Geography · GS - I

Analyse the influence of ENSO and the Indian Ocean Dipole on the Indian southwest monsoon. How can improved seasonal forecasting strengthen India's climate resilience and agricultural preparedness?

EXAM YEAR	PAPER	SUBJECT
DAILY PRACTICE 21/11/2026	GS - I	Geography

MARKS	WORD LIMIT
15	~250 words

Answer Hint

ENSO, El Niño, La Niña, Walker circulation, Indian Ocean Dipole, monsoon variability, seasonal forecasting, agricultural planning, disaster preparedness.

Model Answer

Introduction

The Indian southwest monsoon is influenced by complex interactions between oceanic and atmospheric systems. The El Niño–Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) are two important drivers of its interannual variability.

Influence of ENSO

- **El Niño:** Warming of the central and eastern equatorial Pacific alters Walker circulation and often weakens monsoon circulation over India, increasing the possibility of deficient rainfall.
- **La Niña:** Cooling in the same region generally strengthens atmospheric circulation favourable to the Indian monsoon and can support above-normal rainfall.

- **Neutral phase:** ENSO-neutral conditions do not necessarily guarantee normal rainfall because other climate drivers remain influential.

Role of the Indian Ocean Dipole

The IOD refers to differences in sea surface temperatures between the western and eastern equatorial Indian Ocean.

- A positive IOD can sometimes offset the adverse influence of El Niño on the Indian monsoon.
- A negative IOD may create conditions less favourable for monsoon rainfall.
- ENSO and IOD interactions can produce complex regional rainfall patterns.

Importance of Seasonal Forecasting

Improved forecasting, including AI-based models developed by institutions such as INCOIS, can support:

1. **Agriculture:** Crop selection, sowing schedules and irrigation planning.
2. **Water management:** Reservoir operations and groundwater management.
3. **Disaster preparedness:** Advance preparation for floods, droughts and extreme rainfall.
4. **Policy planning:** Timely crop insurance, contingency plans and food-security measures.

However, seasonal forecasts indicate probabilities rather than certainty. They must be updated using observations and regional forecasts.

Conclusion

Understanding ENSO and IOD interactions is essential for anticipating monsoon variability. Combining AI-based forecasting with local climate information and adaptive agricultural planning can strengthen India's resilience to climate uncertainty.

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