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Cabinet nod for FDI in coal mining

The Union Cabinet approved an ordinance to amend two legacy laws to ease mining rules and selling of coal and enabling foreign direct investment in coal mining.

The ordinance was passed to amend the Mines and Minerals Act, 1957, and Coal Mines Act, 2015.

The country spent ₹1,71,000 crore in coal imports in 2018 to buy 235 million tonnes; of that, 100 MT was not substitutable, but the balance 135 MT could have been substituted by domestic production.

Amendments to two legacy Acts will free the sector from restrictions that were inhibiting its development.

The amendments will open up the coal mining sector completely, enabling anyone to bid for blocks and sell the coal freely to any buyer of their choice.

Until now there were restrictions on who could bid for coal mines — only those in power, iron and steel and coal washery business could bid for mines — and the bidders needed prior experience of mining in India.

This effectively limited the potential bidders and the value that GOI could extract from the bidding.

“End-use restrictions” had been done away with, allowing “anyone to participate in the auction of coal blocks”.

The ordinance essentially democratises the coal industry and makes it attractive for merchant mining companies, including multinationals.

Large investment in mining will create jobs and set off demand in critical sectors such as mining equipment and heavy commercial vehicles.

The country may also benefit from infusion of sophisticated mining technology, especially for underground mines, if multinationals decide to invest.

The opening up of coal mining effectively ends Coal India’s (CIL) monopoly status.

The company has been set a target of one billion tonnes production by 2023-24 — last year, it produced 606 million tonnes.

CIL is a Maharatna PSU and tremendous public resources have been invested in the company over the years.

The company employs about three lakh people, is listed and is a national asset.

Suggested Reading: {EG – Coal – 19/09} Measures taken to boost coal production in India

Coalbed methane (CBM)

Considerable quantity of methane (CBM – unconventional gas) is trapped within coal seams.

A significant portion of this gas remains as free gas in the joints and fractures of the coal seam.

This gas can be accessed by drilling wells into the coal seam and pumping large quantities of
water that saturate the seam (water will occupy the gaps and pores and will push out the gas).

- The presence of this gas is well known from its occurrence in underground coal mining, where it presents a serious safety risk.

**Fire Accidents in Coal Mines are mainly due to Coalbed Methane, and Lignite deposits** (undergo spontaneous combustion).

### Coalbed Methane in India

- India has the 5th largest reserves of coal (9%) in the world.
- India holds significant prospects for commercial recovery of coalbed methane.

<table>
<thead>
<tr>
<th>State</th>
<th>Estimated CBM Resources (BCM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Jharkhand</td>
<td>722</td>
</tr>
<tr>
<td>2. Rajasthan</td>
<td>360</td>
</tr>
<tr>
<td>3. Gujarat</td>
<td>351</td>
</tr>
<tr>
<td>4. Orissa</td>
<td>243</td>
</tr>
<tr>
<td>5. Chhattisgarh</td>
<td>240</td>
</tr>
<tr>
<td>6. Madhya Pradesh</td>
<td>218</td>
</tr>
<tr>
<td>7. West Bengal</td>
<td>218</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State</th>
<th>Estimated CBM Resources (BCM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total CBM</td>
<td>GOI has identified CBM Resources of 2,600 billion cubic meters (91.8 TCF).</td>
</tr>
</tbody>
</table>

- At present, in many coal mines, coal mine methane is not trapped and is blown out.
- At present CBM is produced from some virgin coal mines of
  - Raniganj (South) & Raniganj (East) in West Bengal
  - Sohagpur (West) in Madhya Pradesh
  - Jharia and Bokaro in Jharkhand

**CBM production in the previous five years till February 2020**

<table>
<thead>
<tr>
<th>Rank</th>
<th>State</th>
<th>CBM Production (MMSCM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>West Bengal</td>
<td>2103.24</td>
</tr>
<tr>
<td>2</td>
<td>Madhya Pradesh</td>
<td>879.42</td>
</tr>
<tr>
<td>3</td>
<td>Jharkhand</td>
<td>17.11</td>
</tr>
</tbody>
</table>

Total | 2999.77

MMSCM: Million Metric Standard Cubic Meters

### Problems in Exploration, Extraction of Coalbed Methane in India

- The state-run firms are holding mines in joint venture with private companies and the latter do not have rights to explore unconventional gas resources — coalbed methane, shale gas, tight gas.
- CBM extraction falls under Ministry of Petroleum & Natural Gas whereas coal mining falls under Ministry of Coal.
- Hence, contractors are not allowed to mine gas from coal seams or coal bed methane (CBM) and coal in the same block due to the turf war between the two ministries and other associated bureaucratic hurdles.
- The technology required is very advanced and the public sector companies have very weak organizational setup to efficiently handle such technologies and extract gas economically.
- Private sector companies have necessary financial capabilities and managerial skills but there is no hope due to restricting laws and low gas prices.

### Environmental Concerns

- Methane is a greenhouse gas emitted through CBM extraction. Global methane emissions from coal mines are projected to account for approximately 8 percent of total global methane emissions.
- CBM production behaviour is complex and difficult to predict in the early stages of recovery.
- Water discharges from CBM development could potentially pollute downstream water sources.

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{EG – Energy Resources – 20/04) Indian Strategic Petroleum Reserve (ISPRL)
ISPRL’s strategic crude oil storage facilities

- ISPRL’s strategic crude oil storage facilities are constructed at three underground rock caverns in:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>ISPRL’s storage facility</th>
<th>Capacity in Million Metric Tonnes (MMT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mangalore</td>
<td>1.50</td>
</tr>
<tr>
<td>2</td>
<td>Vishakhapatnam</td>
<td>1.33</td>
</tr>
<tr>
<td>3</td>
<td>Padur (Udupi district, Karnataka)</td>
<td>2.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>5.33 MMT</strong></td>
</tr>
</tbody>
</table>

- All these are located on the coasts of India which are readily accessible to the refineries.
- ISPRL maintains an emergency fuel store of strategic crude oil enough to provide 10 days of consumption.
- These strategic storages are in addition to the existing storages of crude oil and petroleum products with the oil companies and serve in response to external supply disruptions.
- Indian refiners maintain 65 days of crude storage, so India has overall reserve oil storage of 87 days.

Additional storage facilities

- In the 2017-18 budget, it was announced that two more rock caverns will be set up at Chandikhole in Odisha and Bikaner in Rajasthan as part of the second phase.
- In 2018, GOI approved the construction of storage facility in Chandikhole and doubling the capacity at Padur.
- This would raise India’s strategic reserve capacity to 12.33 million tonnes.
Underground hydrocarbon storage

- **Underground rock caverns** are considered as the safest means of storing hydrocarbons.
- The success of underground hydrocarbon storage lies in its economic efficiency, its safety and, ultimately, its excellent environmental track record.
- To retrieve oil from a cavern, all you have to do is pump water into its bottom (oil is lighter than water).

EG – Energy Resources – 20/07/01 SATAT Initiatives

PIB | GS1 > Energy

- **Context:** MoU signed between Indian Oil, NTPC Ltd, & South Delhi Municipal Corporation (SDMC) for Waste to Energy plant in Delhi under SATAT Initiative.

SATAT Initiative

- **Sustainable Alternative Towards Affordable Transportation (SATAT)** Initiative promotes **Compressed Bio–Gas (CBG)** as an alternative, green transport fuel for efficient management of biomass & organic waste.
- **Compressed Bio–Gas plants** are proposed to be set up mainly through independent entrepreneurs.
- SATAT initiative has the potential of addressing environmental problems arising from stubble burning.

Biogas

- Biogas is primarily methane \((\text{CH}_4)\) (50–65%) & **carbon dioxide \((\text{CO}_2)\)** (35–50%).
- Bio–gas is produced through a process of **anaerobic decomposition** (anaerobic digestion) from biomass.
- Anaerobic digestion uses the process of **fermentation** to breakdown organic matter.
- Fermentation is the chemical breakdown of a substance by bacteria, yeasts, or other microorganisms, typically involving effervescence (bubbles in liquid) and the giving off of heat.
- Biomass sources include agriculture residue, cattle dung, sugarcane press mud, municipal waste, etc.
- After purification, it is compressed & called **CBG** (pure methane content of over 95%).
- **CBG** (calorific value ~52,000 KJ/kg) is similar to **CNG** in its composition & energy potential.
- Given the abundance of biomass in the country, CBG has the potential to replace CNG.
- The potential for CBG production in India is estimated at about 62 million tonnes per annum.
- Biogas production is **carbon–neutral**, i.e., there is no net addition of carbon to the environment (the carbon in biogas comes from plant matter that fixed this carbon from atmospheric \(\text{CO}_2\)).
- Challenges: Lack of bio–waste segregation & collection at the household level.

Related: (Geo – EG – 19/05/08) Clean Fuels (Alternate Fuels)
Related: (Geo – EG – 19/05/02) Clean Energy sources: CNG, LNG, LPG and Hydrogen

EG – Infra – 20/02 Vadhavan port

PIB | Livemint | Geography > Economic Geography > Transportation Infrastructure

- GOI has approved a proposal to set up a **major port at Vadhavan near Dahanu in Maharashtra**.
- The total cost of building the port is expected to be Rs. 65,545 crores.
- It will be 13th major port in India.
- Currently, India has 12 major ports at Deendayal (erstwhile Kandla), Mumbai, JNPT,
• With this port, India will become one of the countries in the top-10 container ports in the world.

• A special purpose vehicle (SPV) will be formed with Jawaharlal Nehru Port Trust (JNPT) as the lead partner.

• The port will be developed on the landlord model.

The need for the Vadhavan port

• The position of JN Port, the biggest container port in India is 28th in the world.

• There is a need for a deep draft port that will accommodate the largest Container Ships in the world and also cater to the spill over traffic from JNPT port.

• JNPT and Mundra, the two largest container handling ports of the country have drafts of 15 M and 16 M respectively, while the world’s largest container handling deep draft ports require a draft of 18M-20M.

• The Vadhavan port has a natural draft of about 20 meters close to the shore, making it possible for it to handle bigger vessels at the port.

What is landlord model?

• In the landlord port model, the publicly governed port authority acts as a regulatory body and as landlord while private companies carry out port operations.

• Here, the port authority maintains ownership of the port while the infrastructure is leased to private firms that provide and maintain their own superstructure and install own equipment to handle cargo.

• In return, the landlord port gets a share of the revenue from the private entity.

• The role of the landlord port authority would be to carry out all public sector services and operations such as the award of bids for cargo terminals and dredging.

Need for the landlord model

• Currently, most major port trusts in India carry out terminal operations as well, resulting in a hybrid model of port governance.

• The involvement of the port authorities in terminal operations leads to a conflict of interest.

• The neutrality of the landlord port authority is a basic requirement for fair competition between port service providers, particularly the terminal operators.
development in various sectors and issues arising out of their design and implementation.

- GOI’s zero subsidy **Unnat Jyoti by Affordable LEDs for All (UJALA) & LED Street Lighting National Programme (SLNP)** have marked its fifth anniversary.
- SLNP is the world’s largest streetlight replacement programme.
- UJALA is the world’s largest domestic lighting project.
- Both have been implemented by **Energy Efficiency Services Limited (EESL)**, a joint venture of PSUs under the Ministry of Power.
- Under the SLNP programme, over 1.03 crore smart LED streetlights have been installed till date.
  - This enabled an estimated energy savings of 6.97 billion kWh per year and an estimated greenhouse gas (GHG) emission reduction of 4.80 million tCO2 annually.
  - Through the UJALA initiative, over 36.13 crore LED bulbs have been distributed across India.
  - This has resulted in estimated energy savings of 46.92 billion kWh per year and an estimated GHG emission reduction of 38 million t CO2 annually.
  - Prices of LED bulbs being distributed under UJALA programme have fallen to one-tenth of their rates in 2015 from INR. 310 to INR 38 in 2018.
  - Apart from this, the Government of India initiated the Gram Swaraj Abhiyan (GSA) in 2018, which was aimed at apprising rural communities of various government welfare schemes and initiatives.
  - As a part of GSA, 21,058 Indian villages with a significantly large number of poor households were able to buy LED bulbs for a special price under UJALA programme.

**BEE Notifies New Energy Performance Standards for ACs**

- Bureau of Energy Efficiency (BEE) has notified new energy performance standards for Room Air Conditioners.
- The **24 °C default setting** has been made mandatory from Jan 1, 2020 for all room air conditioners (RACs) covered under the ambit of **BEE star-labelling program**.
- Some countries like Japan have put in place regulation to keep the default AC temperature at 28 °C.
- Additionally, the Indian Seasonal Energy Efficiency Ratio (ISEER) as per the new standards will be applicable from 1st January 2021 onwards.

**Previous measures at improving energy efficiency**

- BEE made voluntary star labelling program for fixed-RACs mandatory in 2009.
- BEE made voluntary star labelling program for inverter-RACs was made mandatory from 1st January 2018.

**Benefits of “24 °C default setting” for ACs**

- Setting higher efficiency standards for cooling is the easiest step that government can take to reduce the need for new power plants, cut emissions and reduce costs at the same time.
- As per BEE, the total connected load in India due to air conditioning will be 200 GW by 2030.
- Normal human body temperature is approximately 36-37°C, commercial establishments, hotels and offices maintain temperature around 18-21°C. This is not only uncomfortable but is actually unhealthy.
• Every 1 degree increase in the AC temperature setting results in saving of 6 per cent of electricity consumed.
• The 24 °C default setting will result in savings of 20 billion units of electricity in one year alone.

**Indian Seasonal Energy Efficiency Ratio**

• The star rating system is a labelling system, under which the manufacturer is required to place a label indicating how much electricity the appliance is likely to consume under pre-set conditions.
• Previously, star rating of ACs in India worked using the Energy Efficiency Ratio (EER).
• EER is the ratio of cooling capacity to power input.
• Air conditioners with higher EER are preferred, as these are more efficient.
• In many countries, the Seasonal Energy Efficiency Ratio is used for calculating the energy efficiency of the air conditioner as there is season-wise variation in temperature.
• Taking this into consideration, BEE has defined Indian Seasonal Energy Efficiency Ratio (ISEER) for ACs as a star rating method for India from January 2018.
• ISEER is the ratio of Cooling Seasonal Total Load (CSTL) to Cooling Seasonal Energy Consumption (CSEC).

**Bureau of Energy Efficiency (BEE)**

• The BEE is a statutory body under the Ministry of Power, Government of India.
• It assists in developing policies and strategies with the primary objective of reducing the energy intensity.
• BEE coordinates with the stakeholders to utilize the existing resources and infrastructure efficiently as per the provisions of Energy Conservation Act, 2001.

Suggested Reading: National Mission for Enhanced Energy Efficiency (NMEE)

{EG – Renewable Energy – 20/02} PM KUSUM scheme new targets

**ET | D2E | General Science, Economic Geography > Energy Sources > Renewable Energy**

• PM-Kusum: Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan
• It was launched in 2019 by the Ministry of New and Renewable Energy (MNRE) to support ✓ installation of off-grid solar pumps in rural areas and ✓ reduce dependence on grid, in grid-connected areas.
• PM-Kusum scheme consisted of three components (as of 2019):
  1. 10 GW of Decentralized Ground Mounted Grid Connected Renewable Power Plants.
  2. Installation of 17.50 lakh standalone (off grid) Solar Powered Agriculture Pumps.
• All three components combined, PM-Kusum aims to add a solar capacity of **25.75 GW by 2022.**
• The total central financial support provided under the scheme would be Rs. 34,422 crores.

**Union Budget 2020 sets new targets**

• The scheme is now extended to
  1. Setup 20 lakh standalone solar pumps.
• The scheme will also allow farmers to set up grid-connected solar power generation on barren land.
**Expected benefits of the PM-Kusum Scheme**

- It reduces farmers' dependence on diesel and kerosene.
- It enables the farmers to set up solar power generation capacity and sell it to the grid.
- It enables farmers would be able to earn livelihood through their baron land also.
- Besides reducing emissions, the scheme also reduces subsidy burden on discoms (~Rs 50,000 crores).

**Criticism of PM-Kusum scheme**

- The scheme might result in over-exploitation of groundwater.
- PM-Kusum may also not help reduce discoms' subsidy burden because the installation of pumps is not mandatorily tied to decrease in subsidised agricultural power supply.
- PM-Kusum’s proposed scheme of installing solar plants on farmland might benefit only the wealthy farmers, as it requires large investment or the ability to lease land for 25 years.

**Recommendations**

- Solar pump schemes should accompany strict measures of control to manage groundwater extraction.
- The focus should be on on-grid solar pumps as they are economically superior to off-grid pumps as excess electricity can be injected into the grid.
- Off-grid pumps should be considered only for unelectrified regions with relatively high water-table.
- Clear targets must be set to provide solar pumps to small and marginal farmers.

**Phosphorus reserves**

- Phosphorous is generally stored in solid or liquid form, and the cheapest way to cope with the high demand for phosphorous fertiliser was to extract if from phosphate rocks.
- Phosphate rocks are a resource that is both limited and not equally distributed.
- The top five phosphate rocks holders — Morocco and Western Sahara, China, Algeria, Syria, and Brazil — account for 84% of the world reserves.
- The phosphorus reserves will most likely get exhausted in another 50 to 100 years.

- Phosphorus can be highly toxic and flammable, yet it is also essential for life.
- It forms the backbone of our DNA as well as the molecule adenosine triphosphate (ATP) that is found in cells and captures chemical energy from the food we eat.
- Most of the phosphate rock mined throughout the world is used to produce phosphate fertilizer.
- Elemental phosphorus and phosphoric chemicals derived from phosphate rocks find application in insecticides, pharmaceutical products, toothpaste, photographic films, matches, fireworks, military smoke, etc.

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**{EG – Resources – 20/01/31} Phosphorus**

D2E | D2E | 31-01-2020
• Of the total reserves, 34% are in Jharkhand, 31% in Rajasthan and 19% in Madhya Pradesh.
• Udaipur (Jhamarkotra mines) is the largest reserve of phosphate in India.
• It is the only commercially exploitable rock phosphate deposit in the country.
• Rajasthan continues to be the principal producing state, contributing 96% of the total production.
• India imports rock phosphate from Jordan (39%), Egypt (22%) and Morocco (17%).

Reduce, Recycle, Reuse

• About 11% of phosphorus entering Earth systems is lost in human urine and excreta.
• In one day, a human being produces 30 g of carbon, 10-12 g of nitrogen (N), 2 g of phosphorus and 3 g of potassium (K) through human excreta.
• If recycled, phosphorus and nitrogen in human urine and excreta can be recovered by up to about 90%.
• This could supply 22% of the current global demand for phosphorus.
• With India's 1.3 billion population, India generates over 204 million tonnes of phosphorous per year.
• The excreta would also contain valuable soil nutrients like over one billion tonnes of carbon, 646 million tonnes of nitrogen, four billion tonnes of organic matter and 145 million tonnes of potassium per year.
• An increasing number of companies are looking to recover phosphorus from wastewater.

Context: The centre has put out a notification to bring the Cauvery Water Management Authority (CWMA) under the administrative control of the Union Ministry of Jal Shakti.


Concerns raised over centre’s CWMA notification by TN farmers

• CWMA was created on the direction of the SC in 2018.
• The centre’s move could dilute the autonomy of the CWMA and reduce CWMA to a “puppet” of the centre.
• CWMA was never designated as an organisation under the earlier Ministry of Water Resources.
• CWMA under Jal Shakti ministry might favour the construction of a dam across Cauvery river at Mekedatu, a project aggressively pursued by the Karnataka, and vehemently opposed by TN.

Centre’s arguments to address the concerns raised

• There is no change in the functions and powers of the CWMA and the Cauvery Water Regulation Committee.
• The decisions taken by the CWMA are final and binding on the riparian States.
• Hence bringing it under Jal Shakti Ministry has no impact on its functional autonomy.
• Besides, there are eight inter-State river water boards functioning under the Jal Shakti Ministry.
• Several subjects like the Godavari and Krishna River Management Boards have been transferred to the new Ministry without compromising with their autonomy.
The Cauvery Basin

- The Cauvery basin extends over states of **TN, Karnataka, Kerala, & Puducherry (UT)**.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>State</th>
<th>Drainage area/catchment area (sq. km.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tamil Nadu</td>
<td>48,730 (55.4%)</td>
</tr>
<tr>
<td>2</td>
<td>Karnataka</td>
<td>36,240 (41.2%)</td>
</tr>
<tr>
<td>3</td>
<td>Kerala</td>
<td>2,930 (0.03%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td><strong>87,900</strong> (2.7% of the total geographical area of the country)</td>
</tr>
</tbody>
</table>

The Cauvery River Course

- The Cauvery River rises at an elevation of 1,341 m at **Talakaveri** on the Brahmagiri range, Kodagu (Coorg) district of Karnataka.
- The river descends from the South Karnataka Plateau to the Tamil Nadu Plains through the **Shivanasamudram waterfalls** (101 m high).
- At Shivanasamudram, the river branches off into two parts and falls through a series of falls and rapids.
- The two branches of the river join after the fall and flow through a wide gorge which is known as **Mekedatu** (Goats leap) (Mekedatu falls is here).
- At **Hogennekkal Falls**, it takes Southerly direction and enters the **Mettur Reservoir**.
- Below Mettur reservoir the river widens with sandy bed and flows as **Akhanda Cauvery**.
- In the last stage, the river divides into two parts, the Northern branch being called ‘**The Coleron**’ and Southern branch remains as Cauvery, and from here the **Cauvery Delta** begins.
- After flowing for about 16 Kms, the two branches join again to form ‘**Srirangam Island**’.
- On the Cauvery, branch lies the “**Grand Anicut**” (constructed by a Chola King in 1st Century A.D).
- Below the Grand Anicut, the Cauvery branch splits into two — Cauvery and **Vennar**.

Tributaries of the Cauvery River

- Left Bank: the **Harangi**, the **Hemavati**, the **Shimsha** and the **Arkavati**.
- Right Bank: **Lakshmantirtha**, the **Kabbani**, the **Suvarnavati**, the **Bhavani**, the **Noyil** and the **Amaravati**.

Cauvery Water Dispute

**Timeline**

- **1892**: Madras presidency disagrees to Mysore’s proposal to build irrigation systems, arguing that it would impede water flow into Tamil Nadu.
- **1924**: Mysore & Madras reach an agreement under which Mysore is allowed to build **Krishnaraja Sagar dam** at Kannambadi (Mandya district, Karnataka).
- The agreement is to be valid for 50 years and reviewed thereafter.
- **1974**: The 1924 water sharing agreement lapses after expiration of its term of 50 years.
- **1986**: Tamil Nadu approaches the centre for setting up a tribunal to settle arising disputes.
- **1990:** *Cauvery Water Disputes Tribunal (CWDT)* was set up under the centre after the SC’s direction.
- **1991:** CWDT passes an interim award asking Karnataka to release 205 TMC of water to Tamil Nadu every year.
- It also directed Karnataka not to increase its irrigated land area from the existing 11,20,000 acres.
- **1998:** *Cauvery River Authority (CRA)* was constituted by the centre for implementation of the interim award.
- **2002:** The CRA directs Karnataka to release 9,000 cusecs per day of Cauvery water to Tamil Nadu. The body was presided over by then prime minister Atal Bihari Vajpayee.
- **2007:** CWDT passed the final award.
- According to the CWDT, the total availability of water in the Cauvery basin is **740 TMC in a normal year**.
- Of the total 740 TMC, CWDT awarded:
  ✓ 419 TMC was awarded to Tamil Nadu
  ✓ 270 TMC to Karnataka
  ✓ 30 TMC to Kerala
  ✓ 7 TMC to Puducherry
  ✓ The remaining 14 TMC was reserved for environmental protection.
- In case the yield was less in a *distress year*, the *allocated shares shall be proportionately reduced*.
- February 2013: The centre notifies the final award of the CWDT, on the direction of the Supreme Court.
- **March 2013:** Tamil Nadu moves the SC, seeking directions to the water ministry for constitution of the *Cauvery Management Board (CMB)*.
- **2016:** SC asks Karnataka to release 15,000 cusecs a day till 20 September and protests flare-up in Karnataka.

- **2017:** SC declared Cauvery a “national asset”. It upheld the principle of equitable apportionment of inter-State river water among riparian States.
- **2018:** SC’s verdict has reduced the allocation of Cauvery water from Karnataka to Tamil Nadu.
- SC declared that the decision was taken considering that the CWDT had failed to consider groundwater held below the Cauvery basin in Tamil Nadu.
- The final allocation for a total of 740 TMC is
  ✓ Karnataka: 284.75 (270 + 14.75) TMC
  ✓ Tamil Nadu: 404.25 (419 – 14.75) TMC
  ✓ 30 TMC to Kerala (unchanged)
  ✓ 7 TMC to Puducherry (unchanged)
  ✓ The remaining 14 TMC was reserved for environmental protection (unchanged)
- The water allocation arrangement will stand unchanged for the **next 15 years**.
- SC has also directed the formation of the *Cauvery Management Board (CMB)*.
- **2018:** The dispute was settled with the *Cauvery Water Management Authority* being set up.
- **2020:** Tamil Nadu and Puducherry have objected to Karnataka’s bid to seek approval for the *Mekedatu dam* project at the fifth Cauvery Water Management Authority (CWMA) meeting.

### Cauvery Water Disputes Tribunal

- GOI, in exercise of the powers conferred by the *Inter-State River Water Disputes Act, 1956* had constituted the Cauvery Water Disputes Tribunal (Autonomous) in 1990.
- It aims to adjudicate upon the water dispute regarding the Inter-State river Cauvery and the river valley thereof among the States of Karnataka, Kerala, Tamil Nadu, and Union territory of Puducherry.

### Cauvery Management Board (CMB)
• CWDT recommended that the CMB be constituted on the lines of the Bhakra Beas Management Board.
• CWDT recommended that CMB be entrusted with the function of
  1. supervision of the operation of reservoirs and
  2. the regulation of water released with the assistance of the Cauvery Water Regulation Committee (CWRC).
• The CWRC is to be constituted by the CMB.
• Chief Engineer of the Central Water Commission will head the CWRC.

Cauvery Water Management Authority (CWMA)

• GOI notified the Cauvery Water Management Scheme on June 2018, in line with the SC’s order.
• It constituted ‘Cauvery Water Management Authority (CWMA)’ and the ‘Cauvery Water Regulation Committee (CWRC)’ to give effect to the decision of the Cauvery Water Disputes Tribunal.

Composition of CMWA

• The authority will comprise a chairman, a secretary and eight members.
• Out of the eight members, two will be full time, while two will be part time members from centre’s side.
• Rest four will be part time members from states.

Mandate

• The main mandate of the CMA will be to secure implementation and compliance of the Supreme Court’s order in relation to “storage, apportionment, regulation and control of Cauvery waters”.
• CMA will also advise the states to take suitable measures to improve water use efficiency.
• It will do so by promoting use of micro-irrigation, change in cropping patterns, improved farm practices, etc.

Issues

• Even two years after its formation, the Authority does not have a full-fledged chairman.
• In fact, the CWMA has had only a part-time head, the chairman of the Central Water Commission (CWC), attached to the Jal Shakti Ministry.

Mekedatu Project

• It is a proposed multi-purpose reservoir project over Mekedatu (it is a narrow and deep gorge at the confluence of Cauvery and Arkavathi rivers; Mekedatu means Goat’s leap in Kannada) across the river Cauvery.
• It is aimed at solving the drinking water problems of Bengaluru and Ramnagar districts in Karnataka.
• 2018: TN has moved to the SC against the approval given by the Central Water Commission (CWC) to build Mekedatu project.
• Karnataka’s argument: The proposed project intends to store excess water that would otherwise flow into the Bay of Bengal. It will by no means affect the mandatory allocation of water to TN and Puducherry.
• TN’s argument: Cauvery was already a deficit basin and the construction or any new project “would drastically affect the lower riparian State in getting their due share of waters.

{Geo – Climatology – 20/01/04} Pyrocumulonimbus clouds

TH | 04-01-2020 | Environment > Climate Change > Consequences | Basics: Thunderstorm, Thunder & Lightning
• The bushfires in Australia are generating so much heat that they are creating their own
weather systems including dry lighting storms and fire tornadoes.

- The weather conditions are the results of the formation of **pyrocumulonimbus clouds**.
- Pyrocumulonimbus clouds have been recorded all over the world but as the **global climate changes**, they may become a more frequent occurrence.
- The pyrocumulonimbus clouds are essentially a **thunderstorm** (**cumulonimbus cloud**) that forms from the smoke plume of a fire as intense heat from the fire causes air to rise rapidly, drawing in surrounding air.
- As the cloud climbs and then cools in the low temperatures of the upper atmosphere, the collisions of ice particles in the higher parts of the cloud build up an **electrical charge**, which can be released as **lightning**.
- These can cause dangerous and unpredictable changes in fire behaviour, making them harder to fight as well as causing lightning strikes that could ignite new fires.
- The rising air also spurs **intense updrafts** that suck in so much air that strong winds develop, causing a fire to burn hotter and spread further.

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{Geo – Climatology – 20/01/12} **IOD and Australian drought (bushfires)**

- The Indian Ocean Dipole (IOD) is defined by the difference in sea surface temperature between two areas — a western pole in the **Arabian Sea** and an eastern pole in the **eastern Indian Ocean** south of Indonesia.
- IOD starts to develop in the equatorial region of Indian Ocean in April and is **best developed in October**.
- With a **positive IOD** winds over the Indian Ocean blow from **Bay of Bengal towards Arabian Sea**.
- This results in the Arabian Sea being much warmer and eastern Indian Ocean around Indonesia becoming colder and dry.
- In the negative dipole year (**negative IOD**), reverse happens making Indonesia much warmer and rainier.

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Indian Ocean Dipole

- The 2019 June-September monsoon in India started its withdrawal on October 9, against the normal date of September 1, making it the most delayed in recorded history.
- It was also the strongest sw monsoon in recent years with a surplus of 10% in 2019 — both attributed in part due to the **positive phase of the Indian Ocean Dipole (IOD)**.

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Pyrocumulonimbus clouds (Source)
• Climate models had indicated that the positive IOD has persisted longer — active right from May 2019 till the first week of January 2020.
• A longer positive IOD is thought to have contributed to a delay in transition of the monsoon trough (ITCZ) from the Northern Hemisphere to the Southern Hemisphere and onset of the Australian monsoon.
• South-east Australia has been abnormally dry since September under prevailing positive IOD conditions, which means that it would need bouts of significant rainfall to have an impact on the fire risk.
• Positive IOD events are often associated with a more severe fire season for South-east Australia.

Suggested Reading: El Nino | ENSO | La Nina | El Nino Modoki | Indian Ocean Dipole (IOD)

Australian bushfires

• Australia, where the summer starts around October, is known to be the most fire-prone of all continents.
• This is mainly because Australia is also the driest inhabited continent.
• Almost 70 per cent of its area comprises arid or semi-arid land, with average annual rainfall less than 35 cm.
• Most of the Australias forest land is in the north and east. Bushfires are common every summer in this region.
• Australia is in the midst of a prolonged drought, now spreading to three consecutive years.
• 2017 and 2019 were the driest 36-month period ever in the Murray-Darling Basin and New South Wales.

{Geo – Climatology – 20/04} Arctic’s Ozone ‘Healed Itself’
How did it heal?

- According to the scientists the closure is **not** due to the reduced pollution levels due to COVID-19 lockdown.
- The closing was because of the **weak polar vortex**.
- The Polar Vortex split allowed the ozone-rich air into the Arctic.

Ozone and its significance

- Ozone ($O_3$) forms less than 0.00005% by volume of the atmosphere and is unevenly distributed.
- $O_3$ is formed at higher altitudes and transported downwards.
- It is between **20 km & 25 km altitude** (in stratosphere) that the greatest concentrations of ozone are found.
- Ozone plays a crucial role in **blocking the harmful ultraviolet radiation** from the sun.
- The lack of the Ozone layer can cause skin cancer and other possibly fatal skin diseases.

Polar Vortex Cold Wave

**Polar Vortex**

*This topic is already explained in detail in Geography PDF > Climatology > Temperate Cyclones* > Polar Vortex

Some additions are made here for better clarity.

- Polar vortex is a **polar cyclone** (an area of low pressure and very cold air) that can reach up to 2,000 km wide.
- It sometimes extends till the **lower stratosphere** (at poles, the troposphere extends only up to 8-9 km).
- It surrounds **polar highs** & lie within the **polar front** (boundary that separates temperate & polar air masses).
- A polar vortex **rotates counter-clockwise at the North Pole** and clockwise at the South Pole.
- Polar cyclones differ with others because they are not seasonal. They can occur at any time of the year.
- It is **formed mainly in winter** and gets **weaker in summer**.
Polar Vortex slipping into Mid-latitudes,
Breakdown of the polar vortex,
**Sudden stratospheric warming (reduces Ozone Depletion),**
Polar vortex event.
All the above terms mean the same — Polar Vortex Cold Wave (reduces Ozone Depletion).
- The polar vortex will remain in its place when the westerlies along with the polar jet are strong (strong polar vortex means that there is **huge temperature contrast** between the temperate and polar regions).
- **When the polar vortex is weak,** it intrudes into the mid-latitude regions by buckling the general wind flow pattern (meandering jet streams or Rossby waves).

**Polar Vortex and Ozone Depletion at South Pole (and also at North Pole)**
- Polar vortex and ozone depletion are two distinct but related phenomena.
- There is a steady decline of about 4% in the total volume of ozone in Earth's stratosphere.
- Much larger decrease in stratospheric ozone is observed around Earth’s polar regions.
- Depletion of ozone is due to increase in **halocarbons** in the atmosphere.

**Halogen: group of reactive non-metallic elements like fluorine, chlorine, bromine, iodine, etc.**

**Ozone Depletion Mechanism:** Halogen atoms like chlorine destroy ozone

- **Photodissociation (under the influence of sunlight)** of **ozone-depleting substances** (ODS) like halocarbon refrigerants, solvents, propellants, and foam-blowing agents (CFCs, HCFCs, carbon tetrachloride and trichloro-ethane, freons, halons) creates **free chlorine atoms** that destroy ozone.

But how does a chlorine atom reach to such high levels of atmosphere?

**Polar Stratospheric Clouds (PSCs – the link between Polar Vortex and Ozone Depletion)**
- They are nacreous clouds that extend from 12-22 km above the surface.
- Nacreous clouds are rare clouds in frigid regions of the **lower stratosphere**.
- They are seen mostly during winter at high latitudes.
- PSCs or nacreous clouds contain water, **nitric acid and/or sulfuric acid**.
- They are formed mainly during the event of polar vortex in winter; more intense at south
pole (because polar vortex here is stronger due to high temperature contrast between the polar & temperate regions).

- The Cl-catalysed ozone depletion is enhanced in the presence of polar stratospheric clouds.
- PSCs convert reservoir compounds into reactive free radicals (Cl and ClO) thereby significantly increasing the reactive halogen radicals. These free radicals accelerate depletion of ozone.
- Thus, polar vortex, in the form of PSCs, accelerate ozone depletion.

Ozone Depletion is Enhanced by PSCs

**Prelims question:** The formation of ozone hole in the Antarctic region has been a cause of concern. What could be the reason for ozone depletion at poles?

a) Presence of prominent tropospheric turbulence; and inflow of chlorofluorocarbons
b) Presence of prominent polar front and stratospheric Clouds and inflow of chlorofluorocarbons
c) Absence of polar front and stratospheric clouds; and inflow of methane and chlorofluorocarbons
d) Increased temperature at polar region due to global warming

**Explanation:**

- Ozonosphere lies at an altitude between 20 km and 55 km from the earth’s surface and spans the stratosphere and lower mesosphere. But the highest concentration occurs between 20 km and 30 km.
- To destroy ozone, ozone-depleting substances (ODS) like CFCs, HCFCs, etc. needs to be carried up to the lower levels of stratosphere.
- And the only weather phenomenon that can reach to this level are Polar Vortex and towering tropical cumulus clouds.
- But towering cumulus clouds (convectional thunderstorms) do not occur at the poles.

**Question:** The formation of ozone hole in the Antarctic region has been a cause of concern. What could be the reason for ozone depletion at poles?

- Presence of prominent tropospheric turbulence: they do not reach the stratosphere (flights prefer lower stratosphere as it is free of any significant weather phenomenon).
- Presence of prominent polar front: essential to keep polar vortex in its place. Polar vortex gives rise to stratospheric Clouds.
- **Presence of stratospheric Clouds:** they have the necessary ingredients (nitric acid and/or sulfuric acid) to amplify ozone depletion.
- Absence of polar front and stratospheric clouds: polar vortex slips into the temperate region and this reduces ozone depletion.
- Inflow of methane: methane (CH₄) is not in the list of ozone-depleting substances.
- It does not contain a halogen like chlorine, bromine, fluorine, etc. But it reacts with halogens to create reservoir compounds.
- Increased temperature at polar region due to global warming: this does not have any direct
impact on ozone depletion (that occurs in the stratosphere) over the poles.

**Answer:** b) Presence of prominent polar front and stratospheric Clouds and inflow of chlorofluorocarbons

*(Geo – Climatology – 20/04)* IMD releases new list of cyclone names

**IMD | PIB | Tropical Cyclones**

- **UPSC CSE Mains 2013:** The recent cyclone on east coast of India was called ‘Phailin’. How are the tropical cyclones named across the world? Elaborate.

### Naming of tropical cyclones worldwide

- It is usual practice for a storm to be named when it reaches tropical storm strength (*winds of 34 knots; 1 knot = speed equal to one nautical mile per hour; 1 nautical mile = 1.852 km*).
- World Meteorological Organisation has divided the world Oceans into Basins and assigned the responsibility of naming the Cyclones to the respective regional bodies — six regional specialised meteorological centres (RSMCs) and five regional Tropical Cyclone Warning Centres (TCWCs).
- Each RSMC and TCWC has its own rules in naming cyclones.
- To avoid controversies and disagreements, the names chosen are meant to be neutral and acceptable.
- In most regions, pre-determined alphabetic lists of alternating male and female names are used.
- In the north-west Pacific, the majority of names used are the names of flowers, animals, birds, trees, etc.

### Naming of tropical cyclones developing over the north Indian Ocean (NIO)

- **India Meteorological Department** (RSMC, New Delhi) is one of the six RSMCs to provide tropical cyclone and storm surge advisories to **13 member countries**.
- It is also mandated to name the Tropical Cyclones developing over the north Indian Ocean (NIO) — Bay of Bengal (BoB) and the Arabian Sea (AS) — following a standard procedure.
- IMD has a list of names contributed by each of 13 member countries.
- Every time a cyclone occurs, a name is picked in the order of the names that are already submitted.
- After all the countries get their turn, the next list of names is followed.

#### Old Table of Names contributed by countries in the Northern Indian Ocean Region

- The cyclone that formed in the Bay of Bengal in the 3rd week of May is named **Amphan (the last name in the old table)**.

#### New table of names of tropical cyclones over north Indian Ocean

- The first cyclone formed after cyclone Amphan will take the name **Nisarga** (the first name in the new table — contributed by Bangladesh).
- The second cyclone formed after cyclone Amphan will take the name **Gati** (the first name in the new list provided by India).
• There are a total of 13 lists (columns) in the new table (13 countries X 13 names = 169 names in total).

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<td>Sira</td>
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Why name tropical cyclones?

• Naming of TCs helps the scientific community, disaster managers, media, and general masses to
  ✓ identify each individual cyclone.
  ✓ create awareness of its development.
  ✓ remove confusion in case of simultaneous occurrence of TCs over a region (storms can often last a week and more than one cyclone can be occurring in the same region at the same time).
  ✓ remember a TC easily
  ✓ rapidly and effectively disseminate warnings to much wider audience (naming them after a person/flower/animal etc. makes it easier for quick information exchange).

Following criteria of naming is adopted by IMD:

• The proposed name should be neutral to political figures, religious believes, cultures and gender.
• The maximum length of the name will be eight letters.

• The names of tropical cyclones over the north Indian Ocean will not be repeated.
• The finalised names may also be reviewed during the course of time of implementation.

{Geo – Climatology – 20/04} IMD’s Monsoon Forecast

TH | Indian Climate > Monsoon Forecast

• Recently IMD has predicted that India will likely have a **normal monsoon in 2020**, with a chance of ‘above normal’ rain in August and September.
• The IMD’s confidence stems largely from global weather models pointing to negligible chances of El Nino.

**Indian Meteorological Department (IMD) issues five kinds of weather forecasts**

1. Nowcast is for less than 24 hours.
2. The short-range forecast is for up to three days.
3. The medium-range is from three to 10 days.
4. The extended-range is for 10-30 days.
5. The long-range is on a seasonal scale (e.g. monsoons).

• The IMD issues a two-stage monsoon forecast: the first in April, followed by a more detailed one in the last week of May, which will also illustrate how the monsoon will spread over the country.

**Monsoon Rainfall distribution categories**

• Long Period Average (LPA) is the averages of rainfall received over a 50-year period between 1951 and 2001, this average comes to **88 cm of rainfall** (according to recent change).
• This is the average rainfall recorded during the months from **June to September** (it doesn’t take into account the retreating monsoon).
IMD maintains five rainfall distribution categories on an all-India scale which are

1. **Normal:** When per cent departure of actual rainfall is +/-10% of LPA, that is, between 96-104% of LPA
2. **Below normal:** When departure of actual rainfall is less than 10% of LPA, that is 90-96% of LPA
3. **Above normal:** When actual rainfall is 104-110% of LPA
4. **Deficient:** When departure of actual rainfall is less than 90% of LPA
5. **Excess:** When departure of actual rainfall is more than 110% of LPA

**Statistical models of monsoon prediction**

- Since long, IMD employed statistical models to forecast the monsoon.
- Statistical models involved identifying climate parameters linked to the performance of the monsoon — for instance, the sea surface temperature gradient between North Atlantic and North Pacific, the volume of warm water in the equatorial Pacific, the Eurasian snow cover, etc.
- Their values are correlated to values of actual rainfall over a hundred years and then, using statistical techniques, extrapolated to forecast a particular year’s monsoon.
- For example, historical data between the monsoons and El Niño shows that they have a negative relationship.
- This is how the IMD dispensed its long-range forecasts until recently.
- This has, however, proved wrong as the IMD missed its mark on forecasting major droughts and rain-deficits.

**Digital System (dynamic model) since 2015**

- IMD started to use the dynamic model along with the statistical model.
- The dynamical model or the Monsoon Mission Coupled Forecast System relies on supercomputers, mathematically simulating the physics of the ocean and the atmosphere.
- It simulates the weather at a chosen set of locations on a given set of variables and the computers calculate how these weather variables will change over days, weeks, months.
- Dynamical models need data about current weather conditions for accurate prediction.
- But IMD does not have enough data collection centres to collect weather data of the entire country.
- The dynamical model, while better at forecasting the state of the weather a week or two in advance, is not reliable in forecasting longer term weather phenomenon like monsoon.

**High-resolution computer models**

- The IMD and several private weather agencies are increasingly relying on more sophisticated and high-resolution computer models to give **localised forecasts** or warn farmers of changes in weather 10-15 days ahead.
- These **shorter forecasts are far more reliable** and help farmers make decisions about sowing.
- These models are also useful for anticipating heat-wave or a cold-wave and therefore useful to urban planners and government.

**Why are monsoons difficult to predict?**

- Indian monsoon is the most complex weather system in the world as it is influenced by multitude of factors such as:
  - El Niño, La Nina, Indian Ocean Dipole, etc. ([El Nino | ENSO | La Nina Indian Ocean Dipole (IOD)])
  - Sub-tropical Jet Stream, Somali Jet, etc.
✓ Atlantic Zonal Mode or Atlantic Nino (Geo – IG – 19/06/04 Atlantic Ocean and Indian Summer Monsoon)
✓ Madden–Julian oscillation (given in May 2019 current affairs file), etc.

- There is no proper understanding of how pollution, aerosols and clouds influence the monsoon.
- IMD has shortage of resources, highly skilled software professionals and scientists.

(Geo – DM – 20/05) Surge-type Glaciers

PIB | Geography > Geomorphology | Disaster Management

- Scientists have found a seasonal advancement in 220 surge-type glaciers in the Karakoram Range of Ladakh.
- Surge-type glaciers are glaciers that have shown advancement in volume and length over a period of time.
- Such glaciers go against the normal trend of considerable reduction in volume and length of most glaciers in the Himalaya in recent decades.
- Surging glaciers represent 40% of the total glacial area of the Karakoram range.
- Surging glaciers do not flow at a constant speed, rather are subjected to cyclical flow instabilities.
- Surge during winter is more controlled because there is low amount of meltwater which flows unstably underneath the glaciers.
- The surging stops in summer because of the channelised flow of the melted water.

Significance of Studying Surging Glaciers

- Surging glaciers can lead to the destruction of villages, roads and bridges.
- They can also advance across a river valley and form an ice-dammed lake.
- These lakes can form catastrophic outburst floods (glacial lake outburst flood).
- Therefore, monitoring of glacier surges & ice-dammed lakes is important to minimize the disaster potential.

Suggested Reading: Glacial Landforms and Cycle of Erosion

(Geo – DM – 20/07/18) National Disaster Response Fund (NDRF)

TH | GS3 > Disaster Management

- Context: GOI has laid out the modalities for receipt of contributions for the purpose of disaster management in the NDRF as per Section 46(1)(b) of the Disaster Management (DM) Act, 2005.

About National Disaster Response Fund (NDRF)

- National Calamity Contingency Fund (NCCF) was renamed as National Disaster Response Fund (NDRF) with the enactment of the Disaster Management Act in 2005.
- NDRF is constituted under Section 46 of the Disaster Management Act, 2005.
- It supplements SDRF of a State, provided adequate funds are not available in SDRF.
- The financial assistance from SDRF/NDRF is only towards meeting the expenses for emergency response, relief & rehabilitation & is not compensation for loss/damage to properties/crops.
- NDRF is placed in the “Public Account” of Government of India under “reserve funds not bearing interest”.
- Comptroller & Auditor General of India (CAG) audits the accounts of NDRF.
- NDRF is subject to RTI.

State Disaster Response Fund (SDRF)

- The SDRF is constituted under Section 48 (1) (a) of the Disaster Management Act, 2005
- It is the primary fund available with State Governments for responses to notified disasters.
• The Central Government contributes **75% of SDRF allocation for general category States/UTs & 90% for special category States/UTs** (NE States, Sikkim, Uttarakhand, Himachal Pradesh, Jammu & Kashmir).

• The annual Central contribution is released in two equal instalments as per the recommendation of the Finance Commission.

• **SDRF shall be used only for meeting the expenditure for providing immediate relief to the victims.**

• **Disaster (s) covered under SDRF:** Cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloudburst, pest attack, frost & cold waves.

• **Local Disaster:** A State Government may use up to 10% of the funds available under the SDRF for providing immediate relief for ‘disasters’ within the local context in the State.

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**{Geo – Geomorphology – 20/04} Earth’s seismic noise**

**IE | Seismic waves**

• Geologists in Britain have reported a change in the Earth’s seismic noise amid the coronavirus lockdown.

• They have observed a 30-50 per cent fall in levels of ambient seismic noise since the lockdown.

**What is seismic noise?**

• In geology, seismic noise refers to the persistent vibration of the ground due to a multitude of causes.

• It is the **unwanted component** of signals recorded by a **seismometer** (instrument that records seismic waves or ground motions caused by earthquakes, volcanic eruptions, explosions, etc.).

• Seismic noise includes vibrations caused due to human activity, such as transport and manufacturing, and makes it difficult for scientists to study seismic data that is more valuable.

• Apart from geology, seismic noise is also studied in fields such as oil exploration & earthquake engineering.

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**How do the reduced seismic noise levels help scientists?**

• The seismic noise vibrations caused by human activity are of high frequency (1-100 Hz), and travel through the Earth’s surface layers.

• Usually, to measure seismic activity accurately and reduce the effect of seismic noise, geologists place their detectors 100 metres below the Earth’s surface.

• However, since the lockdown, researchers have said that they were able to study natural vibrations even from surface readings, owing to lesser seismic noise.

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**{Geo – Geomorphology – 20/05} Simulation Code to Study Earth’s Magnetosphere**

**PIB | Geography > Geomorphology > Geomagnetism**

• Scientists at the Indian Institute of Geomagnetism (IIG) have developed a one-dimensional fluid simulation code capable of studying a wide spectrum of electric field structures in earth’s magnetosphere.

• The developed simulation code is expected to help in planning of future space missions.

**Earth’s Magnetosphere**

• Sun is the major source of plasma deposition in space around the Earth.

• Thus, the Sun forces some of its plasma towards the earth in the form of the solar wind.

• Plasma is the most common state of matter in the universe as a whole.

• It consists of a **gas of ions and free electrons**.
The speed of solar wind varies between 300 to 1500 km/s, which carries with it a solar magnetic field, called the **Interplanetary Magnetic Field (IMF)**.

The interaction of the IMF with the earth’s magnetic field creates the **magnetosphere** of the earth.

The **magnetosphere shields our home planet from solar and cosmic particle radiation, as well as erosion of the atmosphere by the solar wind.**

### Regions of the Earth’s Magnetosphere

- **Bow shock**: It occurs when the magnetosphere of an Earth interacts with the solar wind.
- **Magnetosheath**: It is the region between the magnetopause & the bow shock of a planet’s magnetosphere.
- **Magnetopause**: It is the boundary between the planet’s magnetic field and the solar wind.
- **Northern tail lobe**: The magnetosphere of the earth contains two lobes, referred to as the northern and southern tail lobes. Magnetic field lines in the northern tail lobe point towards the earth.
- **Southern tail lobe**: The magnetic field lines in the southern tail lobes point away from the earth.
- **Plasmasphere**: The plasmasphere, or inner magnetosphere, is a region of the Earth’s magnetosphere consisting of low energy (cool) plasma.
- **Solar winds**: It is a stream of charged particles released from the upper atmosphere of the Sun, called the corona.

### Significance of Study of Plasma Processes

- The plasma processes **have the ability to hamper the working of a number of satellites** that have been placed in orbit in the magnetospheric region.
- However, the morphology of these plasma processes changes over space and time.
- These changes can be ideally deciphered only through computer simulations.
- The study will help advance the knowledge of plasma waves, instabilities, and coherent effects associated with wave-particle interactions that are useful in planning future space missions.
- It can also lead to precisely controlled fusion experiments for ever-expanding energy needs of humanity.

### Indian Institute of Geomagnetism (IIG)

- IIG is an autonomous institution functioning directly under the Department of Science and Technology.
- It has its main Campus at Panvel, Navi Mumbai (Maharashtra).
- It conducts basic and applied research in Geomagnetism (study of dynamics of earth’s magnetic field).

Suggested Reading: Earth’s Magnetic Field, Dynamo theory, Magnetosphere
The Brus (Reangs) are spread across Tripura, Mizoram and southern Assam.

In Mizoram, they are scattered in Kolasib, Lunglei and Mamit districts.

While many Brus of Assam and Tripura are Hindu, the Brus of Mizoram are Christians.

Clashes in 1995 between the Brus and the majority Mizos led to the demand for the removal of the Brus, perceived to be non-indigenous, from Mizoram’s electoral rolls.

This led to ethnic violence which saw more than 40,000 Brus fleeing to adjoining Tripura as refugees.

A quadripartite agreement allowed some 35,000 Bru tribal people to settle permanently in Tripura.

GOI, State governments of Tripura and Mizoram, and representatives of Brus signed the agreement.

The settlement package entails a one-time assistance of ₹4 lakh as fixed deposit, monthly cash assistance of ₹5,000 through DBT, free rations for two years, and ₹1.5 lakh as house-building assistance.

The package also included Eklavya residential schools, permanent residential and ST certificates besides funds to the Mizoram government for improving security in Bru resettlement areas.

The agreement makes Brus of Mizoram opt for the rehabilitation package in the relative safety of Tripura.

However, the issue is not completely resolved as some Brus prefer safe repatriation to Mizoram.

GOI, the Assam government and Bodo groups signed an agreement for peace and development.

The 2020 agreement says the Government of Assam “will notify Bodo language in Devanagari script as the associate official language in the state”.

Bodos are the single largest community among the notified Scheduled Tribes in Assam.

Part of the larger umbrella of Bodo-Kachari, the Bodos constitute about 5-6% of Assam’s population.

The first organised demand for a Bodo state came in 1967-68.

Bodos saw the 1985 Assam Accord as essentially focusing on the interests of the Assamese-speaking people.

In 1987, the All Bodo Students Union (ABSU) revived the Bodo statehood demand.


It subsequently renamed itself National Democratic Front of Boroland (NDFB), and later split into factions.

Under the recent agreement, all NDFB factions should disband their armed organisations within
one month of signing the Memorandum of Settlement (MoS).

**Bodoland Territorial Council (BTC)**

- It is an **autonomous body under the Sixth Schedule of the Constitution**.
- There have been two Bodo Accords earlier, and the second one led to the formation of BTC.
- The area under BTC, formed under the 2003 Accord, is called the Bodoland Territorial Region (BTR).
- BTR comprises **Kokrajhar, Chirang, Baksa and Udalguri districts**, accounting for 11% of Assam’s area and 10% of its population.

**{Geo – HG – 20/02} 1.36 crore Indians living abroad**

- The highest number of Indians abroad are living in the
  1. **United Arab Emirates** (34,20,000 — about one-fourth of all Indians abroad)
  2. **Saudi Arabia** (25,94,947)
  3. **US** (12,80,000)

**TOI | Human Geography > Indian Diaspora**

- India has recently banned the entry of Overseas Citizen of India (OCI) cardholders due to COVID-19.

**Overseas Citizen of India (OCI)**

- In 2005, GOI launched the OCI Scheme by making amendments to Citizenship Act, 1955.
- In 2015, GOI **discontinued the Person of Indian Origin (PIO) card** and merged it with OCI card.

**Eligibility**

Government of India allows the following categories of foreign nationals to apply for OCI Card

- Is a Citizen of India at time of or after the Constitution came into effect.
- Eligible to become citizen of India on 26 January 1950.
- Belonged to a territory that became part of India after 15 August 1947.
- Child or descendent of a person from any of the above mentioned categories.
- Foreign origin spouse of Citizen of India or of a person holding OCI status.
- Anyone who is applying for OCI card **should hold a valid Passport of another country**.
- Individuals who do not have citizenship of any other country are not eligible to gain an OCI status.
• Individuals whose parents or grandparents hold citizenship of Pakistan and Bangladesh are not eligible.

**Benefits for OCI cardholders**

• Lifelong Visa to visit India multiple times.
• No need to register with Foreigners Registration Officer (FRO) for any length of stay.
• Except for acquisition of agricultural and plantation properties, OCI card holders have similar facilities that are extended to NRIs in economic, financial, and educational fields.
• Treated at par with Indian citizens in matters of traffic in airfares in Indian domestic sectors.
• Same entry fee as for Indians for entry into India’s national parks and wildlife sanctuaries.

**Restrictions placed on OCI card holders**

• Do not have right to vote.
• Do not have right to any public service/government jobs
• Cannot hold offices of Prime Minister, President, Vice-President, Judge of Supreme Court and High Court, member of Parliament or Member of state legislative assembly or council.
• **Cannot own agricultural property.**

**{Geo – HG – 20/03} World Happiness Report (WHR)**

• Experiences from several nations confirm that the countries with higher GDP and higher per capita income are not necessarily the happiest countries.

**The World Happiness Report 2020**

• The World Happiness Report 2020 (8th WHR report) ranks cities around the world by their subjective well-being and digs deeply into how the social, urban and environments combine to affect our happiness.
• **Finland** is the world’s happiest nation for the third consecutive year.
• Nordic states along with countries such as Switzerland, New Zealand and Austria are the happiest.
• **India is at 144th place.**

**{Geo – Oceanography – 20/02} Arctic ice melt is disrupting Beaufort Gyre ocean current**

**TH | GS1 > changes in critical geographical features (including water-bodies and ice-caps) and in flora and fauna and the effects of such changes. | Environment > Climate Change > Impacts**
• The **Beaufort Gyre** is a wind-driven ocean current located in the **Arctic Ocean polar region**.

• Wind blows the gyre in a clockwise direction (Polar region = Subsiding cold air = **Anticyclonic condition**).

• In the Arctic, Beaufort Gyre floats above the warmer, salty water, and helps **protect the sea ice from melting**.

• This keeps the polar environment in balance by storing **fresh water near the surface** of the Arctic.

• As the fresh water is slowly released by the gyre into the Atlantic Ocean, it allows the Atlantic Ocean currents to carry it away in small amounts.

• However, since the 1990s, the gyre has accumulated a large amount of fresh water.

• The cause of this gain in freshwater concentration is due to **quick loss of sea ice because of global warming**.

• The westerly winds also increased the speed and size of the gyre, preventing the fresh water from leaving.

• The winds used to change direction every five to seven years releasing the fresh water slowly.

• But the present decades-long absence of change in western wind direction is unusual.

• If the wind changes direction now, it could reverse the current and release the accumulated water all at once.

• This would have hemisphere-wide implications for the climate, especially in Western Europe.

• Western Europe warm climate (due to **North Atlantic Drift**) could be altered by an influx of unprecedented amounts of cold, fresh water from melting ice in the Arctic.

• The release of fresh water from the Arctic to the North Atlantic can **slowdown the Atlantic Meridional Overturning Circulation (AMOC)**.


• AMOC helps regulate the planet’s climate by carrying heat from the tropics to northern latitudes.

• If it is slowed down, it could negatively impact all life forms, especially marine creatures.

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**{Geo LBT – India – 20/01/06} Challakere to be ISRO’s astronaut training hub**

**TH | 06-01-2020 | Location Based Topics for Prelims – India**

• Facility for training astronauts will come up in three years at 400-acre ISRO land at **Challakere**, a shrubby, arid oilseeds town on the Bengaluru-Pune NH4 in **Chitradurga district of Karnataka**.

• Challakere at present houses facilities of the ISRO, DRDO’s Advanced Aeronautical Test Range, the Bhabha Atomic Research Centre, etc.

• ISRO has proposed a ₹ 2,700-crore master plan to house its Human Space Flight Centre (HSFC).

• ISRO has sought the amount outside the ₹10,000 crore budget of Gaganyaan & is awaiting GOI’s approval.

• Everything connected with HSP (Human Space-flight Programme) will shift to Challakere in future.

• Whatever training is being given in Russia for the Gaganyaan crew will all be done by ISRO in Challakere.

• The country pays a hefty, unnamed sum to use similar facilities abroad.
Currently, HSP work is split across various centres such as the **Vikram Sarabhai Space Centre in Thiruvananthapuram** and the **U. R. Rao Satellite Centre in Bengaluru**.

### Human Spaceflight Programme

- Gaganyaan is an Indian crewed orbital spacecraft intended to be the formative spacecraft of the Indian Human Spaceflight Programme.
- Four male pilots of the Indian Air Force in their 30s and early 40s are scheduled to leave for Moscow to train at the Yuri Gagarin Cosmonaut Training Centre for 15 months as candidates for Gaganyaan.

#### Zoji La Tunnel & Z-Morh Tunnel

- An agreement was signed for completing the 6.5 km long 2-lane bi-directional Z-Morh tunnel in J&K.
- The project includes construction of the tunnel along the Srinagar-Sonmarg-Gumri Road.
- Along with **Zoji-la tunnel** (22 km from Z-Morh tunnel), the **Z-Morh tunnel** will ensure year-long road connectivity between Srinagar and Kargil which currently remains closed for about seven months due to snow.

#### Zoji La Tunnel

- Zoji La Tunnel is a 14.2 km long road tunnel under Zoji La pass (altitude of 3,528 m) on the Himalayas between Sonmarg and Drass town of Kargil district, currently under construction.
- It takes more than 3 hours to cross the pass, but the tunnel will reduce the time to only 15 minutes.
- This tunnel was a strategic requirement of the army as the pass is close to LOC.
- Once all tunnels are in place, the time to drive from Srinagar to Leh will be reduced and will not require overnight halt at Kargil. The entire stretch will become motorable throughout the year.

#### Sir Creek

- At an event in Dubai, a former minister of Pakistan recalled plan for Sir Creek pact.
• Sir Creek is a 96-km strip of water in the Rann of Kutch marshlands.
• It is disputed between India and Pakistan.
• The Creek roughly divides the Kutch region of Gujarat from the Sindh Province of Pakistan.

What is the dispute?

• After India’s independence, Sindh became a part of Pakistan while Kutch remained a part of India.
• Pakistan claims the entire creek as per Bombay Government Resolution of 1914.
• The resolution included the creek as part of Sindh and set the boundary as the eastern flank of the creek popularly known as Green Line.
• But India claims that the boundary lies mid-channel as depicted in the map.
• In its support, it cites the Thalweg Doctrine in International Maritime Law, which states that river boundaries between two states may be divided by the mid-channel if the water-body is navigable.

What is the importance of Sir Creek?

• Sir Creek is considered to be among the largest fishing grounds in Asia.
• The region is said to have oil and gas concentration under the sea.
• The Border Roads Organisation (BRO) has constructed the Daporijo bridge over Subansiri river in Arunachal Pradesh in a record span of just 27 days.
• The bridge links roads leading up to the Line of Actual Control (LAC) between India and China.
• The Subansiri River is a tributary of the Brahmaputra River in the Indian states of Assam and Arunachal Pradesh, and the Tibet Autonomous Region of China.
• It originates in the Tibetan Plateau and enters India through Miri hills in Arunachal Pradesh.
• The Subansiri is the largest tributary of the Brahmaputra.

{Geo LBT – India – 20/04} Kasowal Bridge

PIB | Location Based Topics – India

• It is a 484-metre long permanent bridge built by the Border Roads Organization on the river Ravi to connect the Kasowal enclave of Punjab (along the Pakistan border) to the rest of the country.
• Kasowal enclave is around 35 square km.
• It was till now connected through a pontoon bridge of limited load capacity.
• The enclave was formed because it has the Ravi behind it and the International Border ahead of it.
• There are similar enclaves of Pakistani territory too, which lie ahead of Ravi and face Indian territory.
• These Pakistani enclaves — Dera Baba Nanak enclave and Jassar enclave — were occupied by the Indian Army in the 1965 and 1971 wars.
• There are similar enclaves along the India and Bangladesh border.

{Geo LBT – India – 20/04} Rohtang Pass

PIB | Location Based Topics – India

• Context: Border Roads Organization (BRO) opened the Rohtang Pass, three weeks in advance, for transporting essential supplies to Lahaul and Spiti districts of Himachal Pradesh amid the lockdown.
• Rohtang Pass is a high mountain pass on the eastern Pir Panjal Range of the Himalayas.
• It connects the Kullu Valley with the Lahaul and Spiti Valleys of Himachal Pradesh, India.
• Manali-Leh Highway, a part of NH 21, transverses Rohtang Pass.
• River Ravi rises west of the Rohtang pass in the Kullu Hills.

Suggested Reading: {Geo LBT – India – 19/12/25}
Atal Tunnel (Rohtang Tunnel)

{Geo LBT – India – 20/05} National Centre for Polar and Ocean Research
PIB | Location Based Topics for Prelims
- National Centre for Polar and Ocean Research has contributed to the fight against Covid-19.
- National Centre for Polar and Ocean Research (NCPOR) was established as an autonomous Research and Development Institution of the Ministry of Earth Sciences in 1998.
- It is located in Goa.
- It is the nodal agency for planning, promotion, coordination and execution of the entire gamut of polar and southern ocean scientific research in the country as well as for the associated logistics activities.
- Its responsibilities include the Management and upkeep of the
  1. Indian Antarctic Research Bases “Maitri” and “Bharati”, and
  2. Indian Arctic base “Himadri”.

{Geo LBT – India – 20/05} New Road to Kailash Mansarover

TH | Location Based Topics – India
- A new 80 km road is inaugurated in Uttarakhand connecting the Line of Actual Control (LAC) and opening a new route for Kailash Mansarover yatra via Lipulekh Pass.
  - The Link Road is named as the Kailash-Mansarovar Yatra Route under which the Border Roads Organisation (BRO) achieved road connectivity from Dharchula (Uttarakhand) to Lipulekh.
  - Lipulekh Pass also known as Lipu-Lekh Pass/Qiangla or Tri-Corner is a high altitude mountain pass situated in the western Himalayas with a height of 5,334 metre.
  - It is an International mountain pass between India, China, and Nepal.

Existing routes
- The older Lipulekh Pass route was badly damaged in the Uttarakhand floods in 2013.
A new route through Nathu La pass (4,000 metres above sea level in Sikkim) is operational since then.

Both the routes are operational, though the route via Nathu La is shorter and safer.

Advantages of the new Lipulekh route

- It is the shortest & cheapest route with just one-fifth distance of road travel as compared to other old routes.
- There is no air travel involved and the majority of the travel (84%) is in India and only 16% in China compared to other routes (Old Lipulekh and Nathu La) where 80% road travel is in China.
- Except for a 5-km trek, whole travel will be on vehicles reducing the 5-day trek to 2-days road travel.

Kailash Mansarovar

- To Hindus it is the earthly embodiment of the dominant mountain of heaven, Meru, and the residence of Lord Shiva and his consort Goddess Parvati.
- The Kailash range’s supreme peak lies in Tibet at the height of 6,675 meters.
- The pilgrimage to Kailash and to the sacred Mansarover lake that lies 30 km to its south, is run exclusively by a government organization, the Kumaon Mandal Vikas Nigam (KMVN).
- The organization works in collaboration with the Ministry of External Affairs and the Government of China.

Kholongchhu Hydroelectric Project

- The Kholongchhu Hydro Energy Limited is a joint venture between Bhutan & India’s Sutlej Jal Vidyut Nigam Limited (SJVNCL).
- The project is expected to be completed in the second half of 2025.
- The 600 MW run–of–the–river project is located on the Kholongchhu River in eastern Bhutan.
- At present, four projects of bilateral cooperation totalling over 2,100 MW, are operational in Bhutan.
  1. 336 MW Chukha Hydroelectric project,
  2. 60 MW Kurichhu Hydro Electric project,
  3. 1,020 MW Tala Hydro Electric Project &
  4. 720 MW Mangdechhu Hydro Electric Project.

Rewa Ultra Mega Solar Project

- The 750 megawatt Rewa solar Power Plant in MP was dedicated to the nation by Prime Minister.

About Rewa Ultra Mega Solar Project

- The plant consists of three solar power generating units, 250 MW each that are located on a 500–hectare plot of land inside a 1,500–hectare solar park.
- The solar plant was set up by the Rewa Ultra Mega Solar Limited, a joint venture between Madhya Pradesh Urja Vikas Nigam Limited & the Centre’s Solar Energy Corporation of India (SECI).
International Finance Corporation, a World Bank group company, has invested close to $440 million in the project.

The river is also known as ‘Dakshin Bhagirathi’.
The Pamba originates at Pulachimalai hill in the Western Ghats and empties into the Vembanad Lake.

Solar Cells or Photovoltaic Technology

- Solar energy can be converted directly into electrical energy (direct current, DC) by photovoltaic (PV) cells commonly called solar cells.
- Photovoltaic cells are made of silicon & other materials. When sunlight strikes the silicon atoms it causes electrons to eject. This principle is called as ‘photoelectric effect’.
- A typical solar cell is a transparent wafer that contains a very thin semiconductor.
- Sunlight energizes & causes electrons in the semiconductor to flow, creating an electrical current.

The District Disaster Management Authority (DDMA) started clearing the sand deposit left by the 2018 deluge at Pampa.

The Pamba River (also called Pampa river) is the third longest river in the South Indian state of Kerala after Periyar & Bharathappuzha.

Sabarimala temple dedicated to Lord Ayyappa is located on the banks of the river Pamba.
Adani is building the $16.5 billion **Carmichael coal-mining project** in Queensland, Australia.

The project is expected to produce 8 million tonnes of thermal coal (coal for power generation; metallurgical coal (coke) is used in steel making) a year.

The Australian government approved its construction in 2018.

Adani has faced country-wide protests in Australia against the Queensland project.

The project can increase global warming and also threaten the Great Barrier Reef.

Australia is one of the world's largest carbon emitters per capita because of its reliance on coal-fired power.

Environmentalists say that the continued use of coal will lead to higher greenhouse emissions.

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**The Galilee Basin** is one of the largest untapped reserves of coal in the world.

Behind Western China, the Galilee Basin forms the second biggest fossil fuel expansion on the planet.

Carmichael mine will be connected to the **Abbot Port** operated by Adani.

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**{Geo LBT – World – 20/04} Concerns over Chinese dams on Brahmaputra & Mekong**

A new study funded by the U.S. highlighted the impact of China’s dams on the Mekong River.

According to the study, China’s dams on Mekong River (Lancang in China) are causing droughts downstream.
• China has countered that the dams it is building on the river are “run of the river” dams for power generation.
• The study has raised fresh questions on whether dams being built on other rivers that originate in China, such as the Brahmaputra may similarly impact countries downstream.

**Chinese dams on Brahmaputra (Yarlung Tsangpo)**

• India has long expressed concerns over dam-building on the Brahmaputra.
• In 2015, China operationalized its first hydro-power project at Zangmu Dam.
• Three other dams at Dagu, Jiexu and Jiacha are being developed.
• Indian officials have said the dams are not likely to impact the quantity of the Brahmaputra’s flows because they are only storing water for power generation.
• Moreover, the Brahmaputra is not entirely dependent on upstream flows and an estimated 35% of its basin is in India.
• **India does not have a water-sharing agreement with China**, but both sides share hydrological data.

**Mekong River (Lancang River in China)**

• The Mekong, or Mekong River, is a trans-boundary river in Southeast Asia.
• It is the world’s twelfth longest river and the seventh longest in Asia.
• Its estimated length is 4,350 km.
• From the Tibetan Plateau the river runs through China, Myanmar, Laos, Thailand, Cambodia, and Vietnam.
• The extreme seasonal variations in flow and the presence of rapids make navigation difficult.
• The river is a major trade route between western China and Southeast Asia.

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**WATER POWER**

<table>
<thead>
<tr>
<th>DAM</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dagu</td>
<td>640 MW</td>
</tr>
<tr>
<td>2. Jiexu</td>
<td>510 MW</td>
</tr>
<tr>
<td>3. Zangmu</td>
<td>320 MW</td>
</tr>
</tbody>
</table>

• Under construction • Approved in the 12th Five-year Plan (2011-15)

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**Matterhorn**

• **Context:** Indian Tricolour of more than 1,000 meters in size was projected on Matterhorn Mountain, Switzerland to express solidarity to all Indians in the fight against COVID-19.
• **Matterhorn is a mountain in the Swiss Alps.**
• It is situated in the Pennine Alps on the border between Switzerland and Italy.
• Its summit is 4,478 metres high, making it one of the highest summits in the Alps and Europe.
In the middle of the COVID-19 pandemic, China is busy increasing its presence in the South China Sea.

The focus this time is on two disputed archipelagos of the Spratly Islands and the Paracel Islands.

Beijing unilaterally renamed 80 islands and other geographical features in the area.

**Land Disputes in South China Sea: Parcel Islands and Spratly Islands**

The Spratly Islands and Paracel Islands are two of the most contested areas in the South China Sea.

However, unlike other parts of the South China Sea, they do not hold large resources of oil and natural gas.

Most fields containing discovered oil and natural gas are clustered in uncontested parts of the South China Sea, close to shorelines of the coastal countries.

The Paracel Islands, however, contain significant natural gas hydrate resources (given in Oceanography).

Under the UNCLOS, ownership of habitable islands can, however, extend the exclusive access of a country to surrounding energy resources (200 mile EEZ).

Hence, the country that wins the dispute would have the right to explore and develop whatever the resources that are available in the EEZ.

**United Nations International Conferences on the Law of the Sea (UNCLOS)**

For full information on UNCLOS, go to Geography > Oceanography > Resources from the Ocean

- UNCLOS is an international agreement that defines the rights and responsibilities of nations where use of the oceans’ waters by them is concerned.

**Territorial waters**

- Territorial waters are those waters over which a state has full sovereignty
- Territorial waters extend for 19 km (12 miles) from the coast.
- Territorial waters include fjords, estuaries & land between the mainland & offshore islands in internal waters.
Contiguous Zone or Pursuit Zone

- A further contiguous zone of 19 km (24 miles) is recognized in which the coastal state can act against those who break the law (smugglers, pirates, illegal immigrants etc.) within the true territorial waters.
- This, in other words, is a pursuit zone.

Exclusive Economic Zone (EEZ)

- Exclusive economic zone (EEZ) starts at the same baseline as the territorial waters.
- EEZ extend for 320-km (200-mile) from the baseline.
- Within the EEZ, the coastal state has the right to exploit all economic resources — fish, oil and gas, etc.
- The state may extend these rights to the edge of the shelf — as much as 1280 km (800 miles) in some cases — though this does not include rights to the sea itself beyond the 320 km EEZ.
- Land-locked and geographically disadvantaged states can participate on an equitable basis in exploiting an appropriate part of the surplus of the living resources of the EEZs of coastal states.
- In the EEZ and on the continental shelf, all marine scientific research is subject to relevant coastal State’s consent.
- The coastal states, in turn, are expected to grant consent for peaceful purposes to other States.

High Seas

- Beyond all the zones in which individual countries can claim control are the high seas.
- The high seas are free for navigation by vessels of all nations.
- The oceans and the airspace above may also be used freely.
- The oceans may also be freely fished by all nations.
- The States must share with the international community part of the revenue derived.

{Geo LBT – World – 20/07/06) Botswana’s Okavango Delta

DTE | GS1 > Mapping

- Context: Hundreds of elephants have died mysteriously in Botswana’s Okavango Delta.

- Botswana is a land-locked country in Southern Africa.
- Bordered by South Africa to the south & southeast, Namibia to the west & north, Zimbabwe to the northeast & Zambia to the north.
- Currently home to more elephants than any other African country, & southern Africa remains a stronghold for 293,000, or 70%, of the estimated remaining African elephants.
- The Okavango Delta is a vast inland river delta in northern Botswana.
• It was inscribed on the World Heritage List in 2014.

{Geo LBT – World – 20/07/09} Bhashan Char Island

DH | GS1 > Mapping
• **Context:** Hundreds of Rohingya refugees on a flood–prone island in the Bay of Bengal will not be allowed to leave unless they agree to return home.

About Bhashan Char Island

• **Bhashan Char** is an island of Bangladesh.
• It is located in the Bay of Bengal, 37 miles from the coast.
• The Island was formed with Himalayan silt in 2006.

{Geo LBT – World – 20/07/13} World’s Longest Subsea Power Cable

The Guardian | GS1 > Mapping
• **Context:** Construction work has begun on the world’s longest subsea power cable, which will run between Britain & Denmark to share renewable energy between the two countries.

About North Sea, English Channel, Dover Strait

• **The North Sea** is a sea of the Atlantic Ocean located between Great Britain, Denmark, Norway, Germany, the Netherlands, Belgium & France.
• It connects to the ocean through the English Channel in the south & the **Norwegian Sea** in the north.
• **English Channel** is a narrow arm of the Atlantic Ocean separating the southern coast of England from the northern coast of France & tapering eastward to its junction with the North Sea at the **Strait of Dover**.
• The Strait of Dover or Dover Strait, historically known as the Dover Narrows is the strait at the **narrowest part of the English Channel**.
Context: Iran drops India from Chabahar rail project, cites funding delay.

Four years after India & Iran signed an agreement to construct a rail line from Chabahar port to Zahedan, the Iran has decided to proceed with the construction on its own, citing delays from the Indian side in funding.

Chabahar–Zahedan line will be extended to Zaranj across the border in Afghanistan.

The entire project would be completed by March 2022, & that Iranian Railways will proceed without India’s assistance, using approximately $400 million from the Iranian National Development Fund.

The development comes as China finalises a massive 25-year, $400 billion strategic partnership deal with Iran, which could cloud India’s plans.

Trilateral Agreement

The railway project was meant to be part of India’s commitment to the trilateral agreement between India, Iran & Afghanistan to build an alternate trade route to Afghanistan & Central Asia.

In May 2016, during Prime Minister’s visit to Tehran to sign the Chabahar agreement with Iranian President & Afghanistan President, India had signed an MoU with the Iranian Rail Ministry.

The MoU was to construct the Chabahar–Zahedan railway as part of transit & transportation corridor in trilateral agreement between India, Iran & Afghanistan.

Chabahar Port

It is situated in Sistan & Baluchestan Province in south Iran on the Gulf of Oman.

Pakistan’s Gwadar is about 70 kilometres to the west along the coast.

Afghanistan is connected to the port through its land border with Iran, & India via the sea.

The port is readily accessible for all the three countries & acts to facilitate trade among them.

Chabahar is considered to be a significant opportunity for India & Afghanistan to bypass Pakistan’s Gwadar seaport & its trade routes.

The first phase of Chabahar port was inaugurated in December 2017.

India committed to invest $500 million, according to the first phase agreement.

Starit of Hormuz

Strait of Hormuz, the narrow body of water linking the Persian Gulf to the Gulf of Oman, which feeds into Arabian Sea & the rest of the world.

Though the strait is tiny – at its narrowest point it is just 30 km (21miles) across it’s a geopolitically & financially crucial chokepoint

It’s the world’s busiest shipping lane, chiefly because there are limited alternatives to bypass the strait.
Most of the oil that passes through the strait come from Saudi Arabia.

**Persian Gulf**

- The Persian Gulf is (one of the most critical bodies of water), is positioned in the heart of the Middle East.
- Located in southwestern Asia, it separates the Arabian Peninsula from Iran (formerly called Persia).
- It connects with the Gulf of Oman & the Arabian Sea through the Strait of Hormuz, which is 30 to 60 miles wide.
- The Persian Gulf & its coastal areas are the world’s largest single source of crude oil.
- Due to its strategic importance Powerful naval forces from several countries remain in its waters to protect the flow of oil to the rest of the world.

**Context:** Mauritius Prime Minister Pravind Jugnauth will inaugurate the country’s new Supreme Court building in the island–nation’s capital, Port Louis jointly with PM of India.

**Mauritius**

- Mauritius is an island nation in the Indian Ocean about 2,000 kilometres off the south-east coast of the Africa.
- Mauritius is the only country in Africa where Hinduism is the largest religion.

**Source & Credits**
• Hindus in Mauritius are the descendants of the Indian indentured labourers brought by the British in the 1840s to work in the sugarcane fields.
• Mauritius remained a primarily plantation-based colony of the United Kingdom until independence in 1968.
• Nowadays, tourism plays a major role in the country’s economy.

Islands in the region

• Mauritius includes the main island of Mauritius and Rodrigues, Agaléga and St. Brandon.
• The capital and largest city, Port Louis, is located on Mauritius.

Mascarene Islands

• The islands of Mauritius and Rodrigues form part of the Mascarene Islands, along with nearby Réunion, a French overseas department.

Disputed Islands

• As a British colony, Mauritius included Rodrigues, Agalega, St. Brandon, Tromelin, the Chagos Archipelago, and, until 1906, the Seychelles.
• Sovereignty over Tromelin is disputed between Mauritius and France.
• In 1965, the U.K. split the Chagos Archipelago from Mauritian territory, and some islands from the Seychelles, to form the British Indian Ocean Territory (BIOT).
• The sovereignty of the Chagos is disputed between Mauritius and the UK.
• Diego Garcia (US Naval base), one of the islands in the region, was leased to the United States.
• In February 2019, the International Court of Justice issued an advisory opinion ordering the UK to return the Chagos Islands to Mauritius as rapidly as possible, in order to complete the decolonisation of Mauritius.

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