



Changing Western Disturbances

For Prelims: Western Disturbances, Flash floods, Mediterranean region, Caspian Sea, Himalayan glacier, Rabi Crop.

For Mains: Western Disturbances, Significance of Western Disturbances for India.

Why in News?

According to recent studies, the **changing character of [Western Disturbances](#)** might be the primary cause of the abnormal **[winter seasons](#)** in India.

- India has **not experienced a normal winter season in the past three years**. The second wettest season in the country after the **[monsoons](#)** has remained unusually **dry and hot**.

How Western Disturbances Affected Winters in India Recently?

- The northwest region of India, which receives almost **30% of its annual rainfall during the winter season**, saw an **83% and 76% rainfall deficit in December 2022 and February 2023 respectively**.
- The absence of Western Disturbances caused the north Indian plains to **experience severe cold waves and cold days in December 2022 and most of January 2023 due to the cold northern winds flowing down from the Himalayas**.
- Western Disturbances are also responsible for hailstorms that **damage standing crops, fog events that interrupt air, rail and road services** and cloud bursts that result in **[flash floods](#)**.

What are Western Disturbances?

- **About:**
 - Western Disturbances are a series of **[cyclonic storms](#)** that originate in the **[Mediterranean region](#)**, travel over **9,000 km to bring winter rains to northwest India**.
 - A Western Disturbance **collects moisture from the Mediterranean Sea, Black Sea, and [Caspian Sea](#)** and traverses over **Iran and Afghanistan before hitting the western Himalayas**.
 - While the storm systems occur throughout the year, they travel to India mostly between **December and April because the trajectory of the subtropical westerly jet stream**, which transports them, shifts during the winter months to the rim of the Himalayas.
 - For the rest of the year, the jet stream travels from above the **Himalayas to the Tibetan Plateau and China**. Its trajectory changes as per the position of the Sun.
- **Significance for India:**
 - Western Disturbances are the **primary source of snowfall that replenishes the [Himalayan glaciers](#)** during winter.
 - These glaciers **feed major Himalayan rivers like the [Ganga](#), Indus and**

Yamuna as well as myriad mountain springs and rivulets.

- These low-pressure storm systems **help farmers in India grow their [rabi crop](#)**.

▪ **Issues:**

- The Western Disturbances are **not always the harbingers of good weather**. Sometimes WDs can cause **extreme weather events like floods, flash floods, [landslides](#), dust storms, hail storms** and cold waves, destroying infrastructure and impacting life and livelihoods.

How Western Disturbances are Affected by Other Climatic Phenomena?

▪ **La Nina Event:**

- For the past three years, the world has been in a La Niña phase, which refers to the **cooling of ocean surface temperature in the Pacific Ocean**.
 - It **weakens the temperature gradient for the formation of Western Disturbances** as it reduces the temperature of the hot tropical air.

▪ **North Atlantic Oscillation:**

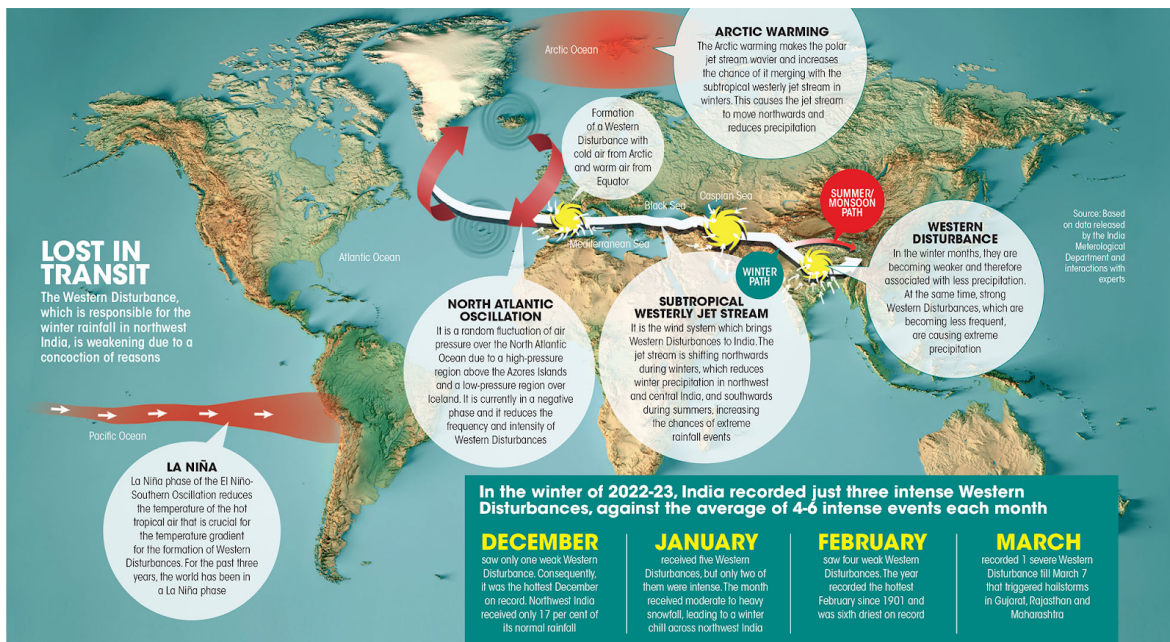
- Western Disturbances are also influenced by the **North Atlantic Oscillation**, a **random fluctuation of air pressure over the North Atlantic Ocean** due to a high-pressure region above the **Azores Islands in the central North Atlantic and a low-pressure region over Iceland**.
 - Due to this, the weather system is currently in a negative phase, as both **low- and high-pressure systems are weak**, and it makes Western Disturbances 20% less frequent and **7% less intense than a positive phase**.

▪ **Subtropical Jet Stream:**

- The **northward shift of the subtropical westerly jet stream** not only reduces the chance of Western Disturbances **striking India but also increases the chance of them affecting higher latitudes such as the Tibetan Plateau** or even as far up as China and Russia.
 - This could indirectly affect the southwest monsoon, which accounts for **80% of India's annual rainfall**.

▪ **Interaction with Southwest Monsoon:**

- The **warming of the Arctic region makes the polar front jet wavier**, causing **Western Disturbances to visit India more frequently during summers**.
- Western Disturbances during **summer, monsoon, and post-monsoon periods increase the chances of them interacting with the southwest monsoon** and other associated local convection systems such as tropical depressions that travel northward from either the Bay of Bengal or the Arabian Sea.
 - Such interactions can cause catastrophic weather disasters.
 - For instance, In May 2021, **a remnant of the extremely severe cyclone Tauktae, which made landfall along the Gujarat coast**, travelled all the way to Delhi and **interacted with a Western Disturbance to cause heavy rainfall in Delhi and its vicinity**.



UPSC Civil Services Examination, Previous Year Questions (PYQ)

Q. Consider the following statements: (2009)

1. In the world, the tropical deserts occur along the western margins of continents within the trade wind belt.
2. In India, the East Himalayan region gets high rainfall from north-east winds.

Which of the statements given above is/are correct?

- (a) 1 only
 (b) 2 only
 (c) Both 1 and 2
 (d) Neither 1 nor 2

Ans: (a)

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