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# IMD Heatwave Alerts Across North India & Early Monsoon Onset Forecast

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# IMD Heatwave Alerts Across North India & Early Monsoon Onset Forecast

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**WHY IN NEWS:**

The **India Meteorological Department (IMD)** on May 17, 2026 issued **heatwave warnings across nine states/UTs** — Rajasthan, Uttar Pradesh, Madhya Pradesh, Punjab, Haryana, Delhi, Chandigarh, Chhattisgarh, and Konkan & Goa — valid through May 22. A **Red Alert (severe heatwave)** was declared for **Bikaner, Jodhpur, Jaisalmer, and Barmer** districts of Rajasthan, with **temperatures of 40–45°C** recorded across Central India, Gujarat, and Rajasthan; Delhi is projected to touch **44°C** by May 21. Simultaneously, IMD forecast **Southwest Monsoon onset over Kerala on May 26, 2026 — five days ahead of the normal onset date of June 1** — with the monsoon already active over the **Andaman & Nicobar Islands** and the **southwest Bay of Bengal**.

## IMD HEATWAVE WARNINGS — MAY 17–22, 2026

### Spatial Coverage of Alerts

| ALERT LEVEL | REGIONS |
|---|---|
| **Red Alert** (Severe Heatwave) | Bikaner, Jodhpur, Jaisalmer, Barmer (Rajasthan) |
| **Orange Alert** (Heatwave) | Rest of Rajasthan, MP, UP, Haryana, Punjab, Delhi, Chandigarh, Chhattisgarh |
| **Orange/Yellow Alert** (Thunderstorm/Rain) | Bihar, Jharkhand, Odisha, eastern UP — 17 states simultaneously |
| **Konkan & Goa** | Heatwave alert (coastal humidity + high temperatures compounding heat stress) |

- Temperatures on May 17: **40–45°C** across Central India, Gujarat, Rajasthan, Haryana
- Delhi forecast: **44°C by May 21**; projected **3–5°C further rise** from May 17 baseline
- 17 states simultaneously under thunderstorm/rain warnings — eastern India experiencing contrasting conditions driven by a Bay of Bengal moisture surge

## IMD Colour-Coded Alert System

IMD uses a **four-colour tiered alert system** for extreme weather:

| COLOUR | MEANING | ACTION |
|---|---|---|
| **Green** | No warning | Routine monitoring |
| **Yellow** | Watch — conditions may worsen | Stay updated |
| **Orange** | Alert — prepare for disruption | Take precautions |
| **Red** | Warning — severe event imminent/occurring | Take immediate action |

The system is designed to communicate risk to district administrations for activating **Heat Action Plans (HAPs)** and deploying disaster response resources.

## WHAT CONSTITUTES A HEATWAVE — IMD DEFINITION

IMD defines a **heatwave** based on absolute temperature thresholds and departure from normal:

| CRITERION | |
|---|---|
| **Plains** — absolute temperature | ≥ 40°C |
| **Hills** — absolute temperature | ≥ 30°C |
| **Coastal stations** — absolute temperature | ≥ 37°C |
| **Departure from normal** | +4.5°C to +6.4°C = Heatwave; ≥ +6.5°C = Severe Heatwave |
| **Declaration rule** | At least 2 stations in a meteorological sub-division must cross threshold on at least 2 consecutive days |

A **Severe Heatwave** is declared when the departure from normal maximum temperature exceeds **+6.5°C**, or when the actual maximum temperature reaches **≥45°C**. Bikaner, Jaisalmer, and Barmer routinely cross 47–50°C during peak summers, qualifying for Red Alerts.

### Why Rajasthan is Most Vulnerable

- **Thar Desert geography** — low vegetation cover, high albedo during the day transitioning to high nocturnal radiative cooling; daytime soil heating is extreme
- **Low humidity** — dry heat accelerates dehydration and heat stress

- **Distance from moisture sources** — no Bay of Bengal or Arabian Sea moisture reaches the region until monsoon onset
- **Low groundwater** — water scarcity amplifies heat mortality risk

## HEAT ACTION PLANS (HAPS) — INDIA'S INSTITUTIONAL RESPONSE

India has operationalised **Heat Action Plans** at city and state levels, pioneered by **Ahmedabad (2013)** — the first city HAP in South Asia, developed after the **2010 Ahmedabad heat event** (1,344 excess deaths).

| COMPONENT | DESCRIPTION |
|---|---|
| **Early Warning System** | IMD colour-coded alerts trigger automatic state-level response |
| **Inter-agency coordination** | Health, water supply, NDRF, municipality, media |
| **Cool spaces** | Designated shaded/air-conditioned public spaces |
| **Night-time shelters** | For outdoor workers and homeless populations |
| **Community messaging** | ORS distribution, hydration awareness in local languages |
| **Medical preparedness** | Heat stroke treatment protocols in district hospitals |

**NDMA (National Disaster Management Authority)** issued updated **Heat Action Plan guidelines in 2019**, which set the template for state and district-level plans. However, coverage remains uneven — most HAPs are in western and central India; eastern India HAPs are nascent despite increasing heat events.

## SOUTHWEST MONSOON ONSET — MAY 26 FORECAST

### What IMD Forecast

IMD's **Long Range Forecast (LRF)** dated around May 14–17, 2026 projects:

| PARAMETER | DETAIL |
|---|---|
| **Forecast onset date — Kerala** | **May 26, 2026** |
| **Normal onset date — Kerala** | **June 1** |
| **Days ahead of normal** | **5 days** |
| **Onset already confirmed** | Andaman & Nicobar Islands, southwest Bay of Bengal |
| **Seasonal rainfall forecast** | **92% of Long Period Average (LPA)** |
| **LPA classification** | Below Normal (90–95% of LPA = Below Normal; <90% = Deficient) |

## How IMD Declares Monsoon Onset Over Kerala

IMD applies a **multi-parameter criterion** (not just rainfall alone) to declare onset:

| CRITERION | THRESHOLD |
|---|---|
| **Rainfall** | Widespread rainfall (60% of stations) with ≥2.5 mm on 5 consecutive days in Kerala/Lakshadweep |
| **Wind field** | Westerly winds in lower troposphere (850 hPa) over Arabian Sea, depth ≥ 600m |
| **Outgoing Longwave Radiation (OLR)** | < 200 W/m² over southeast Arabian Sea and Bay of Bengal |
| **Sea Surface Temperature (SST)** | Arabian Sea SST ≥ 28°C sustained |

These criteria were **revised by IMD in 2017** — prior to this, onset was declared primarily on rainfall alone, leading to premature or delayed declarations. The current multi-parameter approach provides greater scientific rigour.

## Monsoon Progression Timeline (Normal Dates)

| LOCATION | NORMAL ONSET DATE |
|---|---|
| Andaman & Nicobar Islands | May 20 |
| Kerala | June 1 |
| Goa, Karnataka coast | June 5–7 |
| Mumbai | June 11 |
| Delhi | June 27–29 |
| Rajasthan (complete) | July 15 |
| Entire India | July 15 |

A **5-day early onset over Kerala** typically signals a strong initial monsoon surge — though seasonal rainfall totals are determined by mid-season factors including Bay of Bengal cyclogenesis, Western Disturbances, and ENSO conditions.

# EL NIÑO AND THE 92% LPA FORECAST — THE CLIMATE DRIVER

## NOAA El Niño Probability — May 2026

| PERIOD | PROBABILITY |
|---|---|
| **May–July 2026** | **82%** El Niño conditions |
| **Dec 2026 – Feb 2027** | **96%** El Niño conditions |

*(Source: NOAA CPC/IRI Forecast, issued May 14, 2026)*

## El Niño Mechanism

**El Niño** (Spanish for "the boy/Christ child") refers to the **anomalous warming of central and eastern equatorial Pacific Ocean** surface waters. It is the warm phase of the **El Niño-Southern Oscillation (ENSO)** cycle.

**Physical mechanism:**

1. Normally, the Walker Circulation drives **trade winds westward** across the Pacific, piling up warm water in the western Pacific (near Indonesia/Australia) and upwelling cold water off the coast of Peru

2. During El Niño, the **trade winds weaken** — warm water spreads eastward toward South America
3. The **ITCZ (Inter-Tropical Convergence Zone) and convection shift eastward** — reducing moisture and convective activity over the Indian Ocean region
4. The result for India: **weakened southwest monsoon, reduced rainfall**, particularly over peninsular and central India

**ENSO Indices used to define El Niño:**

- **Niño 3.4 region** (5°N–5°S, 120°W–170°W) SST anomaly ≥ **+0.5°C** sustained for 5 overlapping 3-month seasons = El Niño
- **Southern Oscillation Index (SOI):** measures sea-level pressure difference between Darwin (Australia) and Tahiti — negative SOI = El Niño

## El Niño and India Monsoon — Historical Evidence

| EL NIÑO YEAR | INDIA MONSOON OUTCOME |
|---|---|
| 1987 | 81% of LPA — severe drought |
| 2002 | 81% of LPA — severe drought |
| 2009 | 78% of LPA — worst drought since 2002 |
| 2014 | 88% of LPA — below normal |
| 2015 | 86% of LPA — below normal |
| 2023 | 94% of LPA — below normal (but within range) |

**Important caveat:** El Niño is a **probabilistic** influence, not deterministic. The **Indian Ocean Dipole (IOD)** can partially counteract El Niño's suppressive effect. A **positive IOD** (warm western Indian Ocean) often compensates for weak El Niño years. IMD's **2026 forecast of 92% LPA** reflects the combined signal — El Niño suppression partially offset by neutral-to-positive IOD and warmer-than-normal Arabian Sea SSTs.

### Classification of Seasonal Rainfall

| CATEGORY | % OF LPA |
|---|---|
| Deficient | < 90% |
| **Below Normal** | **90–95%** |
| Normal | 96–104% |
| Above Normal | 105–110% |
| Excess | > 110% |

At **92% of LPA**, the 2026 monsoon forecast falls in the **Below Normal** band — sufficient to avoid a drought declaration but sufficient to stress **rain-fed agriculture** in Rajasthan, Vidarbha, Marathwada, and interior Karnataka, which depend on high seasonal totals.

## HEATWAVE + MONSOON DELAY — AGRICULTURAL AND FOOD SECURITY IMPLICATIONS

### Kharif Season Stress

The **kharif crop calendar** (June–October) is tightly coupled to monsoon onset:

| CROP | SOWING WINDOW | MONSOON DEPENDENCE |
|---|---|---|
| Rice (paddy) | June–July | High — 80%+ area is rain-fed |
| Cotton | April–June | High — Vidarbha, Gujarat |
| Soybean | June–July | High — MP, Rajasthan |
| Maize | June–July | Moderate |
| Sugarcane | Year-round | Moderate (irrigation-supplemented) |

An **early monsoon onset (May 26)** is favourable for kharif sowing preparation. However, **92% LPA overall** with **El Niño** conditions means mid-season rainfall may be spatially uneven — pre-monsoon heatwaves stress soil moisture and may delay germination even after rains arrive.

### Heat Mortality and Labour Productivity

- India loses an estimated **101 billion labour hours per year** to heat stress (Lancet Countdown, 2024 estimate)
- Construction, agriculture, and informal sector workers are most exposed
- Health Ministry's **National Programme on Climate Change and Human Health (NPCCBH)** includes heat-specific protocols for state health systems

## UPSC RELEVANCE

### GS Paper 1 — Indian Geography

- Southwest Monsoon: onset criteria, normal dates, spatial progression across India
- El Niño and La Niña: mechanism, ENSO cycle, effect on Indian monsoon
- Heatwave geography: why Rajasthan, MP, and Delhi are most affected; Thar Desert influence
- Long Period Average (LPA): how it is calculated and used in seasonal forecasting

### GS Paper 3 — Economy, Environment, Disaster Management

- Agriculture and monsoon dependence: kharif sowing calendar, rain-fed farming stress under below-normal monsoon
- Food security implications of below-normal rainfall + El Niño
- Disaster Management: Heat Action Plans — Ahmedabad model, NDMA guidelines, institutional framework
- Climate change and heatwave intensification: attribution science, urban heat island effect
- IMD's role in disaster early warning — colour-coded alert system, multi-parameter monsoon onset declaration

**Keywords:** IMD heatwave, Red Alert, Heat Action Plan, Southwest Monsoon onset, Long Period Average (LPA), El Niño, ENSO, SOI, Indian Ocean Dipole (IOD), Niño 3.4 region, kharif season, Thar Desert, NDMA, OLR criterion, monsoon onset Kerala, below-normal rainfall, 92% LPA.

*Established 1875; under Ministry of Earth Sciences (MoES); headquarters New Delhi. IMD is the* **nodal agency for weather forecasting, cyclone warning, and seasonal monsoon outlook** *in India. It issues* **6 seasonal outlooks** *per year for the southwest monsoon (April onset, May update for Kerala, June–September monthly updates).*

*The ENSO cycle oscillates between El Niño (warm Pacific), La Niña (cold Pacific), and Neutral phases with a periodicity of* **2–7 years**. *The* **Southern Oscillation** *is the atmospheric component (SOI);* **El Niño** *is the oceanic component. The* **Niño 3.4 index** *(SST anomaly in 5°N–5°S, 120°W–170°W) is the primary benchmark. NOAA's Climate Prediction Center (CPC) and the International Research Institute for Climate and Society (IRI) issue monthly ENSO forecasts.*

*IMD defines the* **LPA for the southwest monsoon as the average rainfall over the Indian subcontinent for the June–September period**, *calculated over* **50 years (1971–2020)**. *The current LPA is* **87 cm** *(870 mm). Seasonal forecasts express expected rainfall as a percentage of this LPA. LPA was previously calculated over 1951–2000 (89 cm); the 2020 rebasing to 1971–2020 updated it.*

*Ahmedabad became* **India's first city with a Heat Action Plan in 2013** *following the 2010 heat event; developed with Natural Resources Defense Council (NRDC) and IIPH (Indian Institute of Public Health Gandhinagar). NDMA issued national HAP guidelines in 2019. As of 2025, over 100 Indian cities have HAPs, though quality and implementation vary significantly. HAPs are aligned with IMD alert triggers — Orange and Red alerts are pre-agreed cues for activating cooling centres, ORS distribution, and hospital preparedness.*

*IMD declared* **Kerala onset** *as the formal beginning of the monsoon season for India. The* **multi-parameter criterion** *(2017 revision) requires: (i) rainfall ≥ 2.5 mm at 60%+ stations in Kerala/Lakshadweep over 5 days; (ii) westerly winds at 850 hPa; (iii) OLR < 200 W/m². The* **Andaman & Nicobar onset** *(normally May 20) precedes Kerala by ~10 days, making it a reliable precursor indicator. Early Kerala onset has a weak but positive statistical correlation with above-normal all-India seasonal rainfall.*

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