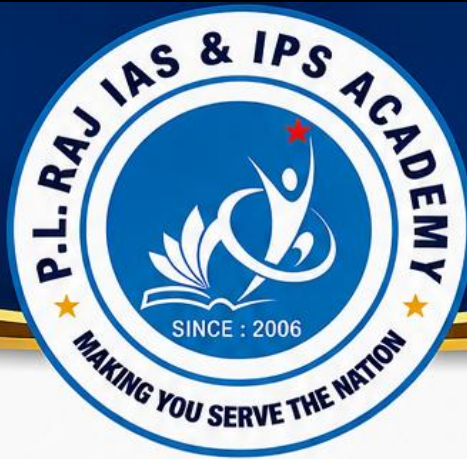
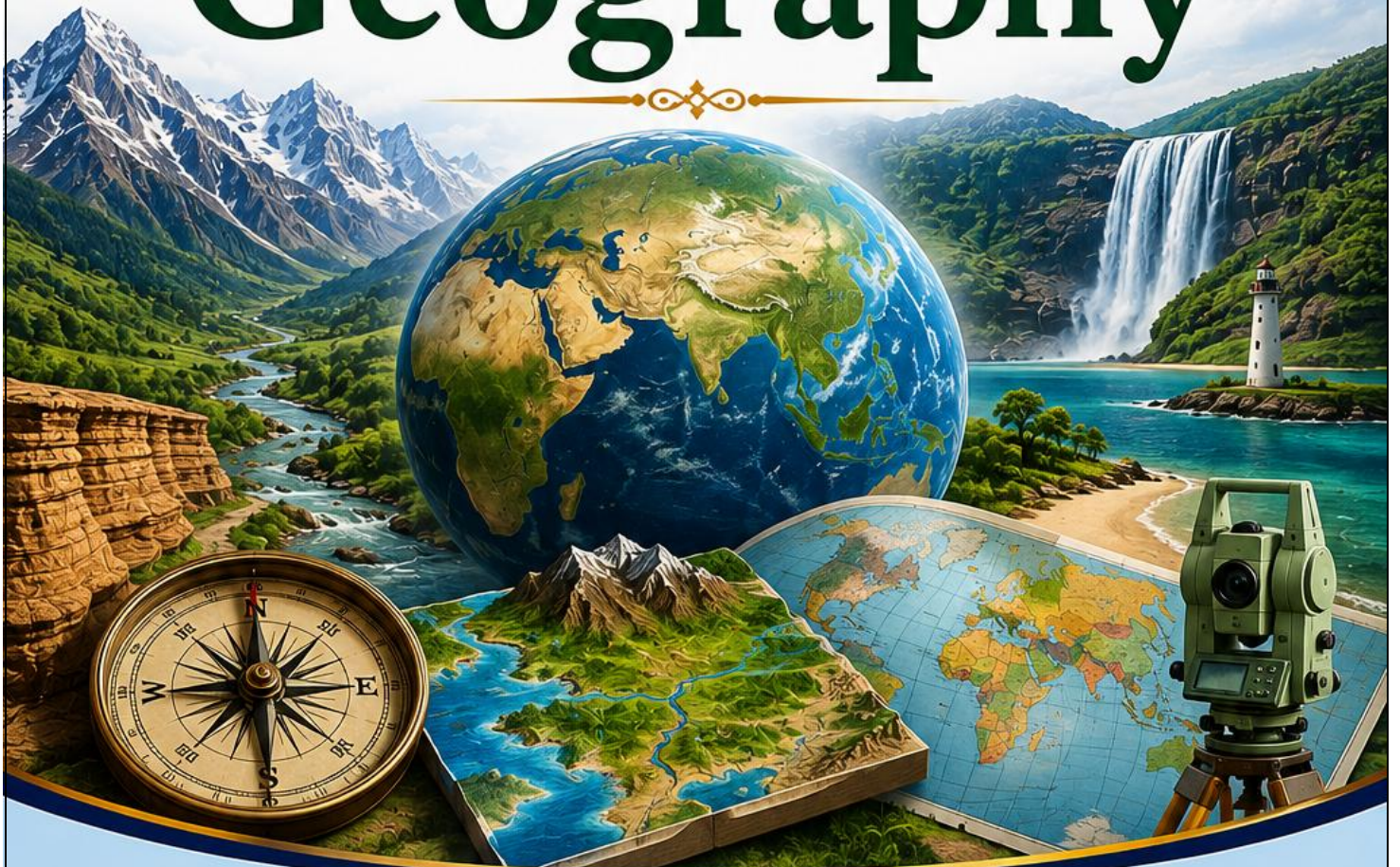




P.L. RAJ IAS & IPS ACADEMY

Civil Services Study Material

Geography



UPSC Prelims Current Affairs

(June 2026)

MONTHLY COMPILATION



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Contents

1. Southwest Monsoon 2026.....	2
2. Padma barrage.....	6
4. V.O. Chidambar Anar Port.....	9
5. Why India May Be Better Prepared to Withstand a Poor Monsoon	11
6. Seismic Doublet: Venezuela's June 2026 Earthquakes	15

1. Southwest Monsoon 2026

The India Meteorological Department (IMD) confirmed the arrival of the southwest monsoon in Kerala on June 4, 2026, marking the official start of India's rainy season. The monsoon arrived slightly ahead of its normal June 1 onset date, bringing relief amid earlier forecasts of below-normal rainfall (92% of Long Period Average) due to expected El Niño conditions. The southwest monsoon contributes approximately 75% of India's annual rainfall, making it critical for agricultural productivity, water security, and overall economic stability.

1. Southwest Monsoon

Onset and Retreat

1. Monsoon season generally starts early June, lasts until September
2. **Onset:** Marked by arrival of southwest monsoon winds bringing moisture-laden air from Indian Ocean
3. **Normal Kerala onset date:** June 1
4. **2026 actual onset:** June 4
5. **Withdrawal/retreat:** Typically begins October (from northwest India)
6. **Northeast monsoon:** October to December bringing rainfall to parts of southern India (Tamil Nadu, Andhra Pradesh, Puducherry)

Progression of Southwest Monsoon

1. Kerala → Karnataka, Goa → Maharashtra, Andhra Pradesh → Central India → Northern India
2. Reaches entire country by approximately July 8-15

3. Two branches:

- i. **Arabian Sea branch:** Strikes Western Ghats first; heavy west coast rainfall; advances toward central-northern India
- ii. **Bay of Bengal branch:** Northeast India; deflected westward by Himalayas across Indo-Gangetic Plains

Monsoon Dynamics

1. **El Niño and La Niña** phenomena influencing strength, distribution
2. **Indian Ocean Dipole (IOD):** Positive IOD can compensate for El Niño's weakening effect
3. **Somali Jet:** Low-level jet stream carrying moisture from Indian Ocean to India
4. **Tibetan Plateau heating:** Creating upper-level divergence supporting monsoon circulation
5. **ITCZ (Inter-Tropical Convergence Zone):** Shifts northward during summer drawing monsoon winds

Agricultural Impact

1. Monsoon success directly influencing crop yields, overall economy
2. ~60% of India's net sown area rain-fed (140 million hectares)
3. Critical for Kharif crops: Paddy, pulses, cotton, oilseeds, maize
4. Below-normal monsoon → food inflation, rural distress, GDP impact
5. Above-normal monsoon → flooding, crop damage in certain regions

Importance Beyond Agriculture

1. **Water security:** Replenishes rivers, groundwater (80%+ recharge), reservoirs
2. **Hydropower:** ~50 GW capacity dependent on monsoon flows
3. **Ecological balance:** Forests, biodiversity, soil moisture

2. What is El Niño?

Definition

1. Means "Little Boy" in Spanish

2. Climate phenomenon characterized by periodic warming of sea surface temperatures in central, eastern equatorial Pacific Ocean

Mechanism

1. **Normally:** Trade winds blow westward pushing warm water toward Asia (warm pool near Australia, Indonesia)
2. **During El Niño:** Trade winds weaken
3. Warm water pushed back east toward west coast of Americas
4. Cold water (normally upwelling off South America) suppressed
5. Disrupting normal atmospheric circulation patterns globally

Periodicity

1. Occurs every 2-7 years
2. Typically lasts 9-12 months
3. Followed by La Niña (opposite phenomenon – cooling of Pacific)
4. **ENSO (El Niño–Southern Oscillation):** Broader climate pattern encompassing El Niño and La Niña cycles

3. Impact of El Niño on Weather Patterns

Global Temperature Rise

1. El Niño causes rise in global temperatures
2. Often leading to warmer-than-average conditions worldwide
3. Contributes to record-breaking global temperature years (1998, 2016, 2023-24 linked to El Niño)

Disruption of Indian Monsoon

1. El Niño typically weakens Indian monsoon
2. Leading to reduced rainfall, drought conditions
3. **Mechanism:** Warmer Pacific waters alter atmospheric circulation; weaken Walker Circulation and Hadley Cell affecting moisture transport to India
4. Historical droughts (2002, 2009) linked to strong El Niño events
5. 2026 IMD forecast: 92% LPA partly due to El Niño influence

Increased Risk of Wildfires

1. Increases likelihood of wildfires especially in:
 - i. Australia (drier conditions)
 - ii. Southern Africa
 - iii. Parts of Americas (California, Amazon)
2. Dry, hot conditions creating fire-prone environments

Extreme Weather Events

1. More intense storms, hurricanes, cyclones particularly in Pacific, Atlantic
2. Flooding in South America (Peru, Ecuador)
3. Drought in Southeast Asia, Australia, India
4. Disrupted agricultural patterns globally

La Niña Effects (Opposite)

1. Strengthens Indian monsoon (above-normal rainfall)
2. Cooling of Pacific, strengthening trade winds
3. Often follows El Niño as correction cycle

4. Way Forward

1. Enhanced district-level monsoon forecasting for precise agricultural planning
2. Drought-resistant crop varieties for El Niño years
3. Strengthening PM Fasal Bima Yojana coverage, claims settlement for monsoon failures
4. Rainwater harvesting, aquifer recharge programs maximizing above-normal monsoon years
5. Real-time weather advisory systems for farmers

5. Conclusion

IMD confirming June 4, 2026 southwest monsoon onset in Kerala marks beginning of India's critical rainy season contributing 75% annual rainfall. Monsoon dynamics — influenced by El Niño (weakening effect through Pacific warming disrupting trade winds, Walker Circulation), La Niña, IOD, and Tibetan Plateau heating —

determine agricultural productivity, water security, and economic stability for 1.4 billion people. El Niño's impacts extend beyond India causing global temperature rise, wildfires in Australia-Africa-Americas, and extreme weather events globally. Climate change intensifying ENSO variability demands enhanced forecasting, climate-smart agriculture, and water resource management ensuring India's food security remains resilient against monsoon variability.

Source: <https://www.thehindu.com/news/national/kerala-monsoon-onset-june-4-imd-why-southwest-monsoon-arrival-matters-for-india/article71055995.ece>

2. Padma barrage

Prelims

Geography, Environment, International Relations

Mains

GS Paper II – International Relations, GS Paper III – Environment, Agriculture

Current relevance

Bangladesh's approval of the **\$2.8 billion Padma Barrage Project** comes amid concerns over dry-season water availability and the impending expiry of the India–Bangladesh Ganges Water Treaty.

About Padma barrage

1. **Location** – project is proposed on the Padma River in **Rajbari District, Bangladesh**.
2. It is **large-scale transboundary water management project** designed to function as a reservoir, helping regulate river flows and improve water availability during the dry season.
3. **Geomorphological and Ecological Features** –
 - I. River traverses **vast low-lying deltaic regions** that are highly prone to flooding, riverbank erosion, and the adverse effects of rising sea levels.
 - II. **Sediment accumulation** on the riverbed, thereby increasing the likelihood of floods during the monsoon period

- III. The river carries **nutrient-rich sediments** that improve soil fertility, sustain aquatic ecosystems, and support agriculture and fisheries.
- IV. Freshwater discharge from the Padma plays a vital role in maintaining the **salinity balance of the Sundarbans**.



Source – **THE HINDU**

3. super El Nino

Prelims:

Geography, Environmental Ecology, Biodiversity and Climate Change

Mains:

GS Paper I – Geography, GS Paper III – Environment, Agriculture, Disaster Management

Current relevance:

A "**Super El Niño**" is in the news after several global climate agencies and research organizations warned that a **strong El Niño** is likely to develop during **2026**.



Highlights:

RONI Value (°C)	El Niño Strength
± 0.5 to ± 0.9	Weak
± 1.0 to ± 1.4	Moderate
± 1.5 to ± 1.9	Strong
$\geq \pm 2.0$	Very Strong (Super El Niño)*

- Definition:** A **Super El Niño** is an **extremely intense El Niño** event marked by **exceptionally warm sea surface temperatures in the equatorial Pacific Ocean**, causing widespread impacts on rainfall, temperature, and weather systems worldwide.

2. Background:

Super El Niño events have occurred several times in the past, **1997–98** and **2015–16** events are generally recognized as the two **strongest Super El Niño** episodes in modern records.

- Indices released by U.S. **National Oceanic and Atmospheric Administration**

(NOAA):

- Oceanic Niño Index (ONI)
- Southern Oscillation Index (SOI)
- Relative Oceanic Niño Index (RONI)

4. Impact on India:

- (i) **Weakens the Southwest Monsoon**, leading to below-normal rainfall.
- (ii) Increases the risk of **water scarcity**, depletion of **reservoir and groundwater levels**.
- (iii) Adversely affects **food grain and horticultural production**.
- (iv) Increases the frequency and intensity of **heatwaves**.
- (v) Reduces agricultural output, affecting **GDP growth**.
- (vi) Higher risk of **forest fires**.
- (vii) Increased frequency of **droughts**.
- (viii) Greater incidence of **heat-related illnesses**.
- (ix) Reduced **hydropower generation** due to lower reservoir levels.

Source: THE HINDU

4. V.O. Chidambar Anar Port

Prelims:

Geography, Economy

Mains:

GS Paper II – Governance, GS Paper III – Indian Economy, Infrastructure, Environment

Current relevance:

V.O. Chidambaranar Port Authority is emerging as a **model Green Port** through decarbonisation, renewable energy adoption, green hydrogen, and AI-driven port management.



Highlights:

1. Background:

V.O. Chidambaranar Port (formerly **Tuticorin Port**) is one of **India's Major Port**, located at **Thoothukudi Tamil Nadu**, on the **Gulf of Mannar** along the **southeastern coast of India**.

2. Green Initiatives:

- (i) **45%** reduction in **net carbon emissions**.
- (ii) Renewable energy offsets **94%** of energy consumption.
- (iii) Nearly 50% reduction in carbon intensity per tonne of cargo.
- (iv) Recognised as a **Scope-2 Emission Free Port**.
- (v) India's **first Green Hydrogen** Pilot Project at a Major Port.

3. More in news:

- (i) **Kendriya Vidyalaya** established at VOC Port. – Expands Access to Quality Education.

- (ii) Also launched the **PortGPT** mobile application, making VOC Port the first major port in India to extend an **enterprise-grade generative artificial intelligence** platform through a dedicated mobile application.

Source: PIB –

<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2277098®=3&lang=1>

5. Why India May Be Better Prepared to Withstand a Poor Monsoon

India faces the possibility of a **below-normal Southwest Monsoon**, with the 2026 seasonal rainfall forecast at around **90% of the Long Period Average (LPA)**. However, improved water storage, groundwater conditions, decentralised conservation and agricultural contingency planning provide greater resilience than during earlier drought episodes.

Southwest Monsoon and Current Situation

1. The **Southwest Monsoon (June–September)** supplies nearly **three-fourths of India's annual rainfall**.
2. IMD's all-India monsoon **LPA is about 87 cm**, based on the 1971–2020 period.
3. Monsoon rainfall is classified using its departure from LPA; therefore, **distribution across space and time is as important as the national seasonal total**.
4. The 2026 outlook indicates greater rainfall stress over **Northwest, Central and parts of Peninsular India**, while Northeast India is relatively better placed.
5. Early-season rainfall weakness was associated with **weak monsoon circulation, inadequate low-pressure systems and unfavourable intra-seasonal conditions** rather than El Niño alone.

What Controls the Indian Monsoon?

Differential land–sea heating → Northward shift of ITCZ → Cross-equatorial flow → Moisture-bearing Southwest Monsoon → Orographic uplift & rainfall

Two major branches operate over India:

Arabian Sea Branch	Bay of Bengal Branch
Strikes the Western Ghats	Moves towards Northeast India
Heavy windward rainfall	Very heavy rainfall over Meghalaya region
Advances into central/northwestern India	Deflected westward along the Indo-Gangetic Plain

The **Western Ghats, Himalayas, Tibetan Plateau, Thar Desert and surrounding Indian Ocean** strongly influence monsoon circulation and rainfall distribution.

El Niño and MJO

1. **El Niño** is the abnormal warming of the **central and eastern equatorial Pacific Ocean**. It alters the Walker Circulation and is generally associated with a weaker Indian monsoon, though **El Niño does not automatically produce drought in India**.
2. The **Madden–Julian Oscillation (MJO)** is an eastward-moving zone of enhanced and suppressed tropical convection. Its location and phase can strengthen or weaken Indian monsoon rainfall on **intra-seasonal timescales**.
3. Hence:
 - i. **ENSO → Seasonal influence**
 - ii. **MJO → Intra-seasonal variability**
4. This distinction is important for understanding why rainfall can fluctuate sharply even within the same monsoon season.

Why a Weak Monsoon Matters

1. A rainfall deficit operates through interconnected geographical and economic channels:
 - i. **Low Rainfall → Low Soil Moisture → Delayed/Reduced Kharif Sowing → Lower Farm Output → Rural Income Stress → Food-price Pressure**
2. At the same time:
 - i. **Low Rainfall → Lower Reservoir & Groundwater Recharge → Irrigation + Drinking Water + Hydropower Stress**

3. Rain-fed regions are particularly vulnerable because irrigation cannot fully compensate for prolonged rainfall deficiency.
4. Major Kharif crops exposed to monsoon variability include **rice, maize, cotton, pulses and oilseeds**.

Why India's Resilience Has Improved

1. **Reservoir Storage:** Carry-over storage from previous favourable rainfall seasons provides irrigation and drinking-water buffers during temporary monsoon deficits.
2. **Groundwater:** Improved recharge in several regions provides supplementary irrigation, though excessive extraction remains a structural concern.
3. **Local Water Conservation:** Expansion of **farm ponds, check dams, watershed works, bunds and rainwater-harvesting structures** improves local storage and soil-moisture retention.
4. **Irrigation:** Greater irrigation coverage and micro-irrigation reduce direct dependence on rainfall, though vulnerability remains high in rain-fed areas.
5. **Energy Diversification:** Growth of **solar and wind power** reduces dependence on hydropower, allowing reservoir water to be managed more flexibly during rainfall shortages.
6. **Agricultural Preparedness:** Around **315 potentially vulnerable districts** were identified for contingency measures, including alternative crops, short-duration varieties, seed availability and district-specific agricultural planning.

Agricultural Adaptation

1. A poor monsoon requires adaptation according to local agro-climatic conditions rather than a uniform national response.
 - i. Promote **short-duration and drought-tolerant varieties** where sowing is delayed.
 - ii. Shift towards relatively **low-water-demand crops**, particularly pulses, millets and oilseeds.
 - iii. Encourage **intercropping and crop diversification** to distribute rainfall risk.

- iv. Expand **micro-irrigation and moisture conservation**.
- v. Maintain contingency seed stocks for delayed sowing or resowing.
- vi. Use weather and agro-meteorological advisories for sowing decisions.

Water Management Dimension

1. India's challenge is increasingly moving from simply increasing water supply towards **managing rainfall variability**.
2. This requires integration of:
3. **Reservoir Management + Groundwater Recharge + Watershed Development + Micro-irrigation + Rainwater Harvesting + Crop Planning**
4. A good national rainfall figure can still coexist with local drought if rainfall is **unevenly distributed geographically or concentrated into a few extreme rainfall events**.

Important Concepts and Facts

Term	What to remember
Southwest Monsoon	June–September
LPA	Long-term average rainfall used to assess monsoon performance
All-India Monsoon LPA	About 87 cm
El Niño	Warming of central/eastern equatorial Pacific
ENSO	El Niño–Southern Oscillation
MJO	Eastward-moving tropical convection system
Rain-shadow region	Leeward side receiving reduced orographic rainfall
Kharif season	Cropping season closely associated with Southwest Monsoon
2026 vulnerable districts	Around 315
Key adaptation principle	Reduce dependence on rainfall through water storage, irrigation and resilient cropping

India's improved preparedness does **not eliminate monsoon dependence**. The deeper geographical challenge is that climate change can increase **spatial and temporal rainfall variability**. Long-term resilience therefore requires moving from **monsoon-dependent agriculture to climate-resilient agriculture**, while simultaneously strengthening watershed management, groundwater sustainability, irrigation efficiency and sub-seasonal weather forecasting.



6. Seismic Doublet: Venezuela's June 2026 Earthquakes

Prelims: Earthquakes | Plate Tectonics | Seismic Waves

GS-I: Physical Geography | Geophysical Phenomena

Why in News?

Northern Venezuela experienced two major earthquakes within less than a minute on **24 June 2026**: magnitude **7.2** near San Felipe and magnitude **7.5** near Yumare. The closely spaced events brought attention to the concept of a **seismic doublet** and earthquake-triggered landslide hazards.

What Is a Seismic Doublet?

1. A seismic doublet refers to two comparably large earthquakes occurring close together in **space and time**, rather than a simple sequence in which one large mainshock is followed by much smaller aftershocks.
2. The distinction matters because the second major event can significantly alter stress on nearby faults and expand the geographical area exposed to strong shaking.

Tectonic Setting

1. Venezuela lies along a geologically complex zone between the **Caribbean Plate and the South American Plate**.
2. Northern Venezuela contains major fault systems associated with predominantly strike-slip deformation, making the region seismically active.
3. For mapping, locate:
 - i. **Caribbean Sea** to the north
 - ii. **Colombia** to the west
 - iii. **Guyana** to the east
 - iv. **Brazil** to the south
 - v. **Caracas** in northern Venezuela

Magnitude and Intensity

1. **Magnitude:** Quantifies the energy released at the earthquake source and is expressed on logarithmic scales such as moment magnitude.
2. **Intensity:** Describes the observed effects of shaking at a particular location and varies spatially according to distance, ground conditions and building vulnerability.
3. **Magnitude $\neq$ Intensity.**
4. **Secondary Hazards**
5. USGS assessments indicated significant potential for **earthquake-triggered landslides** following the Venezuela sequence.
6. Large earthquakes can also produce:

- i. Liquefaction
- ii. Rockfalls
- iii. Infrastructure failure
- iv. Dam or slope instability
- v. Localised tsunami risk where appropriate tectonic displacement occurs offshore

7. Thus, earthquake risk depends not only on seismic magnitude but also on **topography, geology, exposure and infrastructure vulnerability.**