International Journal of Enhanced Research in Educational Development (IJERED)
ISSN: 2320-8708, Vol. 12 Issue 4, July.-August, 2024, Impact Factor: 8.376

Changing Climatic Patterns in India: A Detailed View

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India's climate has never been fixed, but the changes witnessed since 1950 are sharper and faster than at any point in recorded history. Compared to the 1971–2000 baseline used by the India Meteorological Department, the country today is warmer, more variable, and increasingly prone to extremes. These shifts matter deeply because over 65 percent of Indians rely on climate-sensitive sectors like farming, water, and forestry. Climate change in India is no longer a distant forecast; it is a lived reality shaping livelihoods, health, and the economy.

Observed Changes Across India

The clearest signal is temperature. All-India mean annual temperature has risen by 0.7 degrees Celsius since 1901, and 2023 was the warmest year on record at 0.65 degrees above the 1981–2010 average. Heatwaves have increased in frequency by 24 percent between 2010 and 2022 compared to 1981–2009, and they now last longer. In May 2024, Phalodi in Rajasthan recorded 50.5 degrees Celsius.

Rainfall shows a more complicated story. While the all-India southwest monsoon total has not fallen drastically, its character has changed. The west coast and parts of central India are getting 10 to 20 percent more rain, while the Indo-Gangetic Plain and Northeast are seeing a 10 to 20 percent decline. What has risen sharply everywhere is extreme rain. Days with over 150 mm of rainfall have increased by 75 percent since 1950, causing urban floods in Mumbai in 2019, Kerala in 2018, and Delhi in 2023.

Droughts are also intensifying. The area prone to drought has expanded by 57 percent since 1997, and India now faces more "compound events" where heatwaves and droughts hit together. Cyclones are another marker of change. The Arabian Sea, once relatively calm, has seen a 300 percent rise in cyclonic storms between 1980 and 2020, with severe events like Tauktae in 2021 and Biparjoy in 2023. In the Bay of Bengal, cyclones are fewer but more intense, as seen with Fani in 2019.

Along the 7,500 km coastline, sea levels are rising at 3.3 mm per year since 2000, faster than the 20th-century average. The Sundarbans are losing land every year, and cities like Mumbai, Chennai, and Kolkata face higher flood risk by 2050. In the Himalayas, glaciers are retreating at an average of 12.6 meters per year. Gangotri glacier has pulled back over 1,500 meters since 1935, threatening river flows in the long term.

Regional Variations

These changes are not uniform. Northwest India, including Rajasthan, Gujarat, Punjab, and Haryana, has warmed by about 1.2 degrees Celsius, the highest in the country. The region now sees more than 40 days above 45 degrees each summer, yet also faces sudden extreme rain. In 2023, Jaipur received 200 mm in 48 hours after weeks of heat.

The Indo-Gangetic Plain is seeing a 10 percent decline in monsoon rain since 1950, but when rain comes, it is often in short, intense bursts that cause floods. The same district can face a flood in July and a dry spell in August. Winter fog has also increased by 50 percent due to temperature inversions and pollution.

The Himalayas and Northeast are warming at 1.5 degrees, double the global average. Apple cultivation in Himachal has moved 400 meters uphill. Cherrapunji, once the wettest place on earth, now gets 20 percent less rain, but extreme events have doubled. Glacial lake outburst floods are rising, as seen in Chamoli in 2021 and Sikkim in 2023.

Peninsular India shows a split: the west coast is wetter, while the interior Deccan is drier. Kerala's floods in 2018 and 2019 were linked to extreme rain spells. Cyclone activity in the Arabian Sea has jumped from about one storm per year in the 1980s to three per year in the 2010s. Chennai's heat index crossed 54 degrees Celsius in 2024 due to high humidity plus heat.

Why Is This Happening?

The main driver is global warming from greenhouse gases. Carbon dioxide levels are now 420 parts per million compared to 280 before industrialization. India emits 7 percent of global emissions, though per capita emissions are one-third of the world average. Local factors also matter. Aerosols over the Indo-Gangetic Plain weaken monsoon rainfall but worsen heat. Urbanization creates heat islands; Delhi is 7 degrees hotter than nearby villages at night. Deforestation in the Western Ghats disturbs local rainfall. Natural cycles like El Niño also play a role — the 2023 El Niño contributed to India's hottest year.

Impacts on People and Economy

Agriculture is hit first. A 1 degree rise in March cuts wheat yield by 5 percent. The 2022 heatwave affected 15 million farmers. Per capita water availability fell from 1,545 cubic meters in 2011 to 1,486 in 2021, and NITI Aayog warns 21 cities may run out of groundwater by 2030. Health impacts are rising too. Over 25,000 heat-related deaths occurred between 1992 and 2020, and diseases like dengue are now found in Himalayan towns. The RBI estimates climate events cost 5.4 percent of GDP in 2023, and the ILO calculates 101 billion work hours lost to heat each year. The World Bank projects 45 million Indians could migrate by 2050 due to climate stress, with Marathwada and the Sundarbans as hotspots.

India's Response

India has committed under its NDCs to cut emission intensity of GDP by 45 percent by 2030 and reach 500 GW of non-fossil power. As of 2023, 175 GW is installed. The National Action Plan on Climate Change runs eight missions, and all states have State Action Plans. Rajasthan's Jal Swavlamban Abhiyan builds water harvesting structures. Early warning has improved: IMD gives 5-day heatwave forecasts and district agromet advisories. Cyclone deaths fell from 10,000 in 1999 to under 100 during Cyclone Fani in 2019 due to better forecasts and evacuation. New programs like MISHTI for mangroves and the Green Credit Programme aim to build resilience.

The Way Ahead

India needs finer risk maps down to the panchayat level. Climate-smart farming with heat-tolerant wheat like HD 3385, direct seeded rice, and solar pumps must scale up. Cities need cool roofs; Ahmedabad's project cut indoor temperatures by 4 degrees. Traditional water systems like Rajasthan's khadin and johads should be revived with MGNREGS. Finance is critical: India needs 2.5 trillion dollars by 2030 to meet climate goals. The Loss and Damage Fund agreed at COP28 must support farmers who lost 15,000 crore rupees to unseasonal rain in Rajasthan in 2022.

CONCLUSION

The era of a "normal monsoon" is over. India now lives with "normal extremes." Temperature is up, rain is erratic, cyclones are stronger, and heatwaves deadlier. Yet the response is also evolving, from disaster relief to risk reduction, from solar power to early warnings for 1.4 billion people. The task is to cut emissions without cutting development, and to adapt without leaving the poor behind. Every fraction of a degree matters, and for India, every village pond, heat action plan, and drought-tolerant seed matters too. Climate change is no longer just an environmental issue; it is the context for India's 21st-century growth story.

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