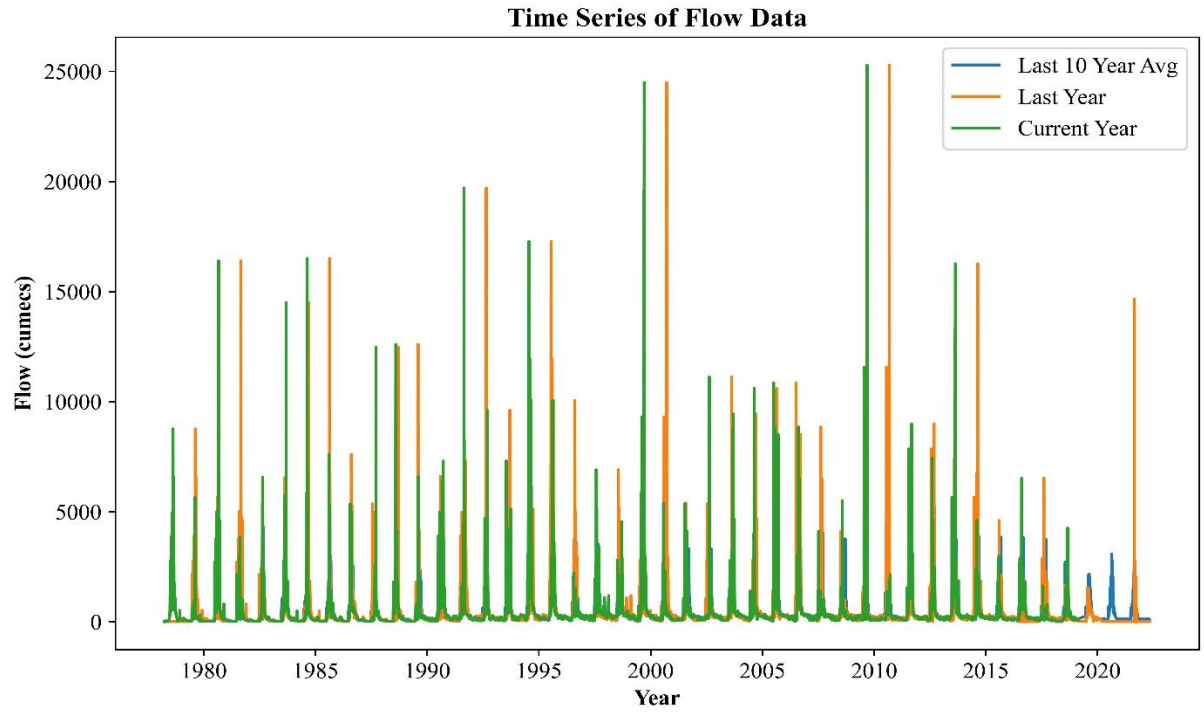
Station Name: Pati

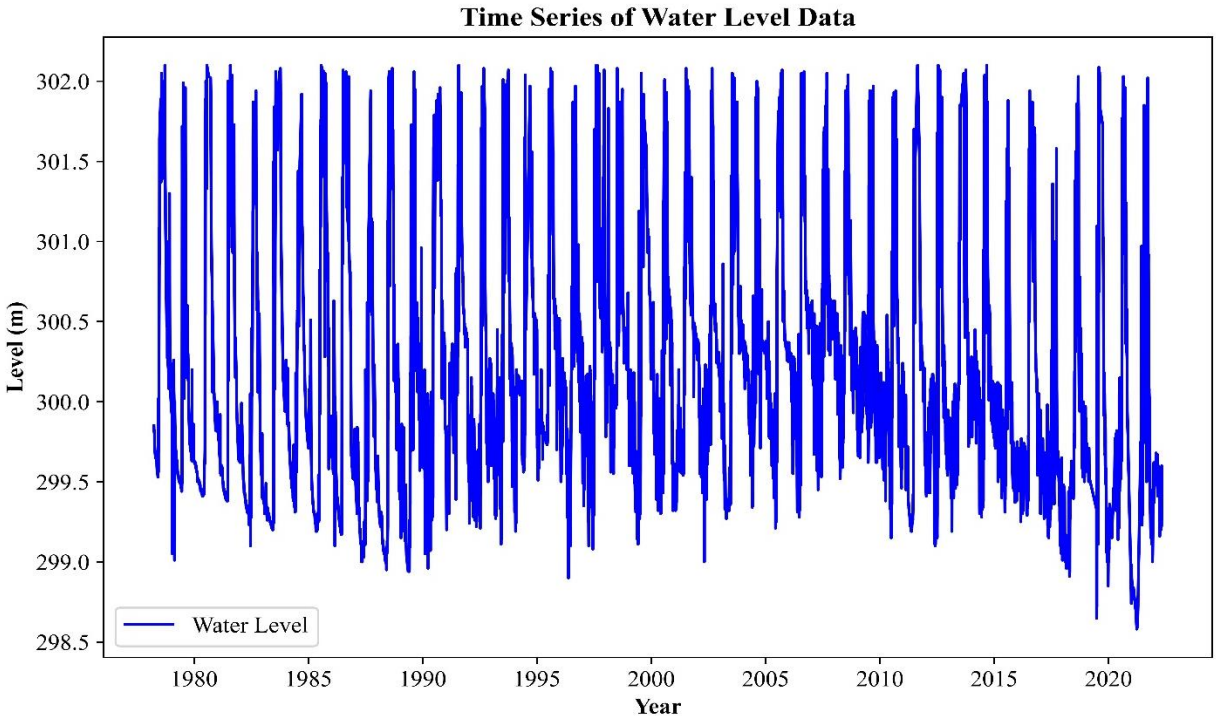




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

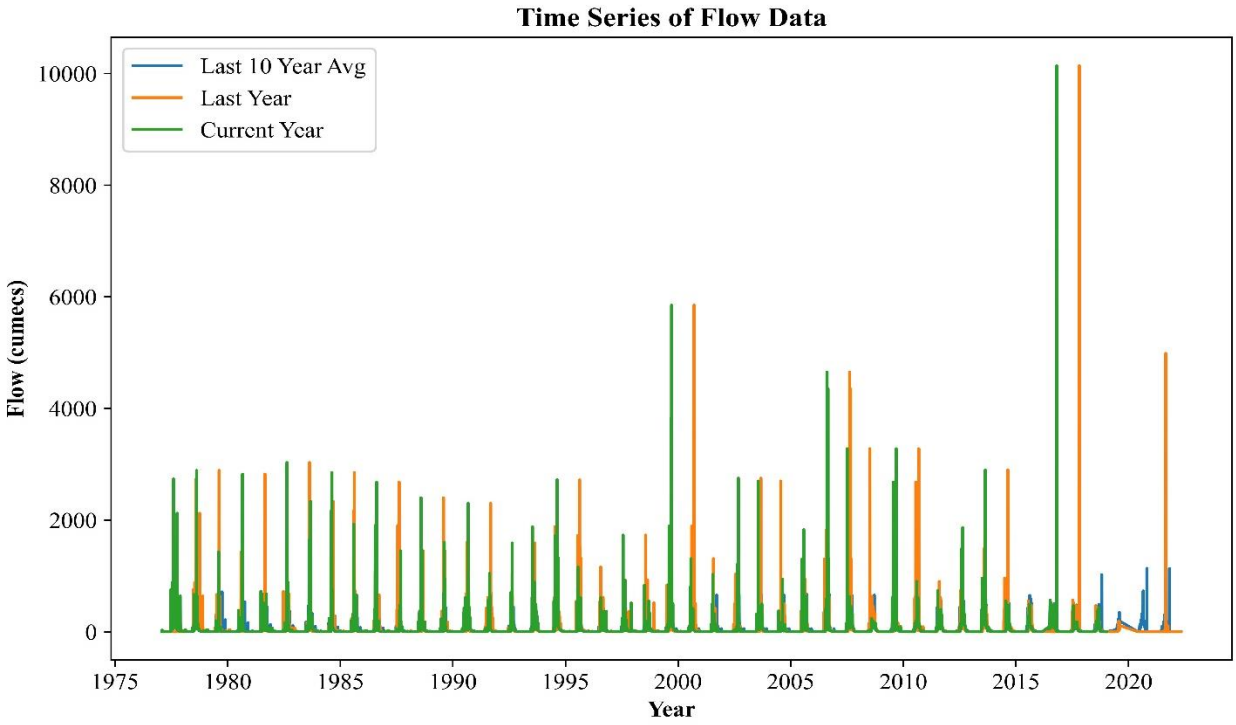
Station Name: Sandia

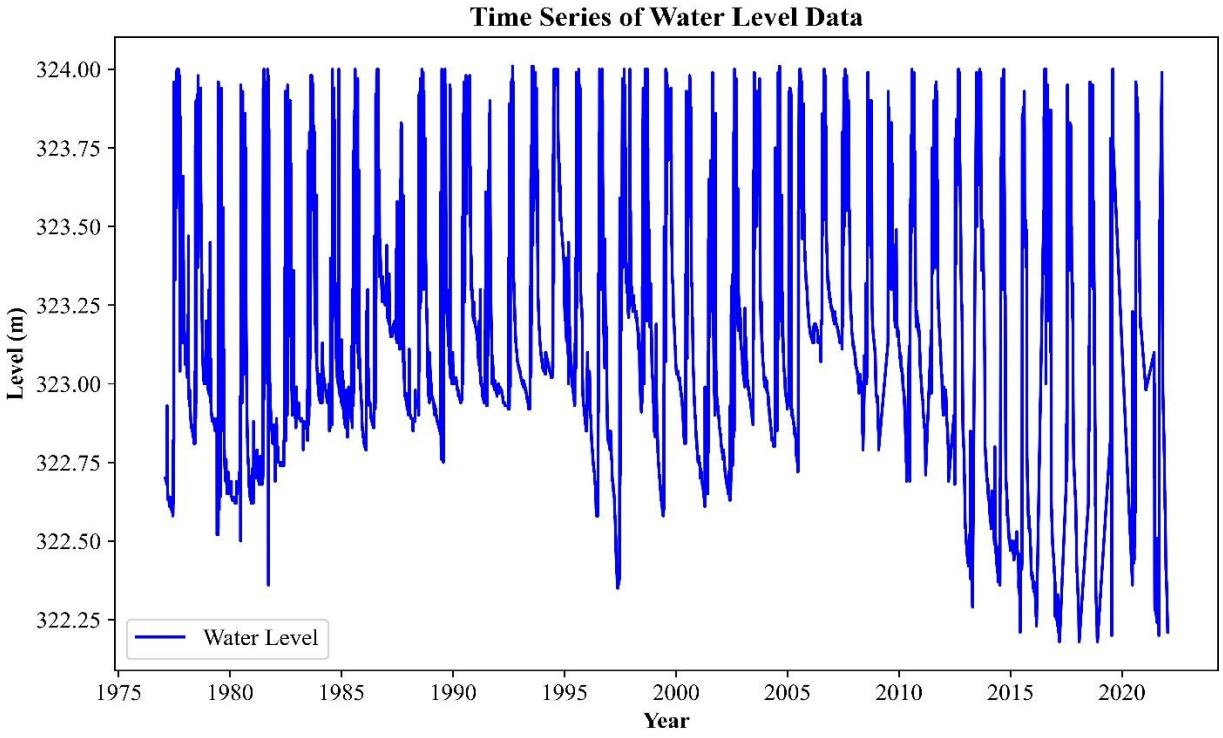




Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

Station Name: Shakkar





Source: *India Water Resources Information System (https://indiawris.gov.in/wris/)*

4. Conclusions

The Narmada River basin is divided into Upper (UN), Middle (MN), and Lower (LN) sub-basins, each with distinct hydrological characteristics. The Upper Narmada shows high variability in water levels and flow, influenced by rugged terrain and rainfall dependency, with stations like Dindori recording extreme water levels of up to 1,480.09 m in July 2020. Middle Narmada basin stations such as Mandleshwar display transitional hydrology, with a peak discharge of 48,200 cumecs reflecting critical flood dynamics. Downstream stations, like the Sardar Sarovar Dam, maintain subdued and controlled flows, with maximum water levels of 155.58 m, emphasizing their importance in regulating terminal flows and mitigating floods.

Time series data reveal seasonal peaks during the monsoon, with upstream stations exhibiting higher variability, such as Belkund at Ghughara, where levels ranged from 357.52 m to 376.82 m in 2021. Midstream stations like Hoshangabad recorded post-monsoon flows 20% higher than the 10-year average, showcasing climatic variability. Downstream flow at Bharuch remained steady due to dam regulation, with water levels capped at 10.72 m. Comparisons between the 10-year average and current year flow trends reveal deviations, including drought-like pre-monsoon conditions at Mandleshwar, where flows were 15% lower than average, and intensified monsoon-driven runoff upstream.

The Narmada's hydrological monitoring network comprises 97 stations (93 manual and 4 telemetric), strategically distributed with a focus on upstream variability (45 stations in UN). Telemetric stations enhance real-time monitoring, critical for flood forecasting and water management. The quantitative analysis from time series plots and rating curves highlights the basin's dependency on monsoonal flows, with seasonal discharge peaks 20–30% higher than annual averages. Overall, these findings stress the need for robust monitoring, expanded real-time systems, and integrated data analysis to optimize flood mitigation, sustainable water resource planning, and climate resilience across the basin.