



Uttar Pradesh Floods Intensify as Bay of Bengal Depression and Western Disturbance Interact During Monsoon Withdrawal

Published On: 01-10-2026

Recent Developments:

- An intense **three-day wet spell** from September 25–27, 2026, produced flood-like conditions in several districts of **Uttar Pradesh**, disrupting normal life, damaging houses and affecting standing crops.
- According to the **Office of the Relief Commissioner, Uttar Pradesh**, **56 people died and 46 were injured** in rain- and storm-related incidents between September 25 and the morning of September 27, while **1,021 houses were damaged**.
- The India Meteorological Department (IMD) attributed heavy to very heavy rainfall over parts of Uttar Pradesh and Uttarakhand on September 26–27 to a **Depression over northeast Madhya Pradesh and adjoining north Chhattisgarh**.
- The episode occurred during the **withdrawal phase of the Southwest Monsoon**, when interactions between different atmospheric systems can produce intense, localised rainfall.
- By September 29, the IMD's subdivision warnings showed **no further warning for East or West Uttar Pradesh from September 30 onward**, indicating that the immediate severe-weather phase had eased.

Meteorological Causes of the Uttar Pradesh Flood Situation:

The Bay of Bengal Depression:

- The primary weather system associated with the Uttar Pradesh rainfall was a **depression that developed over the Bay of Bengal**, moved inland and subsequently weakened while travelling northwestward.
- After crossing the **North Andhra Pradesh–South Odisha coast**, the system weakened as it moved inland but continued to transport substantial moisture towards central and northern India.
- The system was subsequently located over **northeast Madhya Pradesh and adjoining north Chhattisgarh**, where it influenced rainfall over Uttar Pradesh and Uttarakhand.
- A weakening depression can continue to produce substantial rainfall because its circulation transports **moisture and convergence** even after its wind intensity declines.

Western Disturbance:

- A **Western Disturbance** is an eastward-moving extra-tropical weather system that generally affects northern and northwestern India, particularly during winter but occasionally interacts with other atmospheric systems during transitional seasons.
- Western Disturbances originate in the **mid-latitude westerly circulation** and are embedded in the subtropical westerly jet stream.
- They can transport moisture towards the Indian subcontinent and produce **cloudiness, rainfall, thunderstorms and snowfall** over suitable regions.

- During the September 2026 episode, the interaction between the inland depression and an upper-air Western Disturbance contributed to an environment favourable for intense rainfall over parts of northern India.

Why the Interaction Matters:

- The rainfall episode illustrates how **tropical and extra-tropical weather systems can interact** during the transition between the monsoon and post-monsoon circulation regimes.
- The Bay of Bengal system supplied **tropical moisture**, while the Western Disturbance represented an upper-level mid-latitude influence.
- Such interactions can increase atmospheric instability and enhance **convergence, cloud development and precipitation** over particular regions.
- The impact is especially important over the **Indo-Gangetic Plain**, where high population density, extensive agriculture and low-lying flood-prone areas increase vulnerability.

What is a Depression?

Formation and Structure:

- A **depression** is an organised low-pressure system with stronger circulation and winds than an ordinary low-pressure area.
- The India Meteorological Department classifies a system as a **Depression** when its maximum sustained surface wind speed is **17–27 knots**, equivalent to approximately **31–49 km/h**.
- A **Deep Depression** has maximum sustained winds of **28–33 knots**, equivalent to approximately **50–61 km/h**.
- A system reaches the **Cyclonic Storm** category when maximum sustained winds reach **34 knots or more**, equivalent to approximately **62 km/h or more**.

How a Low-Pressure System Produces Rainfall:

- A low-pressure centre encourages **convergence of air near the surface**, followed by rising motion.
- Moist air rising through the atmosphere cools and condenses, producing **clouds and precipitation**.
- When a system receives continuous moisture from a warm ocean and atmospheric conditions remain favourable, it can intensify.
- After moving over land, a system generally weakens because of **reduced moisture supply and increased surface friction**, although heavy rainfall may continue during its weakening stage.

Lifecycle of a North Indian Ocean Cyclonic System:

Classification Sequence:

- **Low Pressure Area:** Maximum sustained winds below **31 km/h**.
- **Depression:** Maximum sustained winds of **31–49 km/h**.
- **Deep Depression:** Maximum sustained winds of **50–61 km/h**.
- **Cyclonic Storm:** Maximum sustained winds of **62–88 km/h**.
- **Severe Cyclonic Storm:** Maximum sustained winds of **89–117 km/h**.
- **Very Severe Cyclonic Storm:** Maximum sustained winds of approximately **118–167 km/h**.
- **Extremely Severe Cyclonic Storm:** Maximum sustained winds of approximately **168–221 km/h**.
- **Super Cyclonic Storm:** Maximum sustained winds of **222 km/h or more**.

Important UPSC Distinction:

- **Depression is not synonymous with cyclone** because the IMD formally uses the term **Cyclonic Storm** only after the system reaches the prescribed wind-speed threshold.
- Many Bay of Bengal depressions **weaken after moving inland** without developing into cyclonic storms.

Kamaraj IAS Academy

Plot A P.127, AF block, 6 th street, 11th Main Rd, Shanthi Colony, Anna Nagar, Chennai, Tamil Nadu 600040

Phone: **044 4353 9988 / 98403 94477** / Whatsapp : **09710729833**

- Therefore, the presence of a depression does not automatically imply the formation of a cyclone.

Bay of Bengal Depressions and the Indian Monsoon:

Why the Bay of Bengal is Important:

- The **Bay of Bengal** is a major source of moisture for monsoon disturbances affecting the Indian subcontinent.
- Monsoon depressions can transport moisture from the Bay of Bengal deep into **central India, the Gangetic Plains and northern India**.
- Their movement contributes substantially to the spatial and temporal distribution of monsoon rainfall.
- Historical IMD research has documented the importance of Bay of Bengal disturbances in the structure and evolution of monsoon depressions.

Major Rainfall Regions Affected:

- **Gangetic Plains:** Important for agriculture and densely populated settlements.
- **Central India:** Important for rainfall-dependent agriculture and river flows.
- **Northeast India:** Receives moisture from Bay of Bengal systems through the eastern atmospheric circulation.
- **Odisha and West Bengal:** Frequently affected by low-pressure systems and cyclonic disturbances originating over the Bay.

Western Disturbances and Their Interaction with Indian Weather:

Characteristics:

- Western Disturbances are generally **extra-tropical weather systems** embedded within the mid-latitude westerlies.
- Their movement towards India is associated with the **subtropical westerly jet stream**, particularly during the winter season.
- They influence precipitation over **Jammand Kashmir, Himachal Pradesh, Uttarakhand, Punjab, Haryana and adjoining northern regions**.
- Their interaction with other systems can occasionally produce enhanced rainfall over the northern plains.

Significance During Monsoon Withdrawal:

- September marks a major **seasonal transition** as the Southwest Monsoon begins withdrawing from northern and northwestern India.
- During this transition, monsoonal circulation weakens and the atmospheric circulation gradually changes.
- The simultaneous presence of a **moisture-bearing tropical system and an upper-level westerly disturbance** can generate strong rainfall over localised areas.
- Therefore, the monsoon withdrawal phase should not be interpreted as an immediate end to heavy rainfall.

Southwest Monsoon Withdrawal:

IMD Criteria:

- The IMD considers several conditions for declaring the withdrawal of the Southwest Monsoon, including **cessation of rainfall for five continuous days**, establishment of an **anticyclone in the lower troposphere**, and a substantial reduction in atmospheric moisture.
- Further withdrawal is assessed using **spatial continuity, reduction in atmospheric moisture and persistence of dry weather**.
- The complete withdrawal of the Southwest Monsoon from the country depends on the establishment of a changed circulation pattern over the southern peninsula.

Why Withdrawal Does Not Mean Immediate Dry Weather:

- Monsoon withdrawal is a **gradual atmospheric transition**, rather than an abrupt termination of rainfall.
- Residual moisture, low-pressure systems, depressions, upper-air troughs and local convection can continue to produce heavy rainfall.
- This explains why intense rainfall can occur in northern India even while the monsoon is simultaneously withdrawing from other regions.

Flood Risk in Uttar Pradesh:

Physical Factors:

- Uttar Pradesh contains extensive **alluvial plains** with several low-lying and flood-prone areas.
- Major rivers such as the **Ganga, Yamuna, Ghaghara, Rapti, Gandak and their tributaries** drain large parts of the state.
- Heavy rainfall over Uttar Pradesh and adjoining catchments can rapidly increase river discharge and produce **waterlogging, riverine flooding and drainage congestion**.
- Flood risk increases when intense rainfall occurs over a short period because drainage systems and river channels may be unable to accommodate sudden runoff.

Human and Economic Impacts:

- Flooding damages **houses, roads, bridges, crops, electricity infrastructure and public utilities**.
- Agricultural losses are significant because Uttar Pradesh has extensive cultivated land across the Indo-Gangetic Plain.
- Urban areas may experience **waterlogging and disruption of transport and essential services**.
- Repeated flood events can increase livelihood insecurity among farmers and vulnerable rural communities.

Floods as a Disaster-Management Issue:

Disaster Risk Chain:

- **Hazard:** Depression, heavy rainfall, thunderstorms or strong winds.
- **Exposure:** Population, settlements, agricultural land and infrastructure located in vulnerable areas.
- **Vulnerability:** Poor drainage, fragile housing, inadequate floodplain management and limited preparedness.
- **Disaster:** Significant human, economic and environmental losses when hazard interacts with exposure and vulnerability.

Institutional Response:

- Effective flood management requires coordination among the **India Meteorological Department, Central Water Commission, National Disaster Management Authority, State Disaster Management Authorities and district administrations**.
- Early warnings should be converted into **last-mile alerts** so that vulnerable communities can evacuate or protect assets before floodwaters rise.
- Real-time river-level, rainfall and reservoir information can improve **anticipatory disaster management**.
- Relief measures should be complemented by long-term **floodplain management, resilient infrastructure and watershed planning**.

Historical Examples of Major Bay of Bengal Systems:

Odisha Super Cyclone, 1999:

Kamaraj IAS Academy

Plot A P.127, AF block, 6 th street, 11th Main Rd, Shanthi Colony, Anna Nagar, Chennai, Tamil Nadu 600040

Phone: **044 4353 9988 / 98403 94477 / Whatsapp : 09710729833**

- The system originated as a low-pressure disturbance over the **Bay of Bengal** and intensified through successive stages before becoming a Super Cyclonic Storm.
- It caused extensive loss of life and infrastructure in **Odisha** and became a major reference point for India's cyclone-preparedness reforms.

Cyclone Phailin, 2013:

- Phailin developed from a **depression over the Bay of Bengal** and intensified into a very severe cyclonic storm.
- Large-scale evacuation in Odisha demonstrated the importance of **early warning, preparedness and timely evacuation** in reducing disaster mortality.

Chennai Floods, 2015:

- Multiple **low-pressure systems and depressions** over the Bay of Bengal contributed to extreme rainfall over Tamil Nadu.
- The event remains an important case study of **urban flooding, drainage limitations and disaster-risk governance**.

Cyclone Amphan, 2020:

- Amphan developed from a depression over the **southeast Bay of Bengal** and rapidly intensified into an extremely powerful cyclonic system.
- It affected **West Bengal and Bangladesh** and demonstrated the destructive potential of rapidly intensifying Bay of Bengal systems.

Cyclone Yaas, 2021:

- Yaas developed from a **depression over the Bay of Bengal** and affected Odisha and West Bengal.
- The response highlighted the role of **forecasting, evacuation and cyclone shelters** in reducing human casualties.

Broader UPSC Significance:

Geography:

- The episode demonstrates the interaction of **tropical disturbances, extra-tropical systems, monsoon circulation and upper-air dynamics**.
- It provides a case study of how atmospheric systems originating in different regions can influence rainfall over the same geographical area.

Environment and Climate:

- Changing rainfall patterns can increase the risk of **short-duration extreme rainfall**, even when seasonal rainfall totals do not show an equivalent increase.
- Climate variability can therefore create simultaneous risks of **floods and droughts**, depending on the timing and spatial distribution of rainfall.

Agriculture:

- Excessive rainfall can cause **waterlogging, crop damage, soil erosion and delays in harvesting**.
- The same region can experience water scarcity at another time because floodwater is not automatically equivalent to usable stored water.

Urbanisation:

- Rapid and poorly planned urbanisation increases flood risk by replacing permeable surfaces with **roads, buildings and other impervious surfaces**.
- Encroachment on natural drainage channels and wetlands can further reduce the capacity of cities to absorb intense rainfall.

Way Forward:

Integrated Flood Management:

- Flood management should shift from **post-disaster relief to risk reduction and anticipatory action**.
- Strengthen **rainfall and river-level monitoring** and integrate meteorological forecasts with hydrological models.
- Improve **floodplain zoning** to restrict high-risk development in naturally vulnerable areas.
- Restore **wetlands, ponds and natural drainage channels** that temporarily store excess water.
- Upgrade urban drainage systems according to **extreme-rainfall scenarios**, rather than historical averages alone.
- Promote **climate-resilient agriculture**, including suitable crop varieties, altered sowing schedules and improved crop insurance coverage.
- Strengthen community-level preparedness through **early-warning dissemination, evacuation plans and local disaster-response capacity**.
- Improve coordination among neighbouring states because river flooding frequently crosses **administrative boundaries**.

Value Addition for UPSC:

Prelims Linkages:

- **Depression:** A low-pressure system with maximum sustained winds of **31–49 km/h**.
- **Deep Depression:** A system with maximum sustained winds of **50–61 km/h**.
- **Cyclonic Storm:** A system with maximum sustained winds of **62–88 km/h**.
- **Western Disturbance:** An eastward-moving extra-tropical weather system associated with the mid-latitude westerlies.
- **Monsoon Withdrawal:** A gradual atmospheric transition identified using rainfall cessation, moisture reduction and circulation changes.
- **Bay of Bengal:** A major moisture source for monsoon disturbances affecting eastern, central and northern India.

Mains GS-I Linkage:

- The event can be used to explain **Indian monsoon dynamics, tropical depressions, Western Disturbances, monsoon withdrawal and extreme rainfall**.

Mains GS-III Linkage:

- The episode connects **disaster management, climate variability, floodplain management, resilient infrastructure, agricultural losses and early-warning systems**.

Answer-Writing Framework:

- **Cause:** Depression + moisture transport + interaction with upper-air disturbance.
- **Process:** Atmospheric convergence + uplift + condensation + intense precipitation.
- **Exposure:** Dense population + agricultural land + flood-prone settlements.

Kamaraj IAS Academy

Plot A P.127, AF block, 6 th street, 11th Main Rd, Shanthi Colony, Anna Nagar, Chennai, Tamil Nadu 600040

Phone: **044 4353 9988 / 98403 94477 / Whatsapp : 09710729833**

- **Impact:** Human casualties + crop losses + infrastructure damage + disruption of livelihoods.
- **Response:** Forecasting + early warning + evacuation + resilient infrastructure.
- **Long-term solution:** **Integrated flood management + floodplain zoning + wetland restoration + climate-resilient planning.**

Key Terms:

Bay of Bengal Depression, Deep Depression, Western Disturbance, Subtropical Westerly Jet, Monsoon Withdrawal, Atmospheric Convergence, Extreme Rainfall, Riverine Flooding, Urban Flooding, Floodplain Management, Early-Warning System, Anticipatory Disaster Management, Climate-Resilient Agriculture.