

5. WESTERN DISTURBANCES – GEOGRAPHY

March, a transition month from winter to summer, saw unusual weather variability, with early heatwaves in Jammu & Kashmir, Punjab, Gujarat, Maharashtra, and Himachal Pradesh, followed by thunderstorms, hailstorms, and rainfall.

1.Introduction

1. Erratic weather events in India, particularly during the pre-monsoon season, have become increasingly frequent due to complex atmospheric interactions.
2. Western Disturbances, combined with local convection and moisture inflow, play a major role in triggering unseasonal rainfall, hailstorms, and thunderstorms.
3. These events have significant implications for agriculture, water resources, and disaster preparedness.

2.Geographical Impact of Erratic Weather in India

Western Himalayan Region

1. States such as Himachal Pradesh and Uttarakhand experience snowfall, hailstorms, and thunderstorms due to the direct influence of Western Disturbances.
2. These regions are highly sensitive to atmospheric instability, leading to landslides and avalanches.

Northwest Plains

1. Punjab, Haryana, and western Uttar Pradesh experience thunderstorms and unseasonal rainfall.
2. These events are particularly harmful to standing rabi crops such as wheat and mustard.

Eastern and Northeastern India

1. States like Odisha, West Bengal, Assam, and other northeastern regions witness intense thunderstorms, lightning, and hail.
2. Nor'westers or Kalbaisakhi storms are common, often causing damage to infrastructure and crops.

Central India and Deccan Plateau

1. Regions including Maharashtra, Madhya Pradesh, Chhattisgarh, and Karnataka face hailstorms and convective thunderstorms.
2. These events are often triggered by the interaction of moist winds with local heating.

3.Causes of Severe Weather Events

Role of Western Disturbances

1. Western Disturbances are extratropical low-pressure systems originating near the Mediterranean, Black Sea, and Caspian Sea regions.
2. They travel eastward under the influence of the subtropical westerly jet stream.
3. These systems bring moisture and cause rainfall, snowfall, and hail during winter and pre-monsoon months.

Cyclonic Circulation and Moisture Inflow

1. Cyclonic circulations in the lower atmosphere increase instability and uplift of air masses.
2. Moist winds from the Bay of Bengal and Arabian Sea enhance humidity and precipitation.
3. Wind convergence over central and northern India intensifies storm activity.

Seasonal and Local Factors

1. Rising temperatures during March increase convection, leading to thunderstorms and hailstorms.
2. Interaction between cold air masses from the west and warm, moist tropical air triggers severe weather.
3. Nor'westers in eastern India are a result of such interactions, producing sudden and intense storms.

4.Western Disturbances: Concept and Characteristics

Nature and Origin

1. Western Disturbances are mid-latitude, extratropical cyclones originating in the Mediterranean region.
2. They move eastward towards India through West Asia.

Mechanism and Movement

1. They are carried by the subtropical westerly jet stream.
2. Unlike monsoon systems, they transport moisture in the upper atmosphere.

Seasonality and Importance

1. They are most active during winter months but increasingly influence pre-monsoon weather.
2. They are crucial for winter rainfall in northwest India and snowfall in the Himalayas.

5.Impact of Western Disturbances in March

Unseasonal Rainfall and Snowfall

1. Western Disturbances bring rainfall to plains and snowfall in the Himalayan region during March.
2. These events are often intense and unseasonal, disrupting normal climatic patterns.

Agricultural Impact

1. Hailstorms and heavy rain damage rabi crops such as wheat, barley, and mustard.
2. Crop losses affect farmer income and food security.

Temperature Regulation

1. Western Disturbances can reduce temperatures by bringing cloud cover and precipitation.
2. This temporarily mitigates heatwave conditions in northern and central India.

Severe Storms and Lightning

1. Interaction with tropical moisture leads to thunderstorms, lightning, and hailstorms.
2. Eastern India frequently experiences Nor'westers during this period.

6.Western Disturbances vs Monsoon Systems

Nature and Origin

1. Western Disturbances are extratropical systems originating in mid-latitudes.
2. Monsoons are tropical systems driven by differential heating of land and sea.

Seasonality

1. Western Disturbances are active mainly in winter and pre-monsoon months.
2. Monsoons occur during the summer season from June to September.

Moisture Source and Impact Area

1. Western Disturbances draw moisture from Mediterranean and nearby seas, affecting mainly northwest India.
2. Monsoons derive moisture from the Indian Ocean and Bay of Bengal, impacting most parts of India.

Climatic Role

1. Western Disturbances bring winter rainfall, snowfall, and cold weather conditions.
2. Monsoons bring widespread rainfall essential for agriculture and water resources.

7.Significance of Western Disturbances

Agricultural Importance

1. Winter rainfall from Western Disturbances is crucial for rabi crops in northwest India.
2. However, excessive or untimely events can cause crop damage.

Water Resource Contribution

1. Snowfall in the Himalayas contributes to glacier formation and river flow.
2. It supports long-term water availability in northern India.

Climate Regulation

1. Western Disturbances help moderate temperature extremes during winter and pre-summer months.
2. They play a role in maintaining climatic balance.

8.Challenges and Concerns

Increasing Frequency of Extreme Events

1. Climate variability is leading to more frequent and intense Western Disturbances.
2. This increases the risk of disasters such as floods, landslides, and crop damage.

Agricultural Vulnerability

1. Unseasonal rainfall and hailstorms pose significant risks to farmers.
2. Crop insurance and adaptation strategies are essential.

Disaster Management Issues

1. Sudden storms and lightning events require improved forecasting and early warning systems.
2. Infrastructure resilience needs to be strengthened.

9.Way Forward

Improved Weather Forecasting

1. Strengthening meteorological systems can enhance prediction accuracy of Western Disturbances.
2. Early warning systems can reduce loss of life and property.

Climate-Resilient Agriculture

1. Adoption of resilient crop varieties and better farming practices can mitigate risks.
2. Expansion of crop insurance schemes is essential.

Integrated Disaster Management

1. Coordination between central and state agencies is needed for effective response.
2. Community awareness and preparedness should be enhanced.

Conclusion

Western Disturbances play a dual role in India's climate system by providing essential winter precipitation while also causing extreme weather events. Their interaction with local and seasonal factors leads to erratic weather patterns with significant socio-economic impacts. Strengthening forecasting, agricultural resilience, and disaster preparedness is crucial to manage these challenges effectively.

Source: <https://www.downtoearth.org.in/climate-change/death-of-winter-rajasthans-vanishing-cold-leaves-crops-withering-and-farmers-struggling>

