



Drishti IAS Presents...



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GEOGRAPHY

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Report on Lightning Strikes

Why in News

According to a report published by the **Climate Resilient Observing Systems Promotion Council (CROPC)**, the number of **deaths due to lightning strikes reduced by nearly 37%** in 2019-20.

- CROPC is a **non-profit organization** that works with the **India Meteorological Department (IMD)**.

About Lightning

- **Lightning** is a very rapid and massive discharge of electricity in the atmosphere.
 - **Inter cloud or intra cloud (IC) lightning** are visible and **harmless**.
 - It is **cloud to ground (CG) lightning**, which is **harmful** as the 'high electric voltage and electric current' leads to **electrocution**.
- It is a **result of the difference in electrical charge between the top and bottom of a cloud**.
 - The **Earth is a good conductor of electricity**. While electrically neutral, it is **relatively positively charged compared to the middle layer of the cloud**. As a result, an estimated **20-25% of the current flow is directed towards the Earth**.
 - It is this current flow that results in **damage to life and property**.
- **Lightning has a greater probability of striking raised objects** on the ground, such as trees or buildings.
- The **most lightning activity** on Earth is seen on the shore of **Lake Maracaibo in Venezuela**.
 - At the place where the Catatumbo river falls into Lake Maracaibo, an average 260 storm days occur every year, and October sees 28 lightning flashes every minute - a phenomenon referred to as the **Beacon of Maracaibo or the Everlasting Storm**.
- The rapid **degradation of the environment** like **global warming**, deforestation, depletion of water bodies, concretisations, rising pollution and **aerosol levels** have cumulatively pushed the environment to extremes. And lightning is direct promulgation of these climatic extremities.

Related News: [Incidents of Lightning](#)

Domestic Vanadium Deposits

Why in News

A recent exploration by **Geological Survey of India (GSI)** has found reserves of **Vanadium in Arunachal Pradesh**.

- This is the **first report of a primary deposit of vanadium in India**.

Key Points

➤ About Vanadium:

- Vanadium (**chemical element** with the **symbol V**) is a scarce element, hard, silvery grey, ductile and malleable **transition metal** with **good structural strength**.
 - Transition metals are all the elements in groups 3–12 of the periodic table. These are superior conductors of heat as well as electricity.

○ Ores:

- Patronite, vanadinite, roscoelite and carnotite.

○ Uses:

- Used primarily as an alloying element in the **Iron & Steel Industry** and to some extent as a **stabilizer in titanium and aluminum alloys used in the aerospace Industry**.
- Modern applications include its use as **vanadium secondary batteries for power plants** and **rechargeable Vanadium Redox Battery (VRB) for commercial applications**.
- Vanadium alloys are used in **nuclear reactors** due to their **low neutron-absorbing properties**.

➤ Availability of Vanadium:

- According to data provided by the GSI, India consumed **4% of total global production of Vanadium in 2017**. However, it is not a primary producer of the strategic metal.
- The largest deposits of Vanadium are in **China**, followed by **Russia and South Africa** respectively.

Domestic Exploration of Lithium

Why in News

Recent surveys by the **Atomic Minerals Directorate**

Note:



for Exploration and Research (AMD) have shown the presence of **lithium resources in Mandya district**, Karnataka.

- AMD is the oldest unit of the **Department of Atomic Energy**.

Key Points

- **About Lithium (Li):**
 - It is a soft, silvery-white metal. Under standard conditions, it is the **lightest metal** and the **lightest solid element**.
 - It is highly **reactive and flammable**, and must be **stored in mineral oil**.
 - It is **an alkali metal and a rare metal**.
 - The **alkali metals** constitute **group 1 elements** lying in the **s-block** of the periodic table (**lithium, sodium, potassium, rubidium, caesium, and francium**).
 - **Rare Metals (RM)** include Niobium (Nb), Tantalum (Ta), Lithium (Li), Beryllium (Be), Cesium (Cs) etc.
 - **Rare Earth Metals (RE)** include Lanthanum (La) to Lutetium (Lu) besides Scandium (Sc) and Yttrium (Y).
 - **Uses:**
 - Lithium metal is used to make **useful alloys**.
 - In Thermonuclear reactions.
 - To make **electrochemical cells**. Lithium is an important component in **Electric Vehicles**, Laptops etc.
- **Extraction Method:**
 - Lithium can be extracted in different ways, depending on the type of the deposit.
 - **Solar evaporation** of large **brine pools**.
 - A **brine pool** is a volume of brine collected in a seafloor depression.
 - Hard-rock extraction of the ore.

Related News: [Rare Earth Metals and China's Monopoly](#)

Western Disturbance

Why in News

According to the **India Meteorological Department (IMD)**, a **western disturbance** is likely to affect the **Himalayan region** soon.

Key Points

- Western Disturbance (WD), labeled as an **extra-tropical storm** originating in the **Mediterranean**, is an **area of low pressure** that brings sudden showers, snow and fog in northwest India.
 - These travel eastwards on high-altitude **westerly jet streams** - massive ribbons of fast winds traversing the earth from west to east.
 - **Disturbance** is an area of **"disturbed" or reduced air pressure**.
- A **WD** is associated with rainfall, snowfall and fog in **northern India**.
- **WD** brings **winter and pre-monsoon rain** and is important for the development of the **Rabi crop** in the Northern subcontinent.
- The WDs are not always the harbingers of good weather. Sometimes **WDs can cause extreme weather events** like floods, **flash floods, landslides**, dust storms, hail storms and **cold waves** killing people, destroying infrastructure and impacting livelihoods.

Semeru Volcano of Indonesia

Why in News

Recently, **Semeru volcano** erupted in **Indonesia's East Java province**. Other volcanoes, such as the **Merapi volcano (Java)** and **Sinabung volcano (Sumatra)**, also erupted recently.

Key Points

- **Semeru Volcano:**
 - Semeru - also known as **"The Great Mountain"** - is the **highest volcano in Java** and one of the **most active**.
 - **Indonesia, with the maximum number of active volcanoes in the world**, is prone to seismic upheaval due to its location on the **Pacific's Ring of Fire**.
 - Semeru volcano is also the part of the **Island arcs** formed by the subduction of the **Indo-Australian plate** below **Sunda Plate** (part of Eurasian Plate).
- **Pacific Ring of Fire:**
 - **The Ring of Fire**, also referred to as the **Circum-Pacific Belt**, is a path along the Pacific Ocean characterized by **active volcanoes and frequent earthquakes**.

Note:



- It traces boundaries between several tectonic plates—including the **Pacific, Cocos, Indian-Australian, Nazca, North American, and Philippine Plates**.



➤ Island Arcs:

- They are long, curved chains of **oceanic islands** associated with **intense volcanic and seismic activity and orogenic** (mountain-building) processes.
 - An island arc typically has a **land mass or a partially enclosed, unusually shallow sea** on its concave side.
 - Along the convex side there almost invariably exists a long, **narrow deep-sea trench**.
 - The greatest ocean depths are found in these depressions of the seafloor, as in the case of the **Mariana (deepest trench in the world) and Tonga trenches**.
- Prime examples of this form of geologic feature include the **Aleutian-Alaska Arc** and the **Kuril-Kamchatka Arc**.

Related News: [Indonesia's Mt. Sinabung](#)

Ratle Hydro Electric Project

Why in News

The Union Cabinet has given its approval for **850 MegaWatt (MW) Ratle hydropower project** on **Chenab river** in J&K.

Key Points

- **The Ratle Hydroelectric Project** is a **run-of-the-river**

hydroelectric power station on the Chenab River, Kishtwar district of the Indian Union Territory of Jammu and Kashmir.

- **Background:** In June 2013, the then Indian Prime Minister laid the foundation stone for the dam.

- **Pakistan has frequently alleged** that it violates the **Indus Water Treaty, 1960**.

➤ Pakistan's Objections and Indus Water Treaty:

- The Pakistan government in 2013 had objected to the construction of the dam, claiming that it was not in conformity with the **Indus Water Treaty**.
 - In **August 2017**, the **World Bank** allowed India to construct the dam.
- The **Indus Waters Treaty** was signed in 1960 after **nine years of negotiations** between India and Pakistan **with the help of the World Bank, which is also a signatory**.
 - The Treaty **provides India an absolute control of all the waters of Eastern Rivers** while **Pakistan shall receive for unrestricted use all those waters of the Western Rivers** which **India** is under obligation to let flow beyond the permitted uses.
 - The **Ravi, the Beas and the Sutlej** are together called as **Eastern Rivers** while the **Chenab, the Jhelum and the Indus** main are called as **Western Rivers**.

➤ Other Projects on Chenab Basin:

- **Kiru Hydro Electric (HE) Project:**
 - The Kiru HE Project of 624 MW installed capacity is proposed on river Chenab (Kishtwar district).
- **Pakal Dul (Drangdhuran) Hydroelectric Project:**
 - It is a reservoir based scheme proposed on river **Marusudar**, the main **right bank tributary of river Chenab** in Kishtwar Tehsil of Doda District in Jammu & Kashmir.
- **Dulhasti Power Station:**
 - It is run-of-the-river with an installed capacity of 390 MW to harness the hydropower potential of **river Chenab** (Kishtwar district).
- **Salal Power Station:**
 - It is a run-of-the-river scheme with an installed capacity of 690 MW to harness the Hydropower potential of **river Chenab**. It is located in **Reasi district of Jammu & Kashmir**.

Note:



Chenab River

- **Source:** It rises in the upper Himalayas in the **Lahaul and Spiti district of Himachal Pradesh state**.
 - The river is formed by the confluence of two rivers, **Chandra and Bhaga**, at **Tandi, 8 km southwest of Keylong**, in the **Lahaul and Spiti district**.
 - The **Bhaga river** originates from **Surya taal lake**, which is situated a few kilometers west of the **Bara-lacha la pass** in Himachal Pradesh.
 - The **Chandra river** originates from **glaciers east of the same pass** (near Chandra Taal).
- **Flows Through:** It flows through the **Jammu region of Jammu and Kashmir into the plains of Punjab, Pakistan, before flowing into the Indus River**.



Thar Desert

Why in News

The **Pakistan Army** is holding a **month-long exercise** code-named '**Jidar-ul-Hadeed**' in the **Thar Desert**. The aim is to **prepare for conflict in extreme desert environments**.

- A **multinational naval exercise** hosted by Pakistan, **Aman-2021**, has also begun in the **Arabian Sea**. **45 countries**, including the **USA, Russia, China and Turkey**, will be participating in the exercise.

Key Points

- **About:**
 - The Thar desert is located **partly in Rajasthan state, northwestern India**, and **partly in Punjab and Sindh provinces, eastern Pakistan**.
 - It is an **arid region** that covers over **2,00,000 sq km**. It forms a **natural boundary** along the border between India and Pakistan.
 - The desert presents an undulating surface, with **high and low sand dunes** separated by sandy plains and low barren hills, or **bhakars**, which rise abruptly from the surrounding plains.
 - **Barchan**, also spelled **Barkhan**, crescent-shaped sand dune produced by the action of wind predominately from one direction. One of the commonest types of dunes, it occurs in sandy deserts all over the world.
- **Surrounding Areas:**
 - It is bordered by the irrigated **Indus River plain** to the west, the **Punjab Plain** to the north and northeast, the **Aravalli Range** to the southeast, and the **Rann of Kachchh** to the south.
- **Climate:**
 - The **subtropical desert climate** there results from **persistent high pressure and subsidence** at that latitude.
 - The prevailing **southwest monsoon winds** that bring rain to much of the subcontinent in summer **tend to bypass the Thar to the east**.
- **Saline Lakes:**
 - Several **playas** (saline lake beds), locally known as **dhands**, are scattered throughout the region.

NDMA Guidelines to Tackle Glacial Bursts

Why in News

A **Glacial Lake Outburst Flood (GLOF)** is suspected to have **caused the flash floods** in **Chamoli district of Uttarakhand**.

Key Points

- **Glacial Lake Outburst Flood (GLOF):**
 - A GLOF refers to the flooding that occurs **when the water dammed by a glacier or a moraine**

Note:



(accumulations of dirt and rocks fallen onto the glacier surface) **is released suddenly**.

- According to NDMA, **glacial retreat due to climate change** occurring in most parts of the **Hindu Kush Himalaya** has given rise to the **formation of numerous new glacial lakes**, which are the **major cause of GLOFs**.

➤ **Glacial Lakes:**

- **About:**
 - Glacial lakes are **typically formed at the foot of a glacier**.
 - As glaciers move and flow, they erode the soil and sediment around them, leaving depressions and grooves on the land. Meltwater from the glacier fills up the hole, making a lake.
- **Types:**
 - Lakes form when meltwater ponds, and this can happen on the ice surface (**supraglacial lakes**), in front of the ice (**proglacial lakes**), or even underneath the ice (**subglacial lakes**).
- **Impact:**
 - Glacier lakes can **affect ice flow** by reducing friction at the ice-bed interface, encouraging basal sliding.
 - They can **change the albedo of the ice surface**, encouraging more surface melt.
 - Proglacial lakes **cause calving**, which affects mass balance and can decouple mountain glaciers from climate.
 - Glacier lakes can be hazardous; moraine and ice dams can fail, **causing catastrophic glacier lake outburst floods** or jokulhlaups.

Mapping Seismic Hazard of Eastern Himalaya

Why in News

Recently, scientists have found the **first geological evidence of an earthquake on the border of Assam and Arunachal Pradesh**, documented as the **Sadiya earthquake in history**. This finding could contribute to a seismic hazard map of the eastern Himalaya, which can facilitate construction and planning in the region.

- This site is near the **Tuting-Tidding Suture Zone**- a major part of the Eastern Himalaya, where the Himalaya

takes a sharp southward bend and connects with the Indo-Burma Range.

Key Points

➤ **About:**

- Scientists found large tree trunks embedded in the **youngest flood deposits at the exit of the Subansiri River** (Sadiya town is located roughly 145 km southeast of Subansiri river), suggesting the **post-seismic aggradation of the river** following an array of **aftershocks** till six months.
- **Aggradation** is the term used in geology for the increase in land elevation due to deposition of sediment.
- **Aftershocks** are earthquakes that follow the largest shock of an earthquake sequence. They are smaller than the mainshock and within 1-2 rupture lengths distance from the mainshock.

➤ **Significance:**

- Studying the past earthquakes help to **determine the seismic potential** of the region.
- This helps in **mapping the earthquake hazard** of the region and enables syncing the development activities accordingly.
- Arunachal Pradesh, being near the **Indo-China Border**, and sometimes center of dispute regarding its ownership, is strategically important.

➤ **Seismic Hazard Map of India:**

- India is one of the highly earthquake affected countries **because of the presence of tectonically active young fold mountains, Himalayas**.
- India has been divided into **four seismic zones (II, III, IV, and V)** based on scientific inputs relating to seismicity, earthquakes that occurred in the past and tectonic setup of the region.
- Previously, earthquake zones were divided into five zones with respect to the severity of the earthquakes but the **Bureau of Indian Standards (BIS)** grouped the country into four seismic zones by unifying the first two zones.

➤ **Seismic Waves, Richter Scale and Mercalli scale:**

- Seismic waves are the vibrations from earthquakes that travel through the Earth and are recorded on instruments called **seismographs**.
- Seismographs record a zigzag trace that shows the varying amplitude of ground oscillations beneath the instrument.

Note:

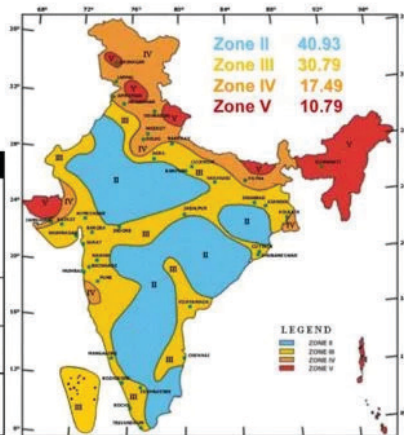


- The earthquake events are scaled either according to the magnitude or intensity of the shock.
- The magnitude scale is known as the **Richter scale**. The magnitude relates to the energy released during the earthquake which is expressed in absolute numbers, 0-10.
- The intensity scale or **Mercalli scale** takes into account the visible damage caused by the event. The range of intensity scale is from 1-12.

Seismic Zone Map of India: -2002

About 59 percent of the land area of India is liable to seismic hazard damage

Zone	Intensity
Zone V	Very High Risk Zone Area liable to shaking Intensity IX (and above)
Zone IV	High Risk Zone Intensity VIII
Zone III	Moderate Risk Zone Intensity VII
Zone II	Low Risk Zone VI (and lower)



Uttarakhand Flash Flood

Why in News

Recently, a **glacial break** in the **Tapovan-Reni area** of **Chamoli District of Uttarakhand** led to massive **Flash Flood** in **Dhaulti Ganga** and **Alaknanda Rivers**, damaging houses and the nearby **Rishiganga power project**.

Key Points

- **Cause of Flash Flood in Uttarakhand:**
 - It occurred in river Rishi Ganga due to the falling of a portion of **Nanda Devi glacier** in the river which **exponentially increased the volume of water**.
 - Rishiganga meets Dhaulti Ganga near Raini. So Dhaulti Ganga also got flooded.
- **Flash Floods:**
 - **About:**
 - These are **sudden surges in water levels** generally during or following an **intense spell of rain**.
 - These are **highly localised** events of **short duration** with a very high peak and usually have less than six hours between the occurrence of the rainfall and peak flood.

- The flood situation **worsens in the presence of choked drainage lines or encroachments** obstructing the natural flow of water.

○ Causes:

- It may be caused by heavy rain associated with a severe **thunderstorm**, **hurricane**, **tropical storm**, or **meltwater from ice or snow flowing over ice sheets or snowfields**.
- Flash Floods can also occur due to **Dam or Levee Breaks, and/or Mudslides (Debris Flow)**.
- In areas on or near **volcanoes**, flash floods have also occurred after eruptions, when glaciers have been melted by the intense heat.

➤ **Glaciers:**

○ About:

- Glaciers are a bulk of ice moving under its weight. It forms in areas where the amassing of snow goes beyond its ablation over many years.
- They are generally seen in the snow-fields.
- This largest freshwater basin covers around 10% of the land surface of the Earth.
- According to the topography and the location of the glacier, it can be categorized as **Mountain Glacier (Alpine Glaciers)** or **Continental Glacier (Ice Sheets)**.
- The Continental Glacier moves outward in all directions whereas the Mountain Glacier moves from a higher to a lower altitude.

Dhauliganga

➤ **Origination:**

- It originates from **Vasudhara Tal**, perhaps the **largest glacial lake** in Uttarakhand.

➤ **About:**

- Dhauliganga is one of the **important tributaries of Alaknanda**, the other being the **Nandakini, Pindar, Mandakini and Bhagirathi**.
 - Dhauliganga is joined by the **Rishiganga river** at Raini.
- It **merges with the Alaknanda at Vishnuprayag**.
 - There it loses its identity and the **Alaknanda flows southwest through Chamoli, Maithana, Nandaprayag, Karnaprayag** until it meets the Mandakini river, coming from the north at Rudraprayag.

Note:



- After subsuming Mandakini, the Alaknanda carries on past Srinagar, before **joining the Ganga at Devprayag near.**
- **Alaknanda then disappears and the mighty Ganga** carries on its journey, first flowing south then west through important pilgrimage centres such as Rishikesh and finally descending into the Indo-Gangetic plains at Haridwar.



Nanda Devi National Park

- **Location:**
 - It is situated around the peak of Nanda Devi (7816m) in the state of Uttarakhand in northern India.
- **About:**
 - The park encompasses the **Nanda Devi Sanctuary**, a **glacial basin** surrounded by a ring of peaks, and drained by the **Rishi Ganga through the Rishi Ganga Gorge.**
- **Established:**
 - The Park was established as Sanjay Gandhi National Park by Notification in 1982 but was later renamed Nanda Devi National Park.
 - It was inscribed a **World Heritage Site by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1988.**
- **Flora:**
 - Some 312 floral species that include 17 rare species have been found here. Fir, birch, rhododendron, and juniper are the main flora.
- **Fauna:**
 - Himalayan black bear, Snow leopard, Himalayan Musk Deer etc.

Related News: Landslide and Flash Floods

Ageing Dams of India: UN Report

Why in News

According to a **United Nations (UN)** report “**Ageing water infrastructure: An emerging global risk**”, over 1,000 large **dams in India** will be roughly 50 years old in 2025 and such ageing embankments across the world pose a growing threat.

- The analysis includes dam decommissioning or ageing case studies from the **USA, France, Canada, India, Japan, and Zambia and Zimbabwe.**

Key Points

- **Indian Scenario:**
 - **India is ranked third** in the world in terms of building large dams.
 - Of the over 5,200 large dams built so far, about **1,100 large dams have already reached 50 years of age** and some are older than 120 years.
 - The **number of such dams will increase to 4,400 by 2050.**
 - This means that **80% of the nation's large dams face the prospect of becoming obsolete** as they will be 50 years to over 150 years old.
 - The **situation with hundreds of thousands of medium and minor dams is even more dangerous** as their shelf life is even lower than that of large dams.
 - **Examples:** Krishna Raja Sagar dam was built in **1931** and is now 90 years old. Similarly, **Mettur dam was constructed in 1934** and is now 87 years old. Both these reservoirs are located in the water scarce **Cauvery river basin.**
- **Step Taken:**
 - Recently, the Cabinet Committee on Economic Affairs has approved the **Dam Rehabilitation and Improvement Project (DRIP)** Phase II and Phase III.
 - It envisages **comprehensive rehabilitation of 736 existing dams** located across the country and complements the **Dam Safety Bill, 2019.**

Related News: Mullaperiyar Dam

Note:



Declining Rainfall in Cherrapunji

Why in News

A recent **study** that looked at the **rainfall pattern** in the **past 119 years** found a **decreasing trend** at **Cherrapunji (Meghalaya)** and nearby areas.

- The village of **Mawsynram** in **East Khasi Hills district of Meghalaya** has beaten Cherrapunji to become the **wettest place in the world**. Mawsynram receives over **10,000 millimetres of rain in a year**.
- Mawsynram is located around **81 km by road from Cherrapunji**, however the straight line distance between the two is **15.2 km**.



Key Points.

- **Reasons:**
 - **Rising Temperature:**
 - The **changes in the Indian Ocean temperature** have a **huge effect** on the rainfall in the region.
 - Increasing sea surface temperatures in the tropical Indian Ocean region was pointed out by the **first climate change assessment report** published by the Union Ministry of Earth Sciences in June 2020.
 - **Increased Human Activities:**
 - The satellite data showed that there was a **reduction in the vegetation area** in northeast India in the past two decades, implying that

human influence also plays an important role in the changing rainfall patterns.

- The traditional way of cultivation known as **Jhum cultivation or shifting cultivation** is **now decreased** and being replaced by other methods.
- There is **sizable deforestation** in the region. The study saw the **decrease in vegetation cover and increase in the areas of cropland** mainly from the year 2006 onwards.
- The analysis showed **reductions in vegetation** with **104.5 sqkm lost per year**.
- On the other hand, there were **significant increases in cropland** (182.1 sqkm per year) and **urban and built-up lands** (0.3 sqkm per year) during the period 2001–2018.

➤ Significance of Studying the North-East Region:

- Since north-east India is mostly hilly and is an extension of the Indo-Gangetic Plains, the **region is highly sensitive to changes** in regional and global climate.
- It has to be noted that the **first signs of the effect of climate change** will be evident for the extreme cases such as the rainfall at Cherrapunji.
- North-east India has the **highest vegetation cover** in India and includes **18 biodiversity hotspots of the world**, indicating the importance of the region in terms of its greenery and **climate-change sensitivity**.

Reason for High Rainfall in Cherrapunji and Mawsynram

- **Cherrapunji (elevation 1313 m) and Mawsynram (elevation 1401.5 m)** are located on the southern slopes of the east Khasi Hills in Meghalaya.
 - Meghalaya is a mountainous state with **numerous valleys and highland plateaus**.
 - **Elevation** in the plateau region ranges between **150 m to 1,961 m**, with the central part comprising the Khasi Hills with the highest elevations.
- The rainfall in Cherrapunji-Mawsynram is **caused by the orography favouring a monsoon wind regime**.
- The northward moving moist winds from the Bay of Bengal passing over the plains of Bangladesh are **forced to converge in the narrow valleys of the Khasi Hills** with orography providing forced ascent that causes condensation, formation of clouds resulting in rain on the windward side of the slope.

Note:



Nathu La, Sikkim

Why in News

Recently, the Indian Army rescued several tourists caught in a snowstorm at **Nathu La** on the **India-China border in Sikkim**.

Key Points

- Nathu La, one of the **highest motorable roads** in the world, is a mountain pass in the Himalayan peaks situated on the Indo-Tibetan border 14450 ft. above sea level.
- Nathu means 'listening ears', and La means 'pass'.
- It is an **open trading border post between India and China**.
- The other passes located in the state of Sikkim are **Jelep La Pass, Donkia Pass, Chiabhanjang Pass**.



Pass	Link/Features
Banihal Pass	Kashmir Valley with the outer Himalaya and the plains to the south.
Bara-Lacha-La Pass	Lahaul district in Himachal Pradesh with Leh district in Ladakh.
Fotu La Pass	Leh with Kargil of Ladakh
Rohtang Pass	Kullu Valley with the Lahaul and Spiti Valleys of Himachal Pradesh.
Shipki La Pass	Kinnaur district of Himachal Pradesh with Autonomous Region of Tibet, China.
Jelep La Pass	Sikkim with Autonomous Region of Tibet, China.
Nathu La Pass	Sikkim with Autonomous Region of Tibet, China.
Lipu Lekh Pass	Chaudans valley of India with Autonomous Region of Tibet, China. It is located close to the tri junction of Uttarakhand (India), China and Nepal.
Khardung La	Ladakh with Siachen glacier. It is the highest motorable pass in the world.
Bom di La	It is in Arunachal Pradesh

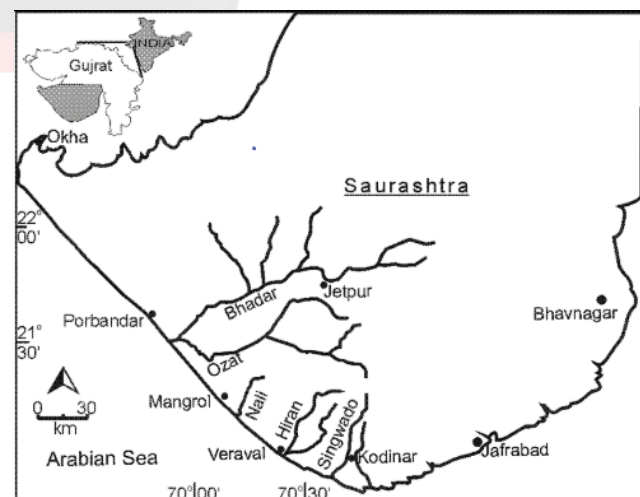
Bhadar Dam: Gujarat

Why in News

Recently, the **Dam Safety Organisation** of the **Central Water Commission** has recommended replacement of floodgates of Bhadar dam which were damaged in the **flash flood** of 2015.

Key Points

- **About Bhadar Dam:**
 - Bhadar dam is located in Rajkot and is second largest in Saurashtra region after Shetrunji dam.
 - Bhadar dam is on the Bhadar River in Saurashtra region in Gujarat.
- **Bhadar River:**
 - The Bhadar is one of the major rivers of Kathiawar (Saurashtra) peninsula in Gujarat.
 - It originates near Vaddi in Rajkot district at an elevation of 261 m above mean sea level.
 - It flows through the Saurashtra region and finally confluence with Arabian sea at Naviobandar (Porbandar).
 - The total length of this river is 198 km. It drains about 1/7th of the area of Saurashtra.



Central Water Commission

- The Central Water Commission is the apex technical organisation in the country for development of water resources and is an attached organization of the Ministry of Water Resources.

Note:



- The Commission is responsible for initiating, co-ordinating and furthering, in consultation with the State Governments, the schemes for control, conservation, development and utilization of water resources throughout the country for the purpose of irrigation, flood management, power generation, navigation etc.

King Bhumibol World Soil Day - 2020 Award

Why in News

The **Indian Council of Agricultural Research (ICAR)** received the prestigious International “**King Bhumibol World Soil Day - 2020 Award**” conferred by the **Food and Agriculture Organization (FAO)**, Rome.

- The award was announced on the eve of **World Soil Day - 2020 (5th December 2020)** in view of the ICAR’s excellent contributions in “**Soil Health Awareness**” on the theme “**Stop soil erosion, save our future**” (2019 theme).

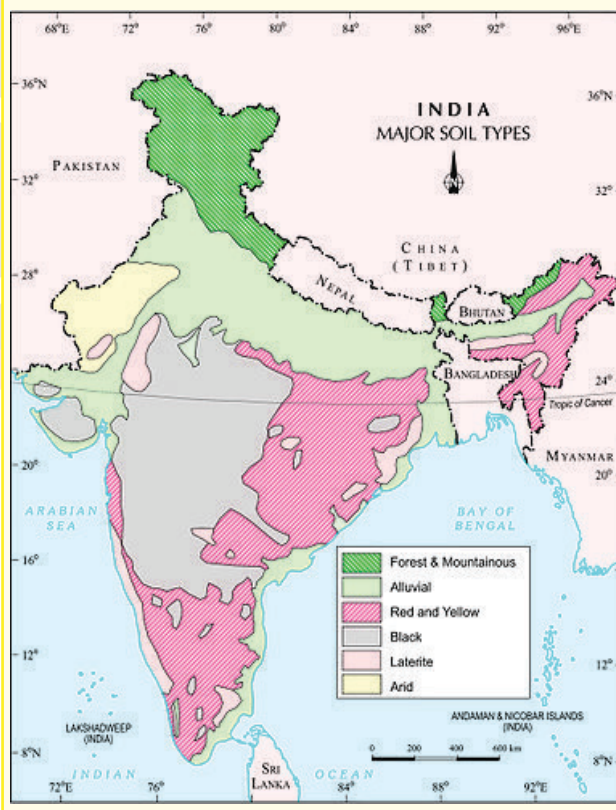
Key Points

- **About King Bhumibol World Soil Day Award:**
 - Launched in 2018, the King Bhumibol World Soil Day Award **acknowledges individuals or institutions** that **raise public awareness of soils** by organising successful and influential World Soil Day celebrations.
 - The award, **sponsored by the Kingdom of Thailand**, is named after **King Bhumibol Adulyadej of Thailand** for his lifelong commitment to raising awareness of the importance of sustainable soil management and rehabilitation for food security, poverty alleviation and more.
 - The former winners of the Award include **Practical Action in Bangladesh in 2018** and the **Costa Rican Soil Science Society (AACS) in 2019**.
- **Indian Council of Agricultural Research (ICAR):**
 - It is an autonomous organisation under the **Department of Agricultural Research and Education (DARE)**, Ministry of Agriculture and Farmers Welfare.
 - It was established on **16th July 1929** and was formerly known as the **Imperial Council of Agricultural Research**.

- It is headquartered at **New Delhi**.
- ICAR is the organisation responsible for the coordination, guidance and management of agricultural research and education in India.
- In this capacity, ICAR **oversees one of the largest networks of agricultural research and education institutes** in the world, covering the whole country in the fields of horticulture, soil science, fisheries and animal sciences among others.

Glinka World Soil Prize

- It is also conferred by FAO in line with soil. It is an annual award for dynamic change-makers dedicated to solving one of our world’s most pressing environmental issues, i.e. **soil degradation**.
- It honours individuals and organizations whose leadership and activities have contributed, or are still contributing to the promotion of sustainable soil management and the protection of soil resources.



Sangay Volcano: Ecuador

Why in News

- Recently, Ecuador’s **Sangay volcano** erupted.

Note:



Key Points

➤ About Sangay Volcano:

- Sangay volcano is one of the **highest active volcanoes in the world** and one of **Ecuador's most active ones**.
- Sangay is the southernmost **stratovolcano** (a volcano built up of **alternate layers of lava and ash**) in the northern volcanic zone of the Andes. It is 5230 m high.
 - The Andes is the **longest above-water mountain range in the world** and boasts some of the highest peaks.
 - **Sangay National Park** is located in the central part of Ecuador on the Andes mountains' eastern side. It is a **world heritage site**.

Volcanic Eruptions

➤ About:

- Volcanic eruptions happen when **lava and gas are discharged from a volcanic vent**.
- The most common consequences of this are population movements as large numbers of people are often forced to flee the moving lava flow.

➤ Types: Volcanic activity and volcanic areas are commonly divided into **six major types**:

○ Icelandic:

- It is characterized by **effusions of molten basaltic lava** that flow from long, parallel fissures. Such outpourings **often build lava plateaus**.

○ Hawaiian:

- It is **similar to the Icelandic variety**. In this case, however, fluid lava flows from a volcano's summit and **radial fissures** to form shield volcanoes, which are quite large and **have gentle slopes**.

○ Strombolian:

- These involve **moderate bursts of expanding gases** that eject clots of incandescent lava in cyclical or nearly **continuous small eruptions**.
- Because of such small frequent outbursts, **Stromboli volcano**, located on Stromboli Island off the northeast coast of **Italy**, has been called the **"lighthouse of the Mediterranean."**

○ Vulcanian:

- It is named for **Vulcano Island** near Stromboli, generally involving **moderate explosions of gas laden with volcanic ash**. This mixture forms

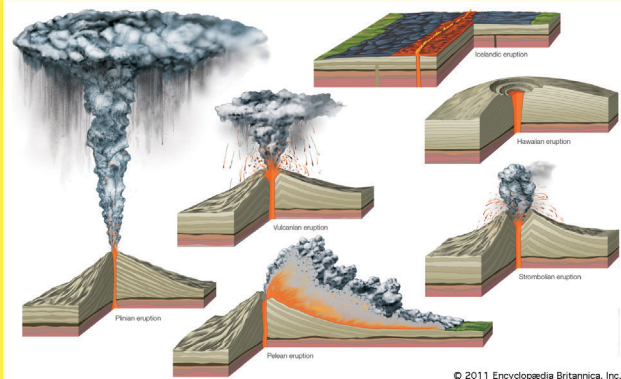
dark, turbulent eruption clouds that rapidly ascend and expand in convoluted shapes.

○ Pelean:

- It is associated with explosive outbursts that generate **pyroclastic flows**, dense mixtures of **hot volcanic fragments and gas**.
- The **fluidized slurries** produced by these eruptions are heavier than air but are of low viscosity and pour down valleys and slopes at great velocities. As a result, they are **extremely destructive**.

○ Plinian:

- This type is an **intensely violent kind of volcanic eruption**. In this type of eruption, gases boiling out of gas-rich magma generate enormous and nearly continuous jetting blasts that core out the magma conduit and rip it apart.
- The uprushing gases and volcanic fragments **resemble a gigantic rocket blast directed vertically upward**. Plinian eruption clouds can **rise into the stratosphere** and are sometimes continuously produced for several hours.
- **Lightning strikes** caused by a buildup of static electricity are common close to Plinian ash clouds, adding one more element of terror to the eruption.



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Eastern Rajasthan Canal Project

Why in News

The Chief Minister of Rajasthan has **demand**ed national project status for the Eastern Rajasthan Canal Project (ERCP).

Note:



- The main advantage of a project which has received national project status is that **90% of the funding for the project will be given by the central government.**
- The estimated cost of the ERCP is around Rs. 40,000 crore.

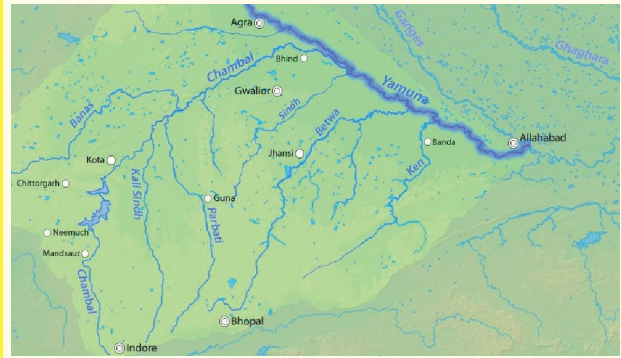
Key Points

- **About the Eastern Rajasthan Canal Project:**
 - It **aims to harvest surplus water** available during rainy season in **rivers in Southern Rajasthan**,
 - Such as **Chambal** and its tributaries, including Kunnu, Parvati, Kalisindh, and
 - **Use this water in south-eastern districts of the state**, where there is scarcity of water for drinking and irrigation.
 - **ERCP** is planned to meet **drinking and industrial water needs** of the southern and south eastern Rajasthan, for humans and Livestock till the year 2051.
 - It **proposes to provide drinking water to 13 districts of Rajasthan** and provide irrigation water for 2.8 lakh hectares of land through 26 different large and medium projects.
 - **13 districts:** Jhalawar, Baran, Kota, Bundi, Sawai Madhopur, Ajmer, Tonk, Jaipur, Karauli, Alwar, Bharatpur, Dausa and Dholpur.

Chambal River

- It is one of the most pollution-free rivers of India.
- It **originates at the Singar Chouri peak** in the northern slopes of the Vindhya mountains (Indore, Madhya Pradesh). From there, it flows in the North direction in Madhya Pradesh for a length of about 346 km and **then follows a north-easterly direction for a length of 225 km through Rajasthan.**
- It **enters U.P.** and flows for about 32 km before joining the Yamuna River in Etawah District.
- It is a rainfed river and its **basin is bounded by the Vindhyan mountain ranges and the Aravallis.** The Chambal and its tributaries drain the Malwa region of northwestern Madhya Pradesh.
- The **Hadauti plateau in Rajasthan** occurs in the upper catchment of the Chambal River to the southeast of the Mewar Plains.
- **Tributaries:** Banas, Kali Sindh, Sipra, Parvati, etc.
- **Main Power Projects/ Dam:** Gandhi Sagar Dam, Rana Pratap Sagar Dam, Jawahar Sagar Dam, and Kota Barrage.

- The **National Chambal Sanctuary** is located along river Chambal on the tri-junction of Rajasthan, Madhya Pradesh and Uttar Pradesh. It is known for critically endangered gharial, the red-crowned roof turtle, and the endangered Ganges river dolphin.



Ken-Betwa Link Project

Why in News

Chief Ministers of **Madhya Pradesh and Uttar Pradesh** signed a memorandum of agreement to implement the **Ken Betwa Link Project (KBLP)**, the first project of the **National Perspective Plan for interlinking of rivers.**

- The two states **signed a tripartite agreement with the Centre** on **World Water Day** (22nd March) to finally implement this ambitious project.

Key Points

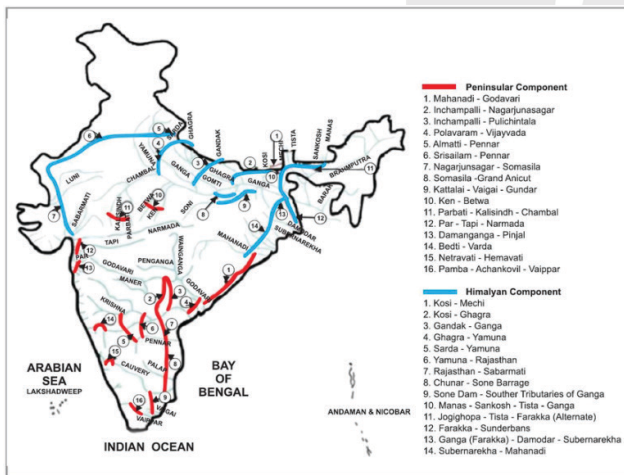
- **Ken Betwa Link Project (KBLP):**
 - The **Ken-Betwa Link Project (KBLP)** is the River interlinking project that **aims to transfer surplus water from the Ken river in MP to Betwa in UP to irrigate the drought-prone Bundelkhand region.**
 - The region spread across the districts of two states mainly Jhansi, Banda, Lalitpur and Mahoba districts of UP and Tikamgarh, Panna and Chhatarpur districts of MP.
 - The project involves building a 77-metre tall and a 2-km wide **Dhaudhan dam and a 230-km canal.**
 - Ken-Betwa is **one of the 30 river interlinking projects** conceived across the country.
 - The project has been **delayed due to political and environmental issues.**

Note:



Ken and Betwa Rivers

- Ken and Betwa rivers originate in MP and are the **tributaries of Yamuna**.
- Ken meets with Yamuna in Banda district of UP and with Betwa in Hamirpur district of UP.
- Rajghat, Paricha and Matatila dams are over Betwa river.
- Ken River passes through Panna tiger reserve.
- **National Perspective Plan for interlinking of rivers:**
 - The **National River Linking Project (NRLP)** formally known as the **National Perspective Plan**, envisages the transfer of water from **water 'surplus' basins** where there is flooding, to **water 'deficit' basins** where there is drought/scarcity, through inter-basin water transfer projects.
 - Under the **National Perspective Plan (NPP)**, the National Water Development Agency (NWDA), has identified 30 links (16 under the Peninsular Component and 14 under the Himalayan Component) for the preparation of feasibility reports (FRs).
 - The NPP for transferring water from water-surplus basins to water-deficit basins was prepared in August 1980.



Suez Canal

Why in News

A large cargo ship named 'Ever Given' got **stuck near the southern end of the Suez Canal** due to a **mishap caused by bad weather**.

- This is causing a huge jam of vessels at either end of the vital international trade artery.

Key Points

About:

- The Suez Canal is an **artificial sea-level waterway** running north to south across the Isthmus of Suez in **Egypt**, to **connect the Mediterranean Sea and the Red Sea**.
- The canal **separates the African continent from Asia**.
- It provides the **shortest maritime route** between Europe and the lands lying around the Indian and western Pacific oceans.
- It is **one of the world's most heavily used shipping lanes**, carrying over **12% of world trade by volume**.
 - The canal is a **major source of income for Egypt's economy**, with the African country earning USD 5.61 billion in revenues from it last year.

History:

- The Suez Canal is actually the **first canal that directly links the Mediterranean Sea to the Red Sea**. It was **opened for navigation in November 1869**.
- The 150-year-old canal was **controlled by British and French interests in its initial years**, but was **nationalised in 1956 by Egypt**.
 - **Suez Crisis**, international crisis in the Middle East, precipitated in July 1956, when the Egyptian president, Gamal Abdel Nasser, nationalized the Suez Canal. The canal had been owned by the Suez Canal Company, which was controlled by French and British interests.
- The Canal **was closed five times**; the last time was the most serious one since it lasted for 8 years. The Canal was then reopened for navigation in June 1975.



Related News: Cape of Good Hope

Note:



Antarctica's Doomsday Glacier

Why in News

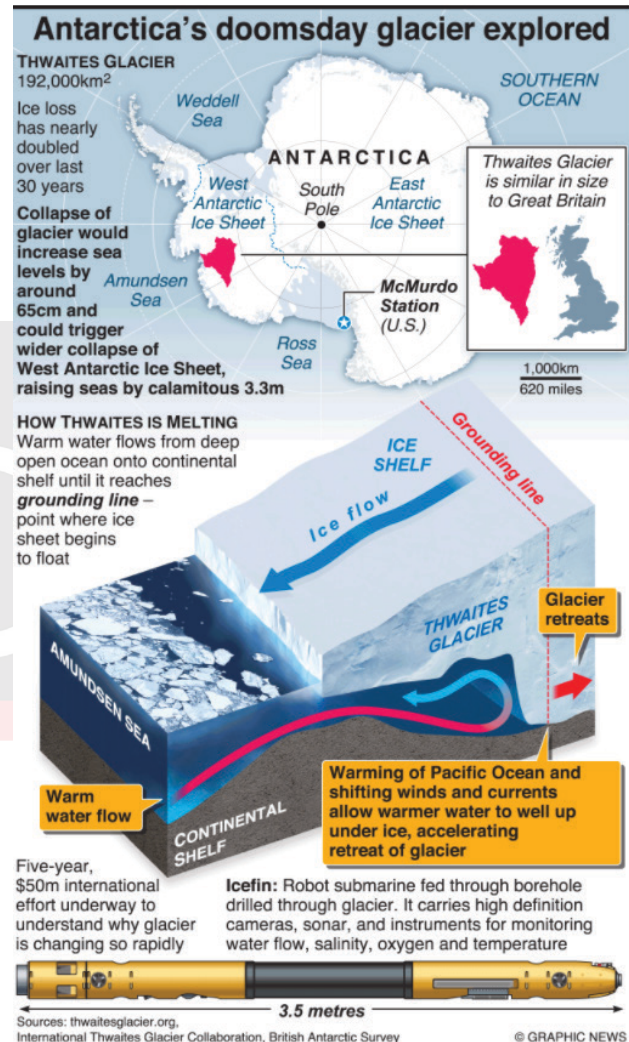
Researchers from **Sweden's University of Gothenburg** have been able to obtain data from underneath Thwaites Glacier, also known as the '**Doomsday Glacier**'.

- They find that the **supply of warm water to the glacier is larger than previously thought**, triggering concerns of faster melting and accelerating ice flow.

Key Points

- **Doomsday Glacier:**
 - Called the **Thwaites Glacier**, it is **120 km wide at its broadest**, fast-moving, and melting fast over the years.
 - Today, Thwaites's melting **already contributes 4% to global sea level rise** each year.
 - It is estimated that it would collapse into the sea in **200-900 years**.
 - Thwaites is **important for Antarctica** as it slows the ice behind it from freely flowing into the ocean.
 - Because of the risk it faces, and poses, Thwaites is often called the **Doomsday Glacier** (Doomsday meaning warning or threat, something that can cause destruction).
- **Previous Studies:**
 - **Detection of Warm Water at Grounding Line:**
 - **About:** In 2020, researchers from **New York University (NYU)** detected warm water at a vital point below the glacier. In the NYU study, scientists dug a 600-m-deep and 35-cm-wide access hole, and deployed an **ocean-sensing device called Icefin** to measure the waters moving below the glacier's surface.
 - **Findings:**
 - The **NYU study** reported water at just two degrees above freezing point at Thwaites's "**grounding zone**" or "**grounding line**".
 - The **grounding line** is the place below a glacier at which the ice transitions between resting fully on bedrock and floating on the ocean as an ice shelf. The location of the line is a **pointer to the rate of retreat of a glacier**.

- When glaciers melt and lose weight, they **float off the land** where they used to be situated. When this happens, the **grounding line retreats**. That **exposes more of a glacier's underside to seawater**, increasing the likelihood it will melt faster.
- This results in the glacier speeding up, stretching out, and thinning, causing the grounding line to retreat ever further.



Godavari River

Why in News

The Godavari water is to be released into the irrigation canals in East and West Godavari districts from the **Polavaram irrigation project** site up to 15th April 2021 against the previous deadline of 31st March 2021.

Note:



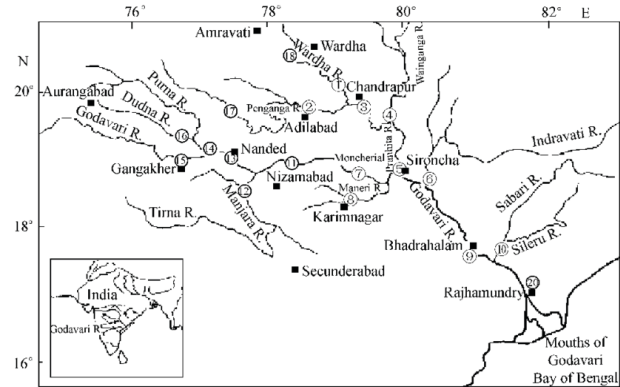
- Work on the **cofferdam** is scheduled to commence in April.

Key Points

➤ Godavari River:

- The Godavari is the **largest Peninsular river system**. It is also called the **Dakshin Ganga**.
- **Source:** Godavari river rises from **Trimbakeshwar near Nasik** in Maharashtra and flows for a length of about 1465 km before **outfalling into the Bay of Bengal**.
- **Drainage Basin:** The Godavari basin extends over states of Maharashtra, Telangana, Andhra Pradesh, Chhattisgarh and Odisha in addition to smaller parts in Madhya Pradesh, Karnataka and Union territory of Puducherry.
- **Tributaries:** Pravara, Purna, Manjra, Penganga, Wardha, Wainganga, Pranhita (combined flow of Wainganga, Penganga, Wardha), Indravati, Maner and the Sabri.
- **Cultural Significance:** **Kumbh Mela** also takes place on the **banks of the Godavari river in Nashik**.
 - Other locations for Kumbh are the **Shipra river in Ujjain**, the **Ganges in Haridwar**, and the **confluence of the Ganges, Yamuna, and the mythical Saraswati river in Prayag**.
- **Godavari River Dispute:** **Godavari river water sharing** is bone of contention among Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Odisha, and Karnataka.
- **Important Projects on Godavari:**
 - Polavaram Irrigation Project.
 - **Kaleshwaram**.
 - **Sadarmatt Anicut** across river Godavari is one among the two irrigation projects in the International Commission on Irrigation and Drainage (ICID) Register of **Heritage Irrigation Structures**.
 - **Inchampalli:** The Inchampalli project is proposed on the Godavari River about 12 km downstream of the **confluence of Indravati with the Godavari River in Andhra Pradesh**.
 - It is a joint project among the States of Maharashtra, Madhya Pradesh, Telangana and Andhra Pradesh.
 - **Sriram Sagar Project (SRSP):** The Sriram Sagar Project is a multipurpose project, located

across the Godavari River near Pochampad of Nizamabad District in Telangana.



➤ Polavaram Irrigation Project:

- Polavaram Project is located in **Andhra Pradesh on the river Godavari**, near Polavaram village.
- It is a **multi-purpose irrigation project** as the project once completed will provide Irrigation benefits and will generate **HydroElectric Power**.
 - In addition, this project will also supply drinking water.
- It will facilitate an **inter-basin transfer to the Krishna river basin** through its Right canal.
- It will also provide indirect benefits such as development of **Pisciculture** (breeding and rearing of fish), tourism and urbanisation.
- The Project has been **accorded national project status by the union government in 2014** (under Section-90 of **Andhra Pradesh Reorganization Act, 2014**).

Cofferdam

- A cofferdam is defined as a **temporary barrier** in or around a body of water which allows the process of **de-watering, diversion, or damming of water within an enclosed area**.
- The major purpose of any cofferdam type is to hold back overwhelming or inconvenient waters and create a dry work environment.
- This allows a project to proceed with as little resistance and as much safety as possible.

Effect of Dust on Monsoon

Why in News

Recently, a study details how the **Indian monsoon**

Note:



gets influenced by the **atmospheric dust particles** swept up by winds **from deserts in the Middle East (Asian Deserts)**.



Key Points

➤ Effect of Dust on Monsoon:

○ About:

- Dust storms from the desert when lifted by strong winds can absorb solar radiation and become hot.
- This can cause **heating of the atmosphere, change the air pressure, wind circulation patterns, influence moisture transport and increase precipitation and rainfall.**

○ Effect on Indian Monsoon:

- Dust from the **Middle East [West Asia]** and also from the **Iranian Plateau** also influences the **Indian Summer Monsoon (South West Monsoon)**.
 - The hot air over the Iranian Plateau can heat the atmosphere over the plateau, strengthen the circulation over the deserts of the Arabian Peninsula and increase dust emission from the Middle East [West Asia].

○ Reverse Effect:

- Indian Summer Monsoon has a reverse effect and can **increase the winds in West Asia to produce yet more dust.**
- A strong monsoon can also transport air to West Asia and again pick up a lot of dust.

➤ Effect of Anthropogenic Dust:

- There is a **difference of opinion**, some studies found that anthropogenic **aerosols** emitted from the Indian subcontinent can decrease summer monsoon precipitation, while others found that absorbing aerosols such as dust can strengthen the monsoon circulation.

- **Aerosols** are defined as a combination of liquid or solid particles suspended in a gaseous or liquid environment.
- **Anthropogenic aerosols include sulphate, nitrate, and carbonaceous aerosols**, and are mainly from fossil fuel combustion sources.

➤ Role of Deserts in Monsoon:

- Deserts across the globe play important roles in monsoons.
- The dust aerosols from deserts in **West China** such as the **Taklamakan desert** and the **Gobi Desert** can be transported eastward to eastern China and can influence the East Asia summer monsoon.
- In the **southwest United States**, there are some small deserts that influence the **North African monsoon.**

➤ Major Deserts of the World:



Monsoon

➤ About:

- A monsoon often brings about thoughts of torrential rains, similar to a hurricane or typhoon. But there is a difference: a **monsoon is not a single storm; rather, it is a seasonal wind shift over a region.**
- The shift may **cause heavy rains in the summer**, but at other times, it may cause a dry spell.

➤ Types:

○ Wet Monsoon:

- A wet monsoon typically **occurs during the summer months** (about April through September) bringing heavy rains.
- On average, approximately **75% of India's annual rainfall** and about **50% of the North American monsoon region** comes during the summer monsoon season.

Note:



- The wet monsoon begins when winds bring cooler, more humid air from above the oceans to the land.
- **Dry Monsoon:**
 - A dry monsoon typically occurs between **October and April**.
 - Instead of coming from the oceans, the **winds tend to come from drier, warmer climates** such as from Mongolia and northwestern China down into India.
 - Dry monsoons tend to be **less powerful than their summer counterparts**.
 - The winter monsoon occurs when “the land cools off faster than the water and a high pressure develops over the land, blocking any ocean air from penetrating.” This leads to a dry period.

Related News: Indian Monsoon Resembled Australian Monsoon, Early Southwest Monsoon

Chenab Bridge

Why in News

Recently, **Indian Railways** completed the **arch closure of the iconic Chenab Bridge** in **Jammu & Kashmir**.

Key Points

- **About Chenab Bridge:**
 - It is the **world's highest railway bridge** and is part of the **Udhampur-Srinagar-Baramulla rail link project (USBRL)**.
 - The Project was **declared as a Project of National Importance in March 2002**.
 - The completion of the steel arch is a major leap towards the completion of the **111 km long winding stretch from Katra to Banihal**.
 - It is arguably the **biggest civil-engineering challenge** faced by any railway project in India in recent history.
- **Unique Features of this Bridge:**
 - Bridge designed to **withstand high wind speed up to 266 Km/Hour**.
 - Bridge designed for **blast load in consultation with DRDO** for the first time in India.
 - Bridge designed to **bear earthquake forces of highest intensity zone-V** in India.



- First time on Indian Railways, **Phased Array Ultrasonic Testing machine** used for testing of welds.
- First time on Indian Railways, **National Accreditation Board for Testing and Calibration Laboratories (NABL)** accredited lab established at site for weld testing.
- Extensive **health monitoring and warning systems** planned through state of art instrumentation.

Illegal Sale of Uranium

Why in News

Two people were arrested under the **Atomic Energy Act, 1962** for possessing uranium without licence and selling it illegally.

- On testing, the sample was **confirmed as natural uranium** by **Bhabha Atomic Research Centre (BARC)**.

Key Points

- **About Uranium:**
 - Uranium **occurs naturally in low concentrations** in soil, rock and water. It is a **hard, dense, malleable, ductile, silver-white, radioactive metal**.
 - Uranium metal has a **very high density**.
 - When finely divided, it **can react with cold water**. In **air** it is coated by **uranium oxide**, tarnishing rapidly.
 - It can **form solids solutions and intermetallic compounds** with many of the metals.
- **Applications:**
 - **Energy Production:** The main use of uranium in the civilian sector is to fuel commercial nuclear power plants for generation of **nuclear energy**.
 - This requires uranium to be **enriched with the uranium-235 isotope**.

Note:



- **Making Atomic Bomb:** The first atomic bomb used in warfare was an uranium bomb.
 - This bomb contained **enough of the uranium-235 isotope** to start a runaway chain reaction which in a fraction of a second caused a large number of the uranium atoms to undergo fission, thereby releasing a fireball of energy.
- **Used as Shield against Radiation:** Depleted uranium is also used as shield against radiation in **medical processes** using radiation therapy and also while **transporting radioactive materials**.
- **Used as Counterweights in Industry:** Its high density also makes it useful as counterweights in aircraft and industrial machinery.
- **Radiometric Dating:** The **isotope uranium 238** is used to estimate the age of the earliest igneous rocks and for other types of radiometric dating.
- **Fertiliser:** **Phosphate fertilisers** are made from material typically high in uranium, so they usually contain high amounts of it.

➤ **Uranium Deposits In India:**

- In India, Uranium deposits occur in the **Dharwar rocks**.
- It occurs along the **Singhbhum Copper belt (Jharkhand); Udaipur, Alwar and Jhunjhunu districts** of Rajasthan, **Durg district** of Chhattisgarh, **Bhandara district** of Maharashtra and **Kullu district** of Himachal Pradesh.
- Significant quantities of reserves have been recently discovered in parts of **Andhra Pradesh and Telangana** between Seshachalam forest and Sresailam (Southern edge of Andhra to Southern edge of Telangana).

➤ **Legal Framework in India:**

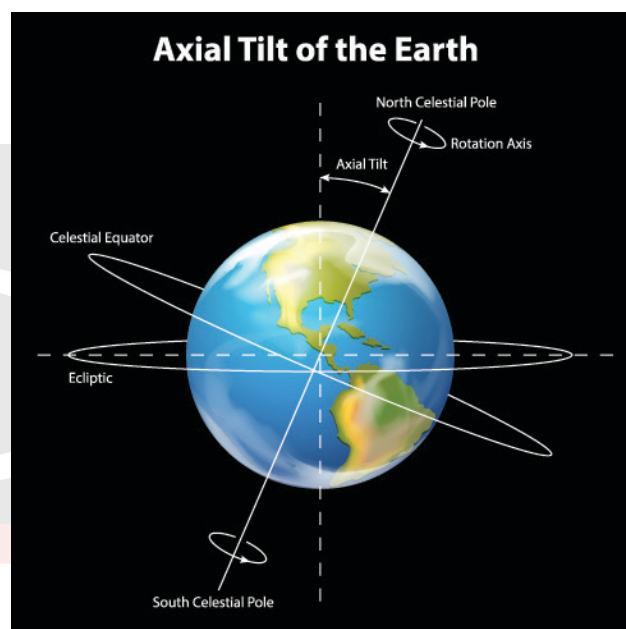
- In pursuance of entry **at serial No. 54 of List I (Union List)**, the Parliament has passed '**The Mines & Minerals (Development and Regulation) Act, 1957 (MMDR Act)**'.
 - Uranium is a major mineral, hence, it is **managed by the Union Government** under provisions of **MMDR Act**.
- The policy and legislation relating to Major minerals are managed by the Ministry of Mines, but **Uranium being an atomic mineral is managed by the Department of Atomic Energy (DAE)**.

Climate Change Causing Shift in Earth's Axis

Why in News

A study published in Geophysical Research Letters of the American Geophysical Union (AGU) says that **due to the significant melting of glaciers** because of global temperature rise, **Earth's axis of rotation has been moving more than usual** since the 1990s.

- While this change is **not expected to affect daily life**, it can **change the length of the day by a few milliseconds**.



Key Points

➤ **Earth's Axis of Rotation:**

- **Earth's axial tilt** (also known as the obliquity of the ecliptic) is about **23.5 degrees**.
 - Due to this axial tilt, the sun shines on different latitudes at different angles throughout the year. This **causes the seasons**.
- The **points** on which the **axis intersects the planet's surface** are the **geographical north and south poles**.
 - The **location of the poles is not fixed**. The **axis moves** due to **changes in how the Earth's mass is distributed** around the planet. Thus, the **poles move when the axis moves**, and the movement is called "**polar motion**".

- Generally, polar motion is **caused by** changes in the hydrosphere, atmosphere, oceans, or solid Earth. But now, climate change is adding to the degree with which the poles wander.

➤ **Findings from the New Study:**

- Since the **1990s**, climate change has caused **billions of tonnes of glacial ice to melt** into oceans. This has **caused the Earth's poles to move in new directions**.
- The **north pole has shifted in a new eastward direction** since the 1990s, **because of changes in the hydrosphere** (meaning the way in which water is stored on Earth).
- From 1995 to 2020, the average speed of drift was **17 times faster** than from 1981 to 1995.
- Also, in the last four decades, the **poles moved by about 4 metres in distance**.
- The calculations were based on satellite data from **NASA's Gravity Recovery and Climate Experiment (GRACE) mission**.
- **Causes of Polar Drift:**
 - **Ice Melting:**
 - The faster ice melting under global warming was the most likely cause of the directional change of the polar drift in the 1990s.
 - As glaciers melt, water mass redistributes, causing shifts in the planet's axis.
 - **Change in Non-Glacial Regions (Terrestrial Water Storage):**
 - Due to climate change and unsustainable consumption of groundwater for irrigation and other anthropogenic activities.
 - **Groundwater Depletion:**
 - As millions of tonnes of water from below the land is pumped out every year for drinking, industries or agriculture, most of it eventually joins the sea, thus redistributing the planet's mass.

Lack of Fire Safety in India

Why in News

Over the past year, there have been deadly fires in hospital buildings, including those treating **Covid-19** patients.

- The **National Crime Records Bureau (NCRB)** says 330 people died in commercial building fires in 2019, while fatalities for residential or dwelling buildings were much higher at 6,329.

Key Points

➤ **Leading Cause:**

- **Electrical faults** are cited as the leading cause of fires but **State governments are widely criticised for being lax with building safety laws** and for failing to equip public buildings with modern technology.
- **Hospital ICUs (intensive care units) are a great fire risk** because they are oxygen-suffused, and need to meet high standards.

➤ **Provisions in India Related to Fire Safety:**

- **Constitutional Provision:**
 - The **Fire Services** is a **State subject** and has been **included as a Municipal function** in the **XIIth Schedule** of the Constitution of India under **Article 243 (W)**.
- **The National Building Code (NBC) of India, 2016:**
 - **NBC, published by the Bureau of Indian Standards**, is a **"recommendatory document"**, and States have been asked to incorporate it into their local building bylaws, making the recommendations a mandatory requirement.
- **The Model Building Bye Laws, 2016:**
 - The **Ministry of Urban Development** has devised a circular called **"Model Building By Laws 2016"** which states the regulatory mechanism and engineering parameters to keep in mind before starting any construction project in India.
 - Point-specific responsibility for all fire-related clearance rests with the **Chief Fire Officer**.
- **Guidelines by National Disaster Management Authority (NDMA):**
 - It has also stipulated **requirements for fire safety in public buildings, including hospitals**, which incorporate elements of the NBC, besides design guidelines on maintaining minimum open safety space, protected exit mechanisms, dedicated staircases, and crucial drills to carry out evacuations.

Total Lunar Eclipse and Supermoon

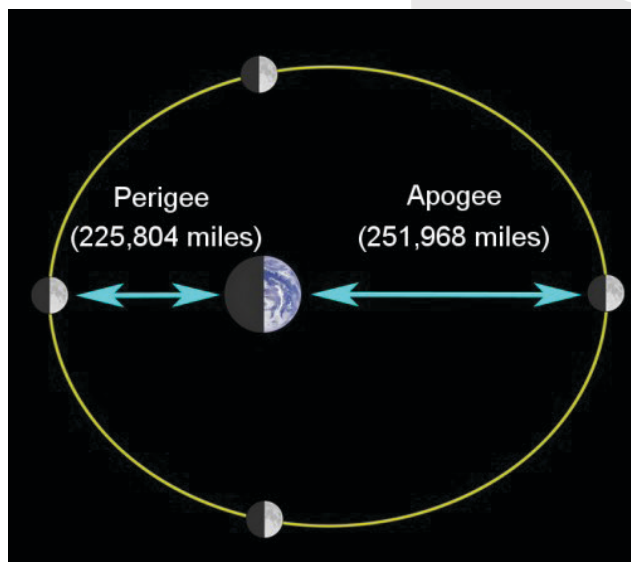
Why in News

Two celestial events - **Total Lunar Eclipse** and **Supermoon** - together coincide on 26th May 2021.

Key Points

➤ Supermoon:

- A supermoon occurs when the Moon's orbit is **closest to the Earth** at the same time that the Moon is full.
 - As the Moon orbits the Earth, there is a point of time when the **distance between the two is the least** (called the **perigee**) and a point of time when the **distance is the most** (called the **apogee**).
- Since a **full Moon** appears at the point of **least distance** from earth, not only does it appear to be **brighter** but it is also **larger than a regular full moon**.
- According to NASA, the term supermoon was **coined by astrologer Richard Nolle in 1979**. In a typical year, there may be two to four full supermoons and two to four new supermoons in a row.



➤ Lunar Eclipse:

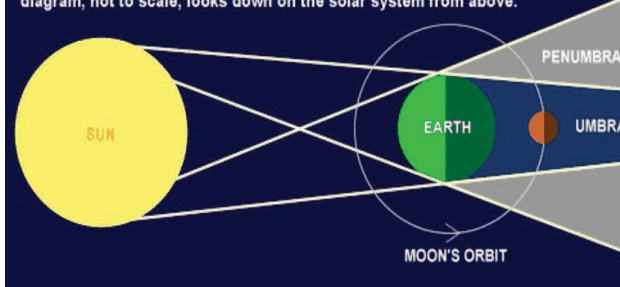
- **About:**
 - Lunar eclipse takes place when the Moon moves into the Earth's shadow. The Earth has

to be directly between the Sun and the Moon, and a lunar eclipse can **only** take place during a **full Moon**.

- First, the Moon moves into the **penumbra** – the part of the Earth's shadow where not all of the light from the Sun is blocked out. Part of the Moon's disc will look dimmer than a regular full Moon.
- And then the Moon moves into the Earth's **umbra**, where direct light from the Sun is totally blocked out by the Earth. This means the only light reflecting off the Moon's disc has already been refracted, or bent, by the Earth's atmosphere.
- **Total Lunar Eclipse:**
 - During this, the whole of the **lunar disc** enters the **Earth's umbra**, so the **Moon appears reddish (Blood Moon)**. This won't last forever, though.
 - After about 14 minutes, the Moon will **move out of Earth's umbra** and back into its **penumbra**. In **total**, the **lunar eclipse** will last a few hours.
 - **Red light** has a **longer wavelength** than **blue light**, which gives the **lunar eclipse** its characteristic **reddish colour**.
 - On Earth, we see the same effect **during sunrises and sunsets**, when the sky has a more reddish glow than during the day.

Anatomy of a Lunar Eclipse

A total lunar eclipse can only occur at Full Moon, when Earth blocks the sunlight normally reflected by the Moon. Some sunlight is bent through Earth's atmosphere, typically allowing the Moon a coppery glow. This diagram, not to scale, looks down on the solar system from above.



Total Solar Eclipse

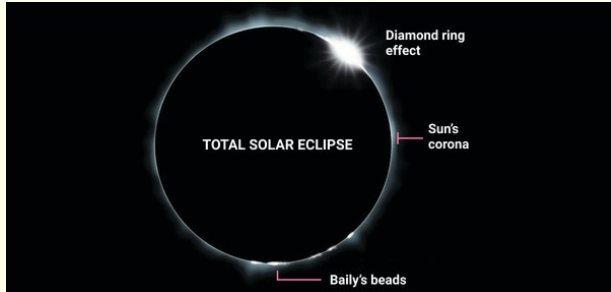
- **Total solar eclipses** occur when the **New Moon** comes **between the Sun and Earth** and casts the darkest part of its shadow, the **umbra**, on Earth. A **full solar eclipse**, known as totality, is **almost as dark** as night.
- During a **total eclipse** of the Sun, the Moon covers

Note:



the **entire disk of the Sun**. In partial and annular solar eclipses, the Moon blocks only part of the Sun.

- When the Moon completely **covers the disk** of the Sun, only the **Sun's corona is visible**.
- It is **called Total eclipse** because at the maximum point of the eclipse (midpoint of time of totality), the sky goes dark and **temperatures can fall**.



A-76: World's Largest Iceberg

Why in News

An **enormous iceberg 'A-76'** has calved from the **western side of the Ronne Ice Shelf**, lying in the **Weddell Sea**, in **Antarctica**.

- It measures around 4320 sq km in size – **currently making it the largest berg in the world**.

Key Points

- **About A-76:**
 - The **newly calved berg 'A-76'** was spotted in recent satellite images captured by the **Copernicus Sentinel-1 mission**.
 - Sentinel-1 is one of the missions of the European Space Agency (ESA) under Copernicus initiative (an earth observation programme).
 - It has **surpassed the now second-place A-23A**, about 3,380 sq km in size and also floating in the **Weddell Sea**.
- **Iceberg:**
 - An iceberg is **ice that broke off from glaciers or shelf ice** and is floating in open water.
 - Icebergs **travel with ocean currents** and either get caught up in shallow waters or ground themselves.
 - The **US National Ice Center (USNIC)** is the **only organisation** that names and tracks Antarctic Icebergs.

- Icebergs are named according to the **Antarctic quadrant** in which they are spotted.

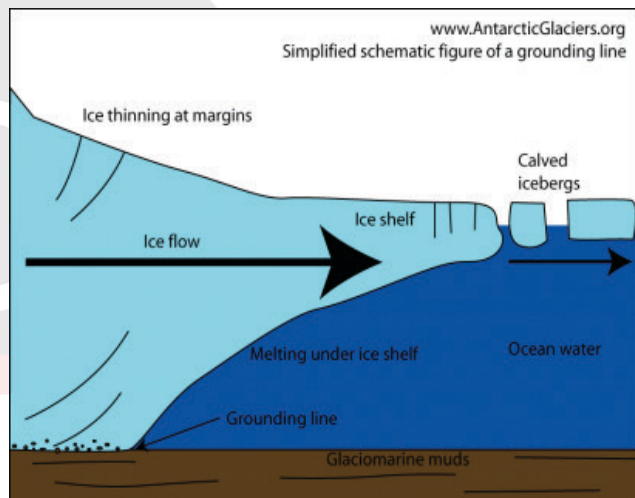
➤ Ice Shelves:

- An ice shelf is a **floating extension of land ice**. The Antarctic continent is surrounded by ice shelves.
- The **Ronne Ice Shelf** on the flank of the Antarctic Peninsula is **one of the largest of several enormous floating sheets of ice** that connect to the **continent's landmass** and extend out into the surrounding seas.

➤ Iceberg Calving:

○ Meaning:

- **Calving** is the **glaciological term for the mechanical loss** (or simply, breaking off) of ice from a glacier margin.
- Calving is most common when a glacier flows into water (i.e. lakes or the ocean) but can also occur on dry land, where it is known as **dry calving**.



Cyclone Tauktae + Cyclone Yaas

Why in News

Recently, **Cyclone Tauktae** made landfall in **Gujarat**.

- The cyclone has left a trail of destruction as it swept through the coastal states of **Kerala, Karnataka, Goa and Maharashtra**.
- Also, **Cyclone Yaas** made landfall south of **Balasore in Odisha**.

Key Points

Note:



➤ **About Tauktae:**○ **Named by:**

- It is a **tropical cyclone, named by Myanmar**. It means 'gecko', a highly vocal lizard, in the Burmese language.
- Typically, **tropical cyclones** in the North Indian Ocean region (**Bay of Bengal and Arabian Sea**) develop during the **pre-monsoon** (April to June) and **post-monsoon** (October to December) periods.
 - **May-June and October-November** are known to produce cyclones of severe intensity that affect the Indian coasts.

○ **Developed in Arabian Sea:**

- Tauktae is the **fourth cyclone in consecutive years** to have developed in the Arabian Sea, that too in the **pre-monsoon period (April to June)**.
- After **Cyclone Mekanu** in 2018, which struck Oman, **Cyclone Vayu** in 2019 struck Gujarat, followed by **Cyclone Nisarga** in 2020 that struck Maharashtra.
- All these cyclones **since 2018** have been categorised either '**Severe Cyclone**' or above.

➤ **About Yaas:**

- The cyclone has been **named Yaas by Oman**. The word Yaas has originated from the Persian language and means '**Jasmin**' in English.
- Typically, **tropical cyclones in the North Indian Ocean region** (Bay of Bengal and Arabian Sea) develop during the **pre-monsoon** (April to June) and **post-monsoon** (October to December) periods.
 - **May-June and October-November** are known to produce cyclones of severe intensity that affect the Indian coasts.

- It has been classified as a **very severe cyclone**.

➤ **Tropical Cyclone:**

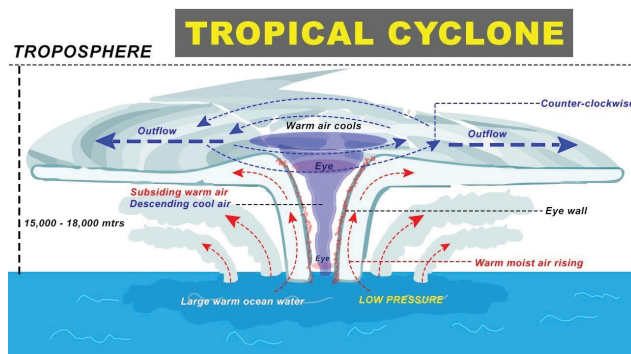
- A tropical cyclone is an **intense circular storm that originates over warm tropical oceans** and is characterized by low atmospheric pressure, high winds, and heavy rain.
- A **characteristic feature** of tropical cyclones is the **eye**, a central region of clear skies, warm temperatures, and low atmospheric pressure.
- Storms of this type are called **hurricanes** in the **North Atlantic and eastern Pacific** and **typhoons** in **SouthEast Asia and China**. They are called

tropical cyclones in the southwest Pacific and Indian Ocean region and Willy-willies in north-western **Australia**.

- Storms **rotate counterclockwise** in the **northern hemisphere** and **clockwise** in the **southern hemisphere**.
- The **conditions favourable** for the **formation and intensification** of tropical storms are:
 - **Large sea surface with temperature higher than 27°C.**
 - Presence of the **Coriolis force**.
 - Small variations in the **vertical wind speed**.
 - A pre-existing weak **low-pressure area** or **low-level-cyclonic circulation**.
 - **Upper divergence** above the sea level system.

➤ **Naming of Tropical Cyclones:**

- According to **WMO (World Meteorological Organization)** guidelines, countries in every region are supposed to give names for cyclones.
- The **North Indian Ocean Region** covers tropical cyclones formed over Bay of Bengal and Arabian Sea.
- The **13 members**, which come under the region, are **Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Sri Lanka, Thailand, Iran, Qatar, Saudi Arabia, the UAE and Yemen**.
- **India Meteorological Department (IMD)**, one of the six **Regional Specialised Meteorological Centres (RSMC)** in the world, is mandated to issue advisories and name tropical cyclones in the **north Indian Ocean Region**.
 - It is an agency of the **Ministry of Earth Sciences**.

**Bay of Bengal vs Arabian Sea (Cyclones)**➤ **Bay of Bengal:**

- As it is **concave or shallow** where when strong winds push water, it gets concentrated as a storm.

Note:



- It is **shaped like a trough that makes it more hospitable for storms** to gain force. Moreover, the **high sea surface temperature makes matters more worse** in the Bay triggering the intensity of the storms.
- Additionally, it **gets more rainfall** with sluggish winds and warm air currents around it that keep temperatures relatively high all year. The **constant inflow of fresh warm water from the perennial rivers** like Brahmaputra, Ganga makes it further impossible to mix with the cooler water below.
- **Lack of landmass between the Pacific Ocean and the Bay of Bengal** tend cyclonic winds to move into the coastal areas causing heavy rainfall.
- The **absence of air movements from north-western India towards the Bay in the post-monsoon phase is also another reason** for the chances of cyclones in the Bay of Bengal.

➤ **Arabian Sea:**

- It is much **calmer** as the **stronger winds help dissipate the heat** and **lack of constant fresh water** helps the warm water to mix with the cool water underneath, reducing the surface temperature.
- The Arabian Sea enjoys the **locational advantage** as the winds from the Pacific Ocean encounter the Western Ghats and the Himalayas cutting down on its intensity and sometimes never reaching the Arabian Sea.

Devika River Project: J&K

Why in News

Recently, the Minister of State for Development of North Eastern Region has asked for suggestions for the **Devika River project in Udhampur, J&K**.

- This project is compared with the **Namami Gange Project**.

Key Points

➤ **About Devika River:**

- Devika river **originates from the hilly Suddha Mahadev temple in Udhampur district of Jammu and Kashmir** and flows down towards **western Punjab** (now in Pakistan) where it **merges with the Ravi river**.

- The river holds **religious significance** as it is revered by Hindus as the **sister of river Ganga**.
- In June 2020, **Devika Bridge** was inaugurated in Udhampur. Apart from taking care of traffic congestion, the Devika Bridge was also meant to **help smooth passage of Army convoys and vehicles**.
- **About National River Conservation Plan:**
 - National River Conservation Plan (NRCP) is a **centrally funded scheme launched in 1995** aimed at **preventing the pollution of rivers**.
 - Programs for river conservation are being implemented under National River Conservation Plan (NRCP) and NGRBA (National Ganga River Basin Authority).

Black Carbon and Glacier Melting

Why in News

The report titled “**Glaciers of the Himalayas: Climate Change, Black Carbon and Regional Resilience**” says that the **glaciers** are melting faster than the global average ice mass. However, the strong policy on **black carbon** can sharply cut glacier melt.

- The research report is **released by the World Bank** and covers the **Himalaya, Karakoram, and Hindu Kush (HKHK)** mountain ranges.

Black Carbon

- Black carbon is a **kind of an aerosol**.
 - An **aerosol** is a suspension of fine solid particles or liquid droplets in the air.
- Among aerosols (such as brown carbon, sulphates), Black Carbon (BC) has been **recognized as the second most important anthropogenic agent for climate change** and the **primary marker to understand the adverse effects caused by air pollution**.
- It **gets emitted** from gas and diesel engines, coal-fired power plants, and other sources that burn fossil fuel. It **comprises a significant portion of particulate matter or PM**, which is an air pollutant.

HKHK Mountain Region

- HKHK Region **spans eight countries**; Afghanistan, Pakistan, India, Nepal, China, Bhutan, Bangladesh and Myanmar and also **has some of the world's tallest mountains including Mt. Everest and K2**.

- HKHK Glaciers **feed into river systems** including Ganga, Yangtze, Irrawaddy, and Mekong.
 - The water that runs down from glaciers **feeds the agriculture**, on which nearly 2 billion people are dependent upon.
- HKHK Region, also known as the **third pole**, along with China's Tien Shan Mountains holds most ice outside the North and the South Pole.

Key Points

- **About Black Carbon:**
 - BC is a **short-lived pollutant** that is the **second-largest contributor to warming the planet behind carbon dioxide (CO₂)**.
 - Unlike other greenhouse gas emissions, BC is **quickly washed out and can be eliminated from the atmosphere if emissions stop**.
 - Unlike historical carbon emissions it is **also a localised source with greater local impact**.
- **Source of Black Carbon in Himalayan Region:**
 - **Industry** (primarily brick kilns) and **residential burning of solid fuel** together account for 45-66% of regional anthropogenic (man-made) BC deposition, followed by **on-road diesel fuels** (7-18%) and **open burning** (less than 3% in all seasons) in the region.
- **Impact of Deposits of BC:**
 - It **acts in two ways** hastening the pace of glacier melt:
 - By decreasing surface reflectance of sunlight.
 - By raising the air temperature.

Southern Ocean

Why in News

Recently, on the occasion of **World Ocean Day (8th June)**, the **National Geographic** magazine has recognised the '**Southern Ocean**' as the world's **fifth ocean**.

- The **International Hydrographic Organisation** too had recognised '**Southern Ocean**' as a **distinct body of water** surrounding Antarctica in **1937** but had **repealed the same in 1953**.
- **Other four Oceans are:** Atlantic, Pacific, Indian, and Arctic Oceans.

International Hydrographic Organisation

- IHO is an **intergovernmental consultative and technical organization** that was **established in 1921** to **support the safety of navigation** and the **protection of the marine environment**.
- **India is also a member of IHO.**

Key Points

- **About:**
 - Most of the **waters that surround Antarctica out to 60 degrees south latitude, excluding the Drake Passage and Scotia Sea**, constitute the newly acknowledged Southern Ocean.
 - The Southern Ocean is the **only ocean 'to touch three other oceans** (Pacific, Atlantic and Indian Ocean) and to completely embrace a continent rather than being embraced by them'.
 - It is also defined by its **Antarctic Circumpolar Current** that was formed 34 million years ago. The current flows from **west to east** around Antarctica.
- **Antarctic Circumpolar Current:**
 - ACC is the **only current in the global ocean to close upon itself in a circumpolar loop**.
 - This trait makes the ACC the most important current in the **Earth's climate system** because it **links the Atlantic, Pacific and Indian Oceans** and is the **primary means of inter-basin exchange** of heat, carbon dioxide, chemicals, biology and other tracers.
 - The ACC is **created by** the combined effects of **strong westerly winds** across the Southern Ocean, and the **big change in surface temperatures** between the Equator and the poles.
 - Ocean density increases as water gets colder and as it gets more salty. The **warm, salty surface waters of the subtropics are much lighter than the cold, fresher waters close to Antarctica**.
 - The depth of constant density levels slopes up towards Antarctica. The westerly winds make this slope steeper, and the ACC rides eastward along it, faster where the slope is steeper, and weaker where it's flatter.

Note:



Summer Solstice: 21st June

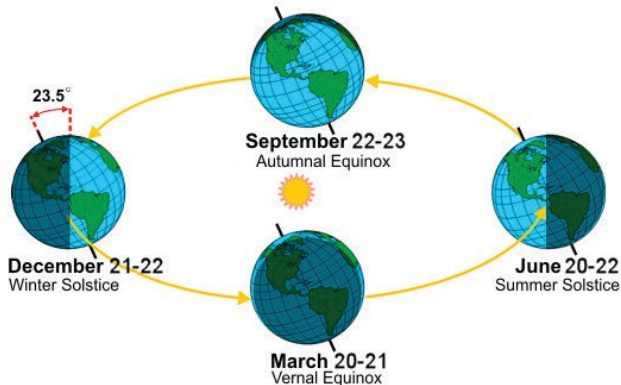
Why in News

21st June is the **longest day** in the Northern Hemisphere, technically this day is referred to as **Summer solstice**. In **Delhi**, the **day length** is around **14 hours**.

- The amount of light received by a **specific area** in the **Northern Hemisphere** during the summer solstice depends on the **latitudinal location** of the place.
- 21st June is also observed as the **International Yoga Day**.

Key Points

➤ About Summer Solstice:



- It is the **longest day and shortest night** of the year in the **Northern Hemisphere**.
- During this, **countries in the Northern Hemisphere are nearest to the Sun** and the **Sun shines overhead on the Tropic of Cancer (23.5° North)**.
- During the solstice, the **Earth's axis — around which the planet spins**, completing one turn each day — is **tilted in a way that the North Pole is tipped towards the sun** and the South Pole is away from it.
- Typically, this imaginary axis passes right through the middle of the Earth from top to bottom and is always **tilted at 23.5 degrees with respect to the sun**.
- At the **Arctic Circle**, the **sun never sets during the solstice**.
- **Greater Amount of Energy:**
 - This day is characterised by a **greater amount of energy received from the sun**.
 - According to **NASA (National Aeronautics and Space Administration)**, the amount of

incoming energy the Earth received from the sun on this day is 30% higher at the North Pole than at the Equator.

- The maximum amount of sunlight received by the Northern Hemisphere during this time is usually on June 20, 21 or 22. In contrast, the **Southern Hemisphere receives most sunlight on December 21, 22 or 23** when the northern hemisphere has its longest nights— or the **winter solstice**.
- **Geography Behind:**
 - The **reason behind the changing lengths of the days** is the **Earth's tilt**.
 - The Earth's axis of rotation is tilted at an angle of 23.5° to its orbital plane. This tilt, **combined with factors such as Earth's spin and orbit**, leads to variations in the duration of sunlight, due to which any location on the planet receives different lengths of days.
 - The Northern Hemisphere spends half the year tilted in the direction of the Sun, getting direct sunlight during long summer days. During the other half of the year, it tilts away from the Sun, and the days are shorter.
 - The tilt is **also responsible for the different seasons on Earth**. This phenomenon causes the movement of the Sun from the northern to the southern hemisphere and vice versa bringing in seasonal changes in the year.

The Equinox

- **Twice each year**, during the equinoxes ("equal nights"), Earth's axis is **not pointed toward our Sun, but is perpendicular to the incoming rays**.
- It results in a **"nearly" equal amount of daylight and darkness at all latitudes**.
- The **vernal or spring equinox** occurs in the northern hemisphere on March 20 or 21. September 22 or 23 marks the northern hemisphere **autumnal or fall equinox**.

Rising Sea Levels

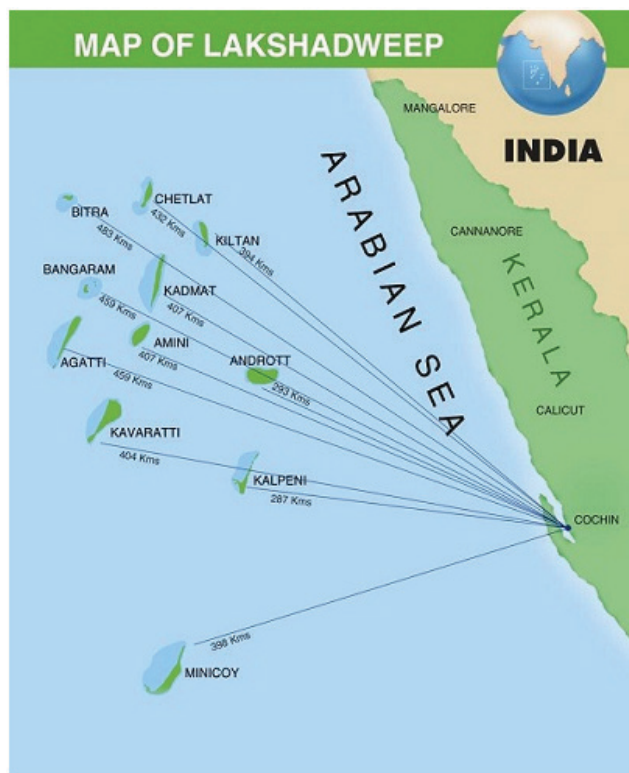
Why in News

Recently, a study has projected that sea levels will rise around **Lakshadweep Islands** due to the impact of **global warming**.

Note:



- It will affect **airport and residential areas** that are quite close to the present coastline.
- **India's smallest Union Territory, Lakshadweep** is an archipelago consisting of 36 islands with an area of 32 sq km.



Key Points

- **Sea Level Rise (SLR):**
 - SLR is an **increase in the level** of the **world's oceans** due to the effects of **climate change**, especially **global warming**, induced by **three primary factors**: Thermal Expansion, Melting Glaciers and Loss of Greenland and Antarctica's ice sheets.
 - Sea level is primarily measured using **tide stations** and **satellite laser altimeters**.
- **SLR is Linked to Three Primary Factors:**
 - **Thermal Expansion:** When water heats up, it expands. About half of the sea-level rise over the past 25 years is attributable to warmer oceans simply occupying more space.
 - **Melting Glaciers:** Higher temperatures caused by global warming have led to **greater-than-average summer melting of large ice formations** like mountain glaciers as well as **diminished snowfall** due to later winters and earlier springs.
- That creates an **imbalance between runoff and ocean evaporation**, causing sea levels to rise.
- **Loss of Greenland and Antarctic Ice Sheets:** As with mountain glaciers, increased heat is causing the massive ice sheets that cover **Greenland and Antarctica** to melt more quickly, and also move more quickly into the sea.
- **Consequences of SLR:**
 - **Coastal Flooding:** Globally, eight of the **world's 10 largest cities** are near a coast, which is threatened by coastal flooding.
 - **Destruction of Coastal Biodiversity:** SLR can cause **destructive erosion**, wetland flooding, aquifer and agricultural soil contamination with salt, and lost habitat for biodiversity.
 - **Dangerous Storm Surges:** Higher sea levels are coinciding with more dangerous **hurricanes** and typhoons leading to loss of life and property.
 - **Lateral and Inland Migration:** Flooding in low-lying coastal areas is forcing people to migrate to the higher ground causing displacement and dispossession and in turn a **refugee crisis worldwide**.
 - **Impact on Infrastructure:** The prospect of higher coastal water levels threatens basic services such as internet access.
 - **Threat to Inland Life:** Rising seas can contaminate soil and groundwater with salt threatening life farther away from coasts.
 - **Tourism and Military Preparedness:** Tourism to coastal areas and military preparedness will also be negatively affected by an increase in SLR.
- **Vulnerability of India:**
 - India's **7,516-kilometre-long coastline** includes 5,422 kilometres of coastline on the mainland and 2,094 kilometres on the islands belonging to nine states and four Union Territories.
 - The coastline **accounts for 90% of the country's trade** and it **spans 3,331 coastal villages and 1,382 islands**.
- **India's Efforts:**
 - **Coastal Regulation Zone:**
 - The coastal areas of seas, bays, creeks, rivers, and backwaters which get influenced by tides up to 500 m from the high tide line (HTL) and the land between the low tide line (LTL) and the high tide line were declared as Coastal Regulation Zone (CRZ) in 1991.

Note:



- The latest regulation **also takes into account rising sea-levels due to global warming.**
- **National Action Plan on Climate Change:**
 - It was **launched in 2008** by the Prime Minister's Council on Climate Change.
 - It aims at creating awareness among the representatives of the public, different agencies of the government, scientists, industry and the communities on the threat posed by climate change and the steps to counter it.

Heat Dome

Why in News

Recently, the Pacific Northwest and some parts of Canada recorded temperatures around 47 degrees, causing a "historic" heat wave.

- This is a result of a phenomenon referred to as a "heat dome".

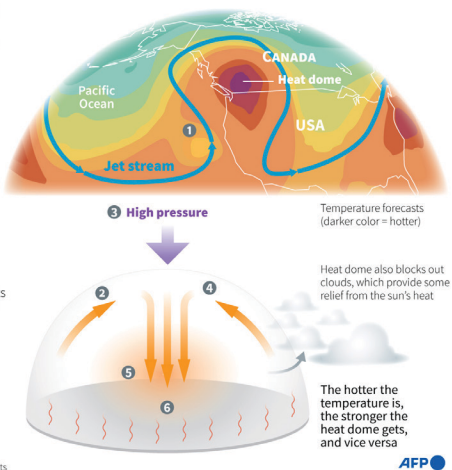
Key Points

- **About:**
 - The phenomenon begins when there is a **strong change (or gradient) in ocean temperatures**. In the process **known as convection**, the gradient causes more warm air, heated by the ocean surface, to rise over the ocean surface.
 - This **strong change in ocean temperature from the west to the east** is the reason for the **heat dome (HD)**.
 - The **western Pacific ocean's temperatures** have increased in the past few decades and are **relatively more than the temperature in the eastern Pacific**.
 - HD also prevents clouds from forming, allowing for more radiation from the sun to hit the ground.
 - A heat dome is **effectively what it sounds like** - an area of high pressure that parks over a region like a lid on a pot, trapping heat. They are more likely to form during **La Niña** years like 2021, when waters are cool in the eastern Pacific and warm in the western Pacific.
- **Impact on Humans (Wet-bulb temperature):**
 - As long as the body is producing sweat, which is then able to evaporate quickly, the **body will be able to remain cool even under high temperatures.**

The 'heat dome'

Occurs when the atmosphere traps hot ocean air like a lid or cap

- 1 In summer, the **jet stream** (which moves the air) shifts northward
- 2 **Hot and stagnant air expands upwards**
- 3 Strong and **high-pressure** atmospheric conditions combine with influences from **La Niña** act like a dome or cap
- 4 In a process known as **convection**, hot air attempts to escape but high pressure pushes it back down
- 5 Under the dome, the air **sinks and compresses**, releasing more heat
- 6 As winds move the hot air east, the jet stream traps the air where it sinks, resulting in **heat waves**



Source: NOAA/US/Canada medias, experts

AFP

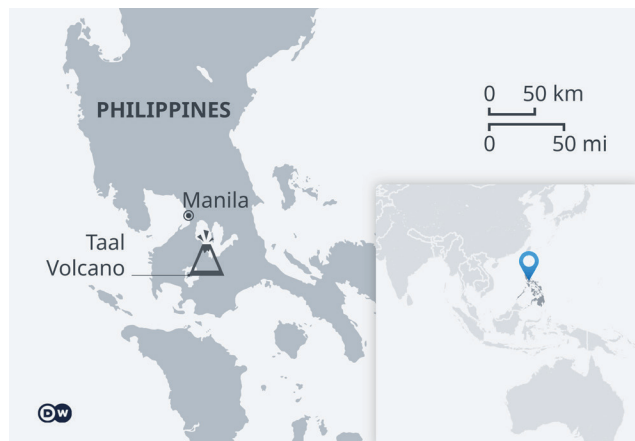
- Wet-bulb temperature (WBT) is a **limit that considers heat and humidity beyond which humans can not tolerate high temperatures.**
- Temperatures beyond WBT **can cause heat related illnesses including heat stroke, heat exhaustion, sunburn and heat rashes.** Sometimes these can prove fatal.

Taal Volcano: Philippines

Why in News

Recently, the Philippines increased the alert level on **Taal Volcano** to **level 3 on a five-level scale** after a **Phreatomagmatic Eruption (PE)** occurred that generated a dark grayish plume, one kilometer high.

- **Alert Level 3** means there is magmatic unrest, or movement of magma that may further drive succeeding eruptions.



Note:

Key Points

- **Susceptibility:**
 - The Philippines is situated at the boundaries of two tectonic plates - the **Philippines Sea Plate and the Eurasian plate** - thus susceptible to earthquakes and volcanism.
 - Taal is one of the most active volcanoes in the Philippines due to its location on the Pacific **"Ring of Fire"** -- a zone of intense seismic activity.
- **Phreatomagmatic Eruption:** An eruption **resulting from the interaction of new magma or lava with water** and can be very explosive. The water can be from groundwater, hydrothermal systems, surface runoff, a lake or the sea.
 - Other **Types of Eruptions** are: Icelandic, Hawaiian, Strombolian, Vulcanian, Pelean and Plinian.
- **Complex Volcano:** It is classified as a **"complex" volcano** by the Philippine Institute of Volcanology and Seismology (PHIVOLCS).
 - A complex volcano, **also called a compound volcano**, is defined as one that doesn't have just one main vent or cone but several eruption points. Another such **example is Mount Vesuvius on the west coast of Italy**.
- **Unpredictable:** Taal has erupted more than 30 times in the last few centuries, the most **recent was in 2020**.

Vembanad Lake: Kerala

Why in News

Kerala houseboats in Vembanad Lake are about to begin soon amid a robust vaccination drive.

- This is the **largest lake in Kerala and the longest Lake in India**.

Key Points

- The lake has its **source in four rivers**, Meenachil, Achankovil, Pampa and Manimala.
 - It is **separated from the Arabian Sea by a narrow barrier island** and is a **popular backwater stretch** in Kerala.
- **Vallam Kali (i.e. Nehru Trophy Boat Race)** is a **Snake Boat Race** held every year in the month of August in Vembanad Lake.

- In 2002, it was **included in the list of wetlands of international importance**, as defined by the **Ramsar Convention**.

- It is the **second-largest Ramsar site in India** only after the **Sundarbans** in West Bengal.

- The Government of India has identified the Vembanad wetland under the **National Wetlands Conservation Programme**.

- The **Kumarakom Bird Sanctuary** is located on the east coast of the lake.



Cloudbursts

Why in News

Recently, cloudbursts have been reported from several places in India.

Key Points

- **About:**
 - Cloudbursts are **short-duration, intense rainfall events over a small area**.
 - It is a weather phenomenon with unexpected **precipitation exceeding 100mm/h over a geographical region of approximately 20-30 square km**.
 - In the Indian Subcontinent, it **generally occurs when a monsoon cloud drifts northwards**, from the Bay of Bengal or the Arabian Sea across the plains then on to the Himalaya that sometimes brings 75 millimetres of rain per hour.
- **Occurrence:**
 - The **relative humidity and cloud cover is at the maximum level with low temperature and slow winds** because of which a high amount of clouds may get condensed at a very rapid rate and result in a cloudburst.
 - **As temperatures increase, the atmosphere can hold more and more moisture and this moisture comes down as a short very intense rainfall for a short duration** probably half an hour or one hour resulting in flash floods in the mountainous areas and urban floods in the cities.

Note:



- **Cloudburst are Different from Rainfall:**
 - Rain is condensed water falling from a cloud while cloudburst is a sudden heavy rainstorm.
 - Rain **over 100mm per hour is categorised as a cloudburst.**
 - The cloudburst is a natural phenomenon, but occurs quite unexpectedly, very abruptly, and rather drenching.
- **Impact of Climate Change:**
 - Several studies have shown that climate change **will increase the frequency and intensity of cloudbursts** in many cities across the globe.
 - In May 2021, the **World Meteorological Organization** noted that there is about a **40% chance of the annual average global temperature temporarily reaching 1.5°C above the pre-industrial level** in at least one of the next five years.
 - It added that there is a **90% likelihood of at least one year between 2021 and 2025 becoming the warmest on record and dislodge 2016 from the top rank.**
 - It is seen that **more cloudbursts are happening in Himalayan region because the decadal temperature rise** in the Himalayan region is higher than the global rate of rising temperatures.
- **Consequences of Cloudbursts:**
 - **Flash floods**
 - **Landslides**
 - Mudflows
 - Land caving

Geo-Tourism in Northeast

Why in News

Recently, the **Geological Survey of India (GSI)** has **identified certain geological sites across the Northeast** for promotion of geo-tourism.

- **12 locations** in the Northeast have been included in the **32 approved geo-tourism or geo-heritage sites** in the country.

Key Points

- **Geo-heritage Sites:**
 - Geo-heritage refers to the **geological features** which are **inherently or culturally significant**

offering insight to earth's evolution or history to earth science or that can be utilized for education.

- **Geological Survey of India (GSI)** is the **parent body** which is making efforts towards identification and **protection of geo-heritage sites/national geological monuments** in the country.
- **Some of these sites are:** Marine Gondwana fossil park in Chhattisgarh; Siwalik vertebrate fossil park in Himachal Pradesh; Stromatolite park in Rajasthan; Pillow lava in Karnataka, Eparchaeon unconformity and Tirumala hills in Andhra Pradesh, **Lonar Lake** in Maharashtra, etc.
- **Geo Tourism:**
 - Geotourism is defined as "tourism that sustains or enhances the geographical character of a place - its environment, culture, aesthetics, heritage, and the well-being of its residents."
- **Geo-heritage sites in Northeast:**
 - **Majuli (Assam):**
 - A river "island", among the world's largest, in **Brahmaputra river.**
 - The island is also the **hub of spiritualism in Assam** because of a number of 'satras' or **Vaishnav monasteries** established by the **15th-16th century saint-reformer Srimanta Sankaradeva** and his disciples.
 - **Sangetsar Tso (Arunachal Pradesh):**
 - It is popularly **known as Madhuri Lake.**
 - It is close to the border with Tibet and was formed due to the damming of a river during a major earthquake in 1950.
 - **Loktak Lake (Manipur):**
 - It is the **largest freshwater lake in the Northeast.**
 - The attractions of this lake are the '**phumdis**' or **floating biomass** and the 'phumsangs' or huts of fishermen on them.
 - The **Keibul Lamjao National Park**, the **only floating wildlife habitat** on earth, is on the southwestern part of the lake and is the **last natural habitat of the sangai or brow-antlered dancing deer.**
 - **Others:**
 - Mawmluh Cave, Mawblei or God's Rock, Therriaghat (**Meghalaya**); Umananda (**Assam**), Chabimura, Unakoti (**Tripura**); Sangetsar Tso (**Arunachal Pradesh**); Reiek Tlang (**Mizoram**);

Note:



Naga Hill Ophiolite (**Nagaland**); Stromatolite Park (**Sikkim**).

- **Related Global Concept:**
 - **UNESCO Global Geoparks:**
 - These are **single, unified geographical areas** where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development.
 - While there are **169 UNESCO Global geoparks** spread across 44 countries, **India is yet to have one of its own.**

Geological Survey of India

- It was set up in **1851 primarily to find coal deposits for the Railways**. Presently, GSI is an attached office to the Ministry of Mines.
- The **main functions** of the GSI relate to creation and updation of national geo-scientific information and mineral resource assessment.
- It is **headquartered in Kolkata**.

Kilauea Volcano: Hawaii

Why in News

Recently, a surge of **earthquakes** and the ground swelling at the **southern part of the crater** was noticed at **Hawaii's Kilauea volcano**.

- A volcano is an **opening on the surface** that allows material warmer than its surroundings to escape from its interior.

Key Points

- Kilauea, also called **Mount Kilauea** ("Much Spreading" in Hawaiian), is located in **Hawaii Volcanoes National Park** on the **southeastern part of the island of Hawaii, US**.
 - The **volcano's 4,090-foot summit** has collapsed to **form a caldera**.
 - A **caldera is a depression** created after a volcano partially collapses after releasing the majority of its magma chamber in an explosive eruption.
- **Recently Erupted Volcanoes:**
 - **Sangay Volcano: Ecuador**
 - **Taal Volcano: Philippines**

- **Mt. Sinabung, Merapi volcano, Semeru volcano (Indonesia)**

Volcanoes in India:

- **Barren Island, Andaman Islands (India's only active volcano)**
- **Narcondam, Andaman Islands**
- **Baratang, Andaman Islands**
- **Deccan Traps, Maharashtra**
- **Dhinodhar Hills, Gujarat**
- **Dhosi Hill, Haryana**

Hurricane Ida

Why in News

Recently, **Hurricane Ida** made landfall in Louisiana, **US**. It is an extremely dangerous **Category 4 storm** and **one of the most powerful storms ever to hit the US**.

- It will test the hundreds of miles of new levees that were built after the devastation of **Hurricane Katrina (2005)**, which made landfall 16 years ago in the US.
- Hurricanes are the **biggest and most violent storms** on the planet.
 - Tropical cyclones or hurricanes **use warm, moist air as fuel**, and therefore form over warm Equatorial water.
- **Names in Different Regions of the World:**
 - **Typhoons:** Tropical cyclones are known as Typhoons in the China Sea and Pacific Ocean.
 - **Hurricanes:** In the West Indian islands in the Caribbean Sea and Atlantic Ocean.
 - **Willy-willies:** In north-western Australia and
 - **Tropical Cyclones:** In the Indian Ocean Region.

Milky Sea Phenomenon

Why in News

The scientists are using new satellite technology **Day/Night Band** to find **glow-in-the-dark milky seas**.

Key Points

- **About:**
 - Also called **mareel**, it is a **rare form of marine bioluminescence** where the **nocturnal ocean**

Note:



surface produces a widespread, uniform and **steady whitish glow**.

- Bioluminescence is **light produced by a chemical reaction within a living organism**.

- About **two or three milky seas occur per year** worldwide, mostly in the waters of the **northwest Indian Ocean** and **off the coast of Indonesia**.
- Sometimes **exceeding 1,00,000 km² in surface area**, it **persists for days to weeks**, drifting within doldrums amid the prevailing **sea-surface currents** and aligning with narrow ranges of sea-surface temperature and marine biomass in a way that suggests water mass isolation.

➤ Causes:

- Arises from a **saprophytic relationship between luminous bacteria and microalgae** that expresses on the macroscale.
 - A strain of luminous bacteria called **Vibrio harveyi** colonizing algae at the water's surface has been found.
- **Indian Ocean Dipole (IOD)**:
 - During its positive phase, the IOD corresponds to warm/wet conditions with warm pooling waters on the western side of the Indian Ocean, and cool/dry conditions with strong easterly winds on the eastern side.
 - These winds **generate upwelling of cool, nutrient-rich coastal waters** which drift offshore with the currents, **leading to algal blooms over a broad region**, and potentially, conditions favourable for **milky sea genesis**.

➤ Purpose:

- Luminous bacteria cause the particles they colonize to glow. The purpose of this glow **could be to attract fish that eat them**.
- These bacteria thrive in the guts of fishes, so when their populations get too big for their main food supply, **a fish's stomach makes a great second option**.

➤ Detection:

- **Source of Information**: The awareness of milky seas is recorded **primarily from mariner sightings concentrated in the major shipping lanes**.
 - In 1995, the **low-light satellite measurements** provided the first overview of a milky sea, off the Somalia coast.

○ Instrument for Detection:

- **Operational Linescan System (OLS)**: Carried by Defense Meteorological Satellite Program (DMSP) series of military weather satellites (US).
 - This instrument is capable of detecting very weak light sources.
- **Day/Night Band (DNB)**: It is planned for **US' National Oceanic and Atmospheric Administration's** and part of the Visible Infrared Imaging Radiometer Suite (VIIRS) and is carried on satellites.
- **Limitations**: These instruments have several limitations from the standpoint of milky sea detection.
 - The **OLS cannot detect the more common bioluminescence events** associated with disturbed-water due to their, typically small extent.
 - The **DNB's spectral response is also sensitive to mesospheric airglow emissions**, which occur as both reflected light off the clouds and as direct upwelling emissions to space.
 - **Atmospheric gravity waves** modulate the intensity of light and form patterns of brightness having spatial scales similar to those expected from milky seas.

Cattle Island: Hirakud Reservoir

Why in News

The **Odisha Forest and Environment Department** is starting **ecotourism packages** for tourists to islands inside the **Hirakud reservoir**.

- **Cattle island**, one of three islands in the Hirakud reservoir, has been selected as a sightseeing destination.

Key Points

➤ Hirakud Dam:

○ Establishment:

- It is a multipurpose scheme conceived by **Er. M. Visveswaraya in 1937**, after recurrence of devastating floods in Mahanadi river.
- Its first hydro power was commissioned in 1956.
- It is the longest dam of India.

○ Location:

Note:



- The dam is built across **river Mahanadi** at about 15 km upstream of Sambalpur town of Odisha.
 - The **Mahanadi River system** is the third largest of peninsular India after Godavari and Krishna, and the largest river of Odisha state.
 - It rises from a place near **Sihawa in Bastar hills** in the state of **Chhattisgarh** to the **south of Amarkantak**.
 - The catchment area of the river extends to **Chhattisgarh, Madhya Pradesh, Odisha, Jharkhand and Maharashtra**.
- **Wildlife Sanctuary:**
 - The **Debrigarh wildlife sanctuary** is located near Hirakud dam. It is bounded on the east and north by the huge Hirakud reservoir.
 - It is one of the select few sanctuaries in the state supporting both terrestrial and aquatic biodiversity.

Sand and Dust Storms Risk Assessment in Asia and the Pacific

Why in News

According to a new **United Nations (UN)** report, more than **500 million people in India** and **more than 80% of the entire populations** of Turkmenistan, Pakistan, Uzbekistan, Tajikistan and the Islamic Republic of Iran are **exposed to medium and high levels of poor air quality due to sand and dust storms**.

- The **risk of impacts from sand and dust storms is projected to increase in the 2030s** due to more extreme drought conditions in parts of Western Australia, south-eastern Turkey, Iran and Afghanistan.

Key Points

- **Sand and Dust Storms:**
 - **About:**
 - Sand and dust storms are **common meteorological hazards** in arid and semi-arid regions.
 - They are usually caused by **thunderstorms – or strong pressure gradients** associated with **cyclones** – which increase wind speed over a wide area.

- Some **40% of aerosols in the troposphere (the lowest layer of Earth's atmosphere)** are dust particles from wind erosion.
- **Main Sources:**
 - The main sources of these mineral dusts are the **arid regions of Northern Africa, the Arabian Peninsula, Central Asia and China**.
 - Comparatively, **Australia, America and South Africa make minor**, but still important, contributions.
- **Impacts:**
 - **Negative:**
 - **Impact on Power Plants:**
 - They can interfere with energy infrastructure, adversely affecting electricity transmission lines and causing power outages.
 - India, China and Pakistan witnessed **1,584 gigawatt-hours (gWh), 679 gWh and 555 gWh of energy loss**, respectively.
 - These losses amounted to over **Rs. 782 crore for India per year**.
 - **Affect Source of Freshwater:**
 - Very high dust deposition also occurs in the **Himalaya-Hindu Kush mountain range** and the **Tibetan Plateau**, the so-called '**third pole**' that are the sources for fresh water for more than 1.3 billion people in Asia.
 - **Increases Melting of Ice:**
 - The deposition of dust on glaciers induces a **warming effect**, increasing the melting of ice, with direct and indirect impacts on society through numerous issues, including food security, energy production, agriculture, water stress and flood regimes.
 - **On Farmland:**
 - Dust deposition **impacted large portions of farmland** in Turkmenistan, Pakistan and Uzbekistan.
 - Much of this dust is characterised by **high salt content, making it toxic for plants**.
 - It **reduces yield**, posing a significant threat to the production of irrigated cotton and other crops.
 - **On Sustainable Development Goals (SDG):**
 - They directly affect **11 of the 17 United Nations-mandated Sustainable Development Goals (SDG)**:

Note:



- Ending poverty in all forms, Ending hunger, Good health and well-being, Affordable and clean energy, Decent work and economic growth, Climate action, etc.

○ Positive:

- They can **increase the nutrient content in the areas of deposition** and benefit vegetation.
- Dust **deposited on water bodies can alter their chemical characteristics**, triggering both positive as well as adverse outcomes.
- Dust particles that carry iron can enrich parts of oceans, **improving the phytoplankton balance and impacting marine food webs**.

Footprints of 3 Dinosaur Species: Rajasthan

Why in News

Recently, in a major discovery, **footprints of three species of dinosaurs have been found in the Thar desert** in Rajasthan's Jaisalmer district.

- It proves the **presence of the giant reptiles in the western part of the State**.

Key Points

➤ Thar Desert:

- **Naming:** The name 'Thar' is **derived from thul**, the general term for the region's sand ridges. It is also called the '**Great Indian Desert**'.
- **Location:** Partly in Rajasthan state, **northwestern India**, and partly in Punjab and Sindh provinces, **eastern Pakistan**.
 - It is **bordered by** the irrigated Indus River plain to the west, the Punjab Plain to the north and northeast, the Aravalli Range to the southeast, and the Rann of Kachchh to the south.
- **Features:**
 - An **arid region** that covers over 2,00,000 sq km.
 - The surface **consists of aeolian (wind-deposited) sand** that has accumulated over the past 1.8 million years.
 - Presents an **undulating surface**, with high and low sand dunes separated by sandy plains and low barren hills, or **bhakers**, which rise abruptly from the surrounding plains.

- **Barchan**, also spelled **Barkhan**, **crescent-shaped sand dune** produced by the action of wind predominately from one direction.
- Several **playas (saline lake beds)**, locally known as **dhands**, are scattered throughout the region.
- The desert supports a relatively **rich biodiversity** with several large mammals, notably the blue bull, blackbuck, and Indian gazelle or chinkara

Impact of Climate Change on El Nino and La Nina

Why in News

According to recent research, **climate change** can cause **extreme and more frequent El Niño and La Niña events**.

- The findings have been obtained using one of South Korea's fastest supercomputers, Aleph.

Key Points

➤ ENSO:

- **El Nino and the Southern Oscillation**, also known as ENSO is a **periodic fluctuation in sea surface temperature (El Niño)** and the **air pressure of the overlying atmosphere (Southern Oscillation)** across the **equatorial Pacific Ocean**.
- **El Nino and La Nina** are complex weather patterns resulting from variations in ocean temperatures in the Equatorial Pacific Region. They are **opposite phases of what is known as the ENSO cycle**.

➤ El Nino:

- **About:**
 - El Nino is a **climate pattern that describes the unusual warming of surface waters in the eastern tropical Pacific Ocean**.
 - It is the "**warm phase**" of ENSO.
 - It occurs **more frequently than La Nina**.
- **Impact:**
 - The warmer waters **cause the Pacific jet stream to move south of its neutral position**. With this shift, **areas in the northern US and Canada are dryer and warmer than usual**. But in the US Gulf Coast and Southeast, **these periods are wetter than usual and have increased flooding**.

Note:



- As El Nino brings rain to South America, it **brings droughts to Indonesia and Australia**.
- El Niño also has a **strong effect on marine life off the Pacific coast**.
 - During normal conditions, **upwelling** brings water from the depths to the surface; this water is cold and nutrient rich.
 - During El Niño, **upwelling weakens or stops altogether**. Without the nutrients from the deep, there are fewer phytoplankton off the coast. This affects fish that eat phytoplankton and, in turn, affects everything that eats fish.
 - The warmer waters **can also bring tropical species, like yellowtail and albacore tuna**, into areas that are normally too cold.

➤ **La Nina:**

○ **About:**

- La Nina, the “**cool phase**” of ENSO, is a pattern that describes the unusual cooling of the tropical eastern Pacific.
 - La Nina events **may last between one and three years**, unlike El Nino, which usually lasts no more than a year.
 - Both phenomena tend to peak during the **Northern Hemisphere winter**.

○ **Impact:**

- Off the west coast of the Americas, **upwelling increases**, bringing cold, nutrient-rich water to the surface.
- It usually has a **positive impact on the fishing industry of western South America**.
- It can also lead to a **more severe hurricane season**.
- Causes the **jet stream** to move northward and to weaken over the eastern Pacific.
- Causes drought in the South American countries of Peru and Ecuador.
 - There are **increased temperatures in Western Pacific, Indian Ocean and off the Somalian coast**. It also leads to **heavy floods in Australia**.

Rabi Crops

Why in News

Recently, the Government of India has inaugurated

the **National Conference on Agriculture for Rabi campaign 2021-22**.

Key Points

Kharif Crops	Rabi Crops
Crops that are sown during the southwest monsoon season are called kharif or monsoon crops .	Those that are sown around the Retreating Monsoon and Northeast monsoon season , which begins by October are called rabi or winter crops .
These crops are sown at the beginning of the season around end May to early June and are harvested post the monsoon rains beginning October .	The harvest for these crops happens typically during April and May, during the summer season .
These crops depend on the rainfall patterns .	These crops are not much affected by the rainfall .
Rice, maize, pulses such as urad, moong dal and millets are among the key kharif crops.	Major Rabi crops are wheat, gram, peas, barley etc.
It requires a lot of water and hot weather to grow.	A warm climate is required for seed germination and cold climate for the growth of crops.
Zaid Crops <ul style="list-style-type: none"> ➤ Sown and harvested: March-July (between Rabi and Kharif). ➤ Important Zaid crops include: Seasonal fruits, vegetables, fodder crops etc 	

Lake Tanganyika: East Africa

Why in News

As per a report by **Save the Children** (a humanitarian organisation), **migration in East Africa's Burundi** in recent years has been seen mainly **because of the rapid and significant rise of Lake Tanganyika**.

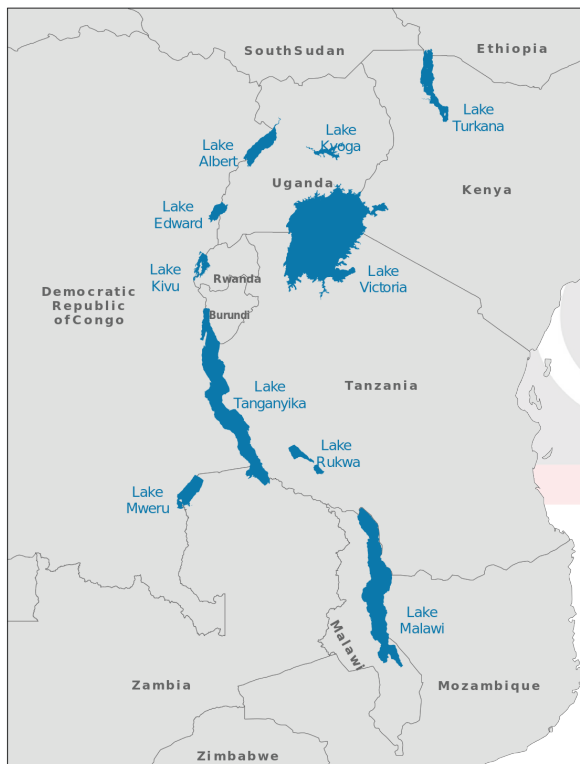
Key Points

- It is the **second largest lake in eastern Africa**. It covers about 12,700 square miles,

Note:



- It is the **longest freshwater lake in the world** and the **second deepest after Lake Baikal in Russia**.
- The lake is **shared among four countries** namely Burundi, Democratic Republic of the Congo (DRC), Tanzania and Zambia
- It is situated on the line **dividing the floral regions of eastern and western Africa**, and oil palms, which are characteristic of the flora of western Africa, grow along the lake's shores.
- The **largest rivers discharging into the lake** are the Malagarasi, the Ruzizi, and the Kalambo. Its **outlet is the Lukuga River**, which flows into the Lualaba River.
- Rice and subsistence crops are grown along the shores, and fishing is of some significance. Hippopotamuses and crocodiles abound, and the bird life is varied.



La Palma Island: Spain

Why in News

Recently, the Cumbre Vieja volcano in La Palma, one of Spain's Canary Islands, erupted.

Key Points

- **About:**



- The Cumbre Vieja volcano **erupted for the first time in 50 years**. The last time hot molten lava erupted and spread was in 1971.
- **La Palma is the most north-westerly island of the Canary Islands, Spain.**
 - Its geography is a **result of a volcanic formation** and has an area of 708 square kilometres making it the **fifth largest of the eight main Canary Islands**.
 - Its highest mountain is the **Roque de los Muchachos, at 2,423 metres being second among the peaks of the Canaries** only to the peaks of the Teide massif on Tenerife.
- The **Canary Islands are a group of ocean island volcanoes** located off the coast of western Africa that have been formed by volcanic activity since around 20 million years ago. It comprises the Spanish provinces of Las Palmas and Santa Cruz de Tenerife.

New Varieties of Turmeric

Why in News

Recently, a high-yielding curcuminoid-rich variety of turmeric named **CIM-Pitamber** and the **NBRI's (National Botanical Research Institute) Keshari variety** have been introduced in Nabarangpur (One of the **Aspirational Districts**) of Odisha.

Key Points

- **CIM-Pitamber:**

Note:



○ About:

- It is a high-yielding **curcuminoid-rich variety** of turmeric developed by **Central Institute of Medicinal and Aromatic Plants (CIMAP)**.
 - **High yielding varieties (HYV)** of seeds are those seeds which **produce huge quantities of crops** particularly wheat and rice.
 - Regular supply of water, maximum use of fertilisers and use of pesticides in an accurate proportion is needed to use these seeds.
- In this variety, **curcuminoid content is 12.5% more** than the existing variety.
 - **Curcuminoid** is a substance derived from turmeric which has anti-**cancer** properties, anti-inflammatory, anti-aging, anti-diabetic and has **several medicinal properties**.

○ Benefits:

- It can yield **50% more than the existing varieties** of turmeric and help farmers. It is also **tolerant to the leaf blotch disease of turmeric**.
- Turmeric with high **content of curcuminoid** is preferred by European nations and North America. Export and sale value will be more if curcumin content is more.

➤ Keshari variety:

- It is **tolerant to low temperature** and frost during winter. It has a **longer growth period** as compared to other varieties, which directly **reflects higher fresh rhizome yield** of high quality.
- In comparison to other existing varieties, there is **less problem of yellowing and falling of leaves** in this variety during winter, which leads to extending the life period of this variety.
- The total curcuminoid **content is around 1.16 %**, **which is also more than other existing cultivated varieties** of north India.

➤ Turmeric:

- Turmeric is a **flowering plant**, *Curcuma longa* of the **ginger family**, it is used as **condiment, dye, drug and cosmetic** in addition to its use in religious ceremonies.
- Its color comes mainly from **curcumin**, a bright **yellow phenolic compound**.
- India is a leading producer and exporter of turmeric in the world. India produces **80% of turmeric** in the world.

- **Telangana** was the leading producer of turmeric in India during 2018. **Maharashtra** and **Tamil Nadu** were second and third in the ranking that year.

- It can be **grown in diverse tropical conditions** from **sea level to 1500 m above sea level**, at a temperature range of **20-35°C** with an annual **rainfall of 1500 mm or more**, under **rainfed or irrigated conditions**.

Central Institute of Medicinal and Aromatic Plants

- It is a **frontier plant research laboratory of Council of Scientific and Industrial Research (CSIR)**, established in 1959.
- It is steering multidisciplinary high quality research in biological and chemical sciences and extending technologies and services to the farmers and entrepreneurs of medicinal and aromatic plants (MAPs).
- It is **headquartered in Lucknow**.

National Botanical Research Institute

- It is **one of the constituent research institutes of the CSIR set up in 1953**. It is **headquartered in Lucknow**.
- It undertakes **basic and applied research on various aspects of plant science**, including documentation, systematics, conservation, prospection, and genetic improvement.

Detoxification of Lukha River: Meghalaya

Why in News

Recently, the Meghalaya Government has claimed that a **detoxing pilot project** has brought the **Lukha river back** from the dead.

Key Points

➤ About:

- The Lukha River was considered toxic beyond redemption a decade ago owing to **contamination due to acid mine drainage and run-off from the coal mines**.
- **Phytoremediation method** was used to detoxify the river, where **Algae** was used to remove major toxic contents from the water.

➤ Lukha River:

Note:



- The Lukha is located in the southern part of **east Jaintia Hills** of Meghalaya where most of Meghalaya's **rat-hole coal mines** are located.
 - It has become a victim of the unsustainable large-scale mining of coal and limestone, allegedly responsible for the pollution that turns the river its surreal winter hue.
- It **receives water from the Lunar river** (Wah Lunar) and small streams draining from the **Narpuh Reserve Forest** and the undulating hills of the area while flowing down.
- The river is mainly fed by monsoon rain and flows in the south-west direction and later takes a southern path after **joining the Lunar river near the Gaddum village**.
- The river passes via the Sonapur village and then **into southern Assam's Barak Valley and ends up in the floodplains of Bangladesh**.

Water Level in Mullaperiyar Dam

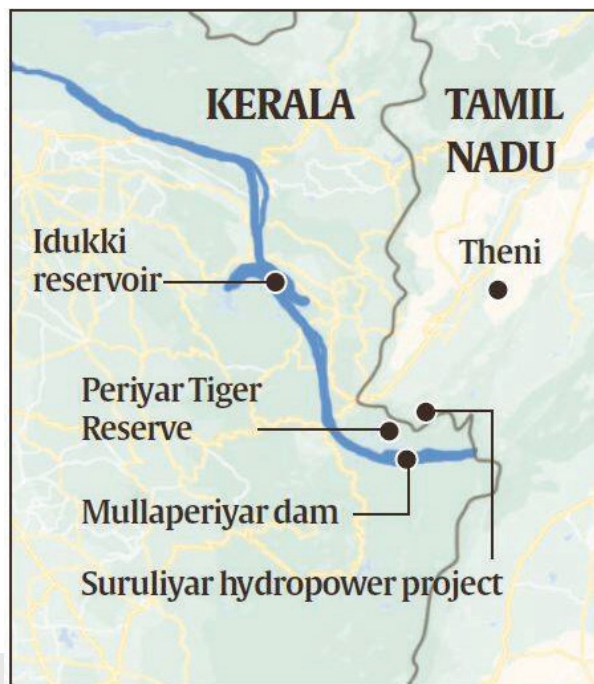
Why in News

Recently, the **Supreme Court** has **directed the Supervisory Committee** to take an immediate and firm decision on the **maximum water level** that can be maintained at **Mullaperiyar dam** amidst torrential rains in Kerala.

- The **Ministry of Jal Shakti** has constituted a **three-member Supervisory Committee** to settle the issue of Mullaperiyar dam between Kerala and Tamil Nadu.

Key Points

- **About:**
 - **Centre of a Decades-old Dispute:**
 - For Kerala, where it is situated, the dam presents a **threat to lakhs living downstream**,
 - For Tamil Nadu, which controls the dam, the water it provides is the **lifeline of people in five districts**.
 - **Reasons for Recent Revival of the Dispute:**
 - Recently, **heavy rains have increased water flow** in Mullaperiyar dam. The excess water from Mullaperiyar **can flow to downstream Idukki reservoir**, which can lead to floods.



- The **SC in 2018** had agreed that the **water level in the Mullaperiyar reservoir** should be maintained **two or three feet below the permissible limit of 142 feet** as an immediate precaution to guard against floods or other disasters.

➤ Mullaperiyar Dam:

- It is located on the **confluence of the Mullayar and Periyar rivers** in Kerala's Idukki district.
 - The reservoir is **within the Periyar Tiger Reserve**.
- It is **operated and maintained by Tamil Nadu** for meeting the drinking water and irrigation requirements of five of its southern districts.
 - According to a 999-year lease agreement made during British rule the operational rights were handed over to Tamil Nadu.
- The water diverted from the reservoir is first used for **power generation in lower Periyar (by Tamil Nadu)** before **flowing into the Suruliya**, a tributary of **Vaigai river**, and then for irrigating nearly **2.08 lakh hectares** in Theni and four other districts farther away.

Periyar River

- The Periyar River is the **longest river in the state of Kerala** with a length of 244 km.
- It is also known as '**Lifeline of Kerala**' as it is one of the few perennial rivers in the state.

Note:



- Periyar River originates from Sivagiri hills of **Western Ghats**, in Tamil Nadu and flows through the Periyar National Park.
- The main tributaries of Periyar are Muthirapuzha, Mullayar, Cheruthoni, Perinjankutti.

Idukki Dam

- It is located in Kerala (168.91 m). The dam stands between the two mountains – Kuravanmala (839 m) and Kurathimala (925 m).
- It is one of the highest arch dams in Asia and third tallest arch dam.
- It is built on the Periyar River, in the ravine between the Kuravan and Kurathi Hills in Kerala.
- It was constructed and is owned by the Kerala State Electricity Board. It supports a 780 MW hydroelectric power station.

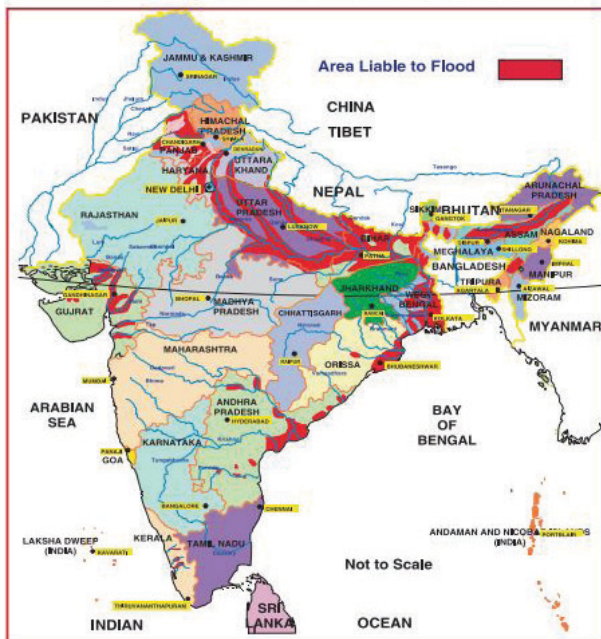
Flood Plain Zoning

Why in News

Recently, a **Comptroller and Auditor General of India (CAG)** report on preparedness and response to floods was presented in the Kerala assembly.

- The report was prepared against the backdrop of the devastating Kerala floods of 2018.

AREA LIABLE TO FLOODS



Key Points

➤ About:

- **Concept:** The basic concept of flood plain zoning is to regulate land use in the flood plains to restrict the damage caused by floods.
- **Determining Developmental Activities:** It aims at determining the locations and the extent of areas for developmental activities in such a fashion that the damage is reduced to a minimum.
- **Adds Limitations:** It envisages laying down limitations on development of both the unprotected as well as protected areas.
 - In the **unprotected areas**, boundaries of areas in which developmental activities will be banned, are to be established to prevent indiscriminate growth.
 - In the **protected areas**, only such developmental activities can be allowed, which will not involve heavy damage in case the protective measures fail.
- **Utility:** Zoning cannot remedy existing situations, although, it will definitely help in minimising flood damage in new developments.
- Flood plain zoning is not only necessary in the case of floods by rivers but it is **also useful in reducing the damage caused by drainage congestion particularly in urban areas.**

➤ Model Bill for Flood Plain Zoning:

- **About:** The Bill provides clauses about flood zoning authorities, surveys and delineation of flood plain area, notification of limits of flood plains, prohibition of the use of the flood plains, compensation and most importantly removing obstructions to ensure free flow of water.
- It will seek to replace dwellings in low-lying areas by parks and playgrounds as absence of human settlement in those areas would cut down loss of lives and property.
- **Challenges in Implementation:**
 - There has been **resistance on the part of the states** to follow-up the various aspects of floodplain management including possible legislation.
 - The reluctance of the states is **mainly due to population pressure and want of alternative livelihood systems.**

Note:



- The lukewarm response of the states towards the enactment and enforcement of the floodplain regulations has fuelled a **significant increase in the encroachments into the flood plains**, sometimes authorised and duly approved by the town planning authorities.

➤ **Related Constitutional Provisions and Other Measures:**

- Based on the inclusion of **drainage and embankments as entry 17 of List II (State List)**, flood control has been seen to fall under the purview of the state government, except in the case of “**regulation and development of inter-state rivers and river valleys**,” which is mentioned in **entry 56 of List I (Union List)**.
 - **Floodplain zoning** is firmly **within the state government’s ambit** as it deals with the land along the riverbanks and **land is a state subject under entry 18 of List II**.
 - The central government’s role can only be to issue advisories and prescribe guidelines.
- Flood control and mitigation are **not directly mentioned** in any of the three legislative lists included in the **seventh schedule** Constitution.
- The **National Disaster Management Authority (NDMA)** in 2008 has issued guidelines for states for floodplain zoning as an important “non-structural measure” to mitigate floods.
 - It suggested that **areas likely to be affected by floods in a frequency of 10 years should be reserved for green areas** like parks, gardens and others while concrete structures should not be allowed there.
 - It also talked about other zones in the floodplain like in areas of flooding in a 25-year frequency and asked states to make plans accordingly in those areas.

Leonids Meteor Shower

Why in News

The **annual Leonids Meteor Shower** has begun and will be active between **6th and 30th November**, with peak activity expected on **17th November**.

Key Points

- **Meteor:** It is a **space rock or meteoroid** that enters Earth’s atmosphere.

- **Meteoroids are objects in space** that range in size from dust grains to small asteroids.
 - Most are pieces of other, larger bodies that have been broken or blasted off. These come from **comets, asteroids**, planets and the Moon.
- When **meteoroids enter Earth’s atmosphere** (or that of another planet, like Mars) at high speed and burn up, the **fireballs or “shooting stars”** are called meteors.
 - **Fireballs are larger explosions of light and color** that can persist longer than an average meteor streak. This is due to the fact that fireballs originate from larger particles of cometary material.
- **When a meteoroid** survives its journey through the atmosphere and **hits the ground, it’s called a meteorite**.

➤ **Meteor Shower:**

- When **Earth encounters many meteoroids at once**, it is called a meteor shower.
 - Comets, like Earth and the other planets, also orbit the sun. Unlike the nearly circular orbits of the planets, the **orbits of comets are usually quite lop-sided**.
 - As a **comet gets closer to the sun**, some of its icy surface boils off, releasing lots of particles of dust and rock (meteoroids).
 - This comet debris gets scattered along the comet’s path, **especially in the inner solar system** (including planets Mercury, Venus, Earth and Mars).
 - Then, several times each year as **Earth** makes its journey around the sun, **its orbit crosses the orbit of a comet**, which means Earth encounters a bunch of comet debris.
- Meteor showers are **named for the constellation where the meteors appear to be coming from**. So, for example, the Orionids Meteor Shower, which occurs in October each year, appears to be originating near the constellation ‘**Orion the Hunter**’.

➤ **Leonids Shower:**

- The debris that forms this meteor shower **originates from a small comet called 55P/Tempel-Tuttle in the constellation Leo**, which takes 33 years to orbit the sun.

Note:



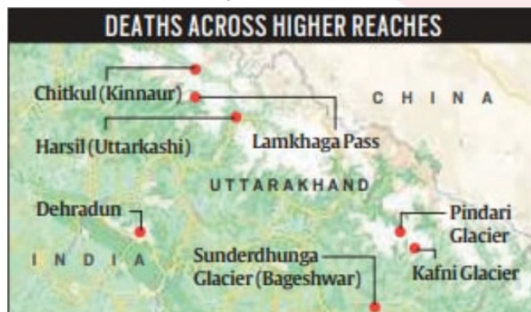
- The Leonids are **considered to be a major shower** that features the fastest meteors which typically travel at speeds of 71 km per second, although the rates are often as low as 15 meteors per hour.
- The Leonids are **also called fireballs and earthgrazer meteors**.
 - Fireballs, because of their bright colours, and earthgrazer, because they streak close to the horizon.
- A **Leonid shower turns into a meteor storm every 33 years** and when it happens hundreds to thousands of meteors can be seen every hour. The **last Leonid meteor storm took place in 2002**.
 - A **meteor storm** should have at least 1,000 meteors per hour.

Weather Forecasting

Why in News

Recently, **21 trekkers died at the Lamkhaga Pass trek in four mountaineering and trekking expeditions** which once again puts the spotlight on the importance of right **weather forecasting**.

- Lamkhaga Pass is a **high altitude pass in Garhwal Himalayas (Uttarakhand) which connects with Sangla in Himachal Pradesh**. Due to its altitude and remoteness, it is considered **one of the toughest treks in the Himalayas (Uttarakhand)**.



Key Points

- **Weather Forecasting:**
 - It is the **prediction of the weather through application of the principles of physics**, supplemented by a variety of statistical and empirical techniques.
 - In addition to predictions of atmospheric phenomena themselves, weather forecasting **includes predictions of changes on Earth's surface caused**

by atmospheric conditions - e.g., snow and ice cover, storm tides, and floods.

➤ Weather Forecasting Methods:

- Weather forecasters rely on a massive chunk of data to design computer models and simulations that help predict an incoming change in the weather.
- **India Meteorological Department (IMD)** uses the **INSAT series of satellites** hovering in the **geosynchronous orbit** along with the **Real-Time Analysis of Products and Information Dissemination (RAPID)**, a weather data explorer application, that acts as a gateway and provides quick interactive visualisation along with 4-Dimensional analysis capabilities.
- The forecasters use **data generated by the satellites** around cloud motion, cloud top temperature, water vapour content that help in rainfall estimation, weather forecasting, and provide the genesis of **cyclones** and their direction.
- Apart from tracking satellite data, **IMD collaborates with ISRO for ground-based observations** from the **Automatic Weather Stations (AWS)**, the Global Telecommunication System (GTS) that measure temperature, sunshine, wind direction, speed and humidity.
 - Meanwhile, the Agro-meteorological Tower (AGROMET) and **Doppler Weather Radar (DWR) systems** augment the observations.
- **In 2021, IMD adopted a new strategy** for issuing monthly and seasonal operational forecasts for the southwest monsoon rainfall by modifying the existing two-stage forecasting strategy.
 - The new strategy is **based on the existing statistical forecasting system and the newly developed Multi-Model Ensemble (MME)-based forecasting system**.
 - The MME approach uses the coupled global climate models (CGCMs) from different global climate prediction and research centres, including IMD's Monsoon Mission Climate Forecasting System (MMCFS) model.
- All these technological strides have been possible **since the National Monsoon Mission (NMM) was initiated in 2012** with a budgetary allocation of Rs 551 crore and the broad objective to set up a dynamical prediction system for seasonal forecast and to improve the monsoon forecasting skills in the country.

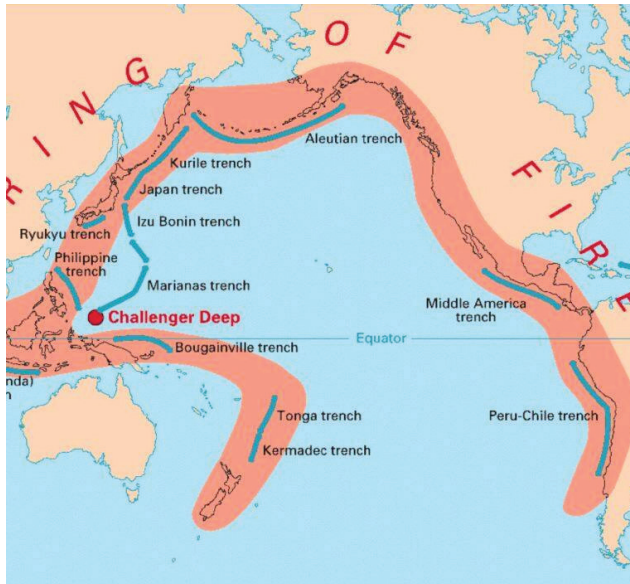
Note:



Pacific Ring of Fire

Why in News

The Pacific 'Ring of fire' is situated just over 60 kilometers from the island nation of Tonga, where recently **Hunga Tonga-Hunga Ha'apai volcano** erupted sending ash and smoke thousands of feet into the air.



Key Points

➤ About:

- Also called Pacific rim or the Circum-Pacific Belt, is an area along the Pacific Ocean that is characterized by active volcanoes and frequent earthquakes.
- It is home to about 75% of the world's volcanoes – more than 450 volcanoes. Also, about 90% of the world's earthquakes occur here.

➤ Geographical Stretch:

- The Ring of Fire is stretched to approximately 40,000 kilometers tracing boundaries **between several tectonic plates including the Pacific, Juan de Fuca, Cocos, Indian-Australian, Nazca, North American, and Philippine Plates.**
- The chain runs up **along the western coast of South and North America, crosses over the Aleutian Islands in Alaska**, runs down the eastern coast of Asia past New Zealand and into the northern coast of Antarctica.
- Bolivia, Chile, Ecuador, Peru, Costa Rica, Guatemala, Mexico, United States, Canada, Russia, Japan,

Philippines, Australia, Papua New Guinea, Indonesia, New Zealand, and Antarctica **are some of the important places located in the ring of the fire.**

➤ Causes of Volcanic Activity:

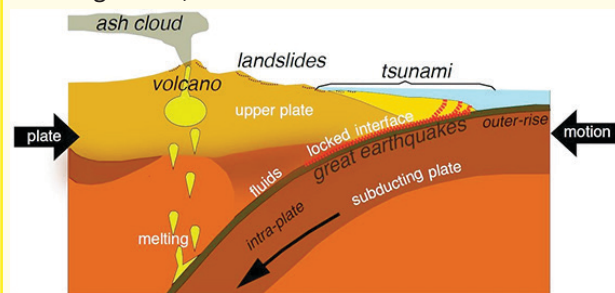
- Tectonic plates move towards each other **creating subduction zones**. One plate gets pushed down or is subducted by the other plate. This is a very slow process – **a movement of just one or two inches per year.**
- As this subduction happens, **rocks melt, become magma and move to Earth's surface and cause volcanic activity.**
 - In the case of Tonga, the Pacific Plate was pushed down below the Indo-Australian Plate and Tonga plate, causing the **molten rock to rise above and form the chain of volcanoes.**

➤ Recent Research:

- The Pacific Plate, which drives much of the tectonic activity in the **Ring of Fire, is cooling off.**
- Scientists have discovered that the **youngest parts of the Pacific Plate (about 2 million years old) are cooling off** and contracting at a faster rate than older parts of the plate (about 100 million years old).
- The younger parts of the plate **are found in its northern and western parts**; the most active parts of the Ring of Fire.

Subduction

- Subduction happens **when tectonic plates shift, and one plate is pushed under another. This movement of the ocean floor produces a "mineral transmutation", which leads to the melting and solidification of magma i.e., the formation of volcanoes.**



- In other words, when a **"downgoing" oceanic plate is pushed into a hotter mantle plate, it heats up, volatile elements mix**, and this produces the magma. The magma then rises up through the overlying plate and spurts out at the surface.

Note:



- A subduction zone is **the biggest crash scene on Earth**. These boundaries mark the collision between two tectonic plates.
- When two tectonic plates meet at a subduction zone, one bends and slides underneath the other, curving down into the mantle, the hotter layer under the crust.

Indonesia Relocating its Capital

Why in News

Recently, **Indonesia's parliament** has passed a law approving the **relocation of its capital from slowly sinking Jakarta** to a site 2,000 kilometres away on jungle-clad Borneo island that will be named **"Nusantara"**.

- The move was first tipped by President Joko Widodo in April 2019, citing rising **sea levels and severe congestion** on densely populated Java island.
- Jakarta lies on the northwest coast of Java. The largest islands in Indonesia are Sumatra, Java, Kalimantan (Indonesian Borneo), Sulawesi, and the Indonesian part of New Guinea (known as Papua or Irian Jaya).



Key Points

- **Reasons for Relocation:**
 - Jakarta has long been **plagued by serious infrastructure problems and flooding** exacerbated by **climate change**, with experts predicting up to a third of the city **could be underwater by 2050**.
 - Jakarta is home to more than 30 million people in its greater metro area.
 - Moreover, Jakarta is the **centre for administration, governance, finance and trade**, it has inevitably led

to relentless construction in the city, due to which the water is not able to seep into the ground in many areas, leading to increased run-off.

- Jakarta has been Indonesia's capital since the country became independent in 1949. The city has become **overcrowded and extremely polluted** for the last few decades.
- Another important reason to shift the capital from Java island to Borneo island has been the **growing inequality – financial and otherwise**.
 - Java Island, especially Jakarta which is spread across more than 661.5 square kilometres, is immensely populated whereas East Kalimantan, spread across 127,346.92 square kilometres, is bigger than Jakarta, it is a lot less populated than the current capital.
- **Relocation Site:**
 - The new capital (Nusantara) will cover about **56,180 hectares in East Kalimantan province** on the Indonesian part of Borneo, which the country shares with Malaysia and Brunei.
 - However, environmentalist critics of the capital's move have warned it could **damage ecosystems in the region**, where mining and palm oil plantations already threaten **rainforests** that are home to Borneo's endangered species.

Note:

- Indonesia is **not the first country in the region** to relocate from an overpopulated capital.
- Malaysia moved its government to Putrajaya from Kuala Lumpur in 2003, while Myanmar moved its capital to Naypyidaw from Rangoon in 2006.

Unusually Colder and Wetter Winter

Why in News

In India, especially in North India, the winter of 2021-22 has been unusually cold and unusually long. The days, in particular, have **felt colder and chillier than normal**.

Key Points

- **About:**
 - **Colder:**

Note:



- Since December 2021, maximum temperatures across the North, Northwest and Central India regions have persistently remained below normal, resulting in “cold day” conditions. Technically, this means more than just a day that is cold.
 - A cold day is one in which **the maximum temperature falls below 16 degrees Celsius**, a phenomenon that is commonly seen during the winter months in the northern plains of India.
- **Wetter:**
 - Light to moderate intensity rainfall is also commonly seen during winters in neighboring regions of North India.
 - This January, however, has seen **widespread rain across the central, northwestern, northern, eastern, and northeastern** regions of India.
 - As many as 24 states or Union Territories have recorded **rainfall varying from excess to large excess this month**.
- **Less Fog than Normal:**
 - December and January are known for the formation of dense fog across North India.
 - In January 2022, the national capital remained affected by fog for 252 hours against a normal of 292 hours.
 - IMD officials said the ongoing winter has recorded the **lowest fog hours since 1991-92 over Delhi**.
- **Causes:**
 - **Western Disturbances:**
 - Until 25th January 2022, **seven western disturbances had passed over India** — nearly all of them **strong enough to cause widespread rain, snowfall, and turbulent weather across large geographical areas** between Pakistan and Northeast India.
 - These systems caused hailstorms in northern Maharashtra, and heavy rainfall in Tamil Nadu.
 - **La Niña:**
 - Frequent and higher numbers of **western disturbances are associated with La Niña**.
 - **At present, moderate intensity La Niña conditions** — which manifests itself as cooler than normal sea surface temperatures in the equatorial Pacific Ocean — are prevailing.
 - **Cold Winds from Far North:**

- After a western disturbance crosses India, **cold winds from the far north of the country penetrate to lower latitudes**, and can reach up to even Telangana and Maharashtra, leading to colder weather, and sometimes to cold wave conditions.
- **Low-lying Clouds and Moisture:**
 - The presence of low-lying clouds and the availability of moisture along the Indo-Gangetic plains made it favorable for cold day conditions and the additional chill factor experienced during the day time.
 - This was the longest and most intense spell of the season so far.

Western Disturbance

- **Western Disturbance (WD)**, labeled as an **extra-tropical storm** originating in the Mediterranean, is **an area of low pressure that brings sudden showers, snow and fog** in northwest India.
- The disturbance **travels from the “western” to the eastern direction**.
 - These travel **eastwards on high-altitude westerly jet streams** - massive ribbons of fast winds traversing the earth from west to east.
- **Disturbance means** an area of “disturbed” or reduced air pressure.
 - Equilibrium exists in nature due to which the air in a region tries to normalise its pressure.
- In the term “extra-tropical storm”, storm refers to low pressure. “Extra-tropical” means outside the tropics. As the WD originates outside the tropical region, the word “extra-tropical” has been associated with them.

Warming of High Altitude Himalayas

Why in News?

According to a recent study, **water vapour exhibits a positive radiative effect** at the **Top of the Atmosphere (TOA)**, suggesting an increase in overall warming in the **High Altitude Himalayas** due to it.

What is Water Vapour?

- **About:**

Note:



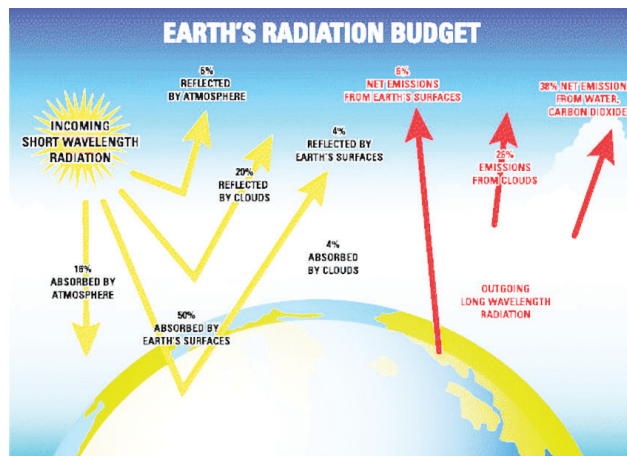
- Water vapour is the **state of water** when it is in the hydrosphere.
- It can be achieved by water evaporation or boiling of water or by sublimation of ice. Water vapour is the most dominant of greenhouse gases.
- In fact, **95% of greenhouse gases** are water vapour. Increased levels of carbon dioxide increase water vapour, which leads to warmer temperatures.

➤ **Significance:**

- Water vapour plays a **dominant role in the radiative balance and the hydrological cycle**.
- It is a **principal element in the thermodynamics of the atmosphere**, it transports latent heat, it contributes to absorption and emission in a number of bands and **it condenses into clouds that reflect and absorb solar radiation**, thus **directly affecting the energy balance**.

What Does the Recent Research Say?

- It shows the **atmospheric radiative effect** due to **Precipitable Water Vapour (PWV)** is about 3-4 times higher compared to aerosols, resulting in atmospheric heating rates of 0.94 and 0.96 K Day⁻¹ (K=Kelvin) at Nainital and Hanle, respectively.
- **Radiative forcing or effect** is the **change in energy flux in the atmosphere caused by natural or anthropogenic factors** of climate change as measured by watts / metre². It is a scientific concept used to quantify and compare the external drivers of change to Earth's energy balance.
- The results **highlight the importance of PWV and aerosol radiative effects** in the climate-sensitive Himalayan region.
- The **researchers assessed the combination of aerosols and water vapour** radiative effects over the Himalayan range that is **specifically important for regional climate and highlighted the importance of water vapour** as a key **greenhouse gas** and climate forcing agent over the Himalayan region.
- The study **will provide a comprehensive investigation** of the combined impact of aerosols and water vapour on the **radiation budget**.
 - The **Earth radiation budget (ERB)** is a combination of the broadband fluxes of solar radiation reflected by Earth and the fluxes of longwave radiation absorbed and emitted by Earth and its atmosphere.



What is Precipitable Water Vapour?

- It is one of the **most rapidly varying components** in the atmosphere and is mainly **accumulated in the lower troposphere**.
 - **Troposphere:** The troposphere is the **lowest layer of Earth's atmosphere** and most of the mass (about 75-80%) of the atmosphere is in the troposphere. **Most types of clouds are found** in the troposphere, and almost all weather occurs within this layer.
- It is **equivalent to the depth of liquid water** that would result if all the water vapor in the atmospheric column is condensed and precipitated, and is used to diagnose the atmospheric humidity over a specific location.

What about the Himalayas?

- **About:**
 - The Himalayas are the **highest and the youngest fold mountain ranges** of the world.
 - Their geological structure is **young, weak and flexible** since the Himalayan uplift is an ongoing process, making them one of the highest earthquake-prone regions of the world.
 - It separates India, along its **north-central and northeastern frontier**, from China (Tibet).
- **Area:**
 - The **Indian part of Himalayas** covers an area about 5 lakh km² (about 16.2% of the country's total geographical area) and forms the northern boundary of the country.
 - The region is **responsible for providing water to a large part of the Indian subcontinent**. Many rivers considered holy like the **Ganga and Yamuna** flow from the Himalayas.

Note:



➤ Ranges:

- The Himalayas are a **series of parallel mountain ranges** extending along the North-West to the South-East direction (known as the Strike of the Himalayas). These ranges are separated by longitudinal valleys. They include,
 - Trans-Himalayas
 - The Greater Himalayas or Himadri
 - The Lesser Himalayas or Himachal
 - Shiwaliks or the Outer Himalayas
 - The Eastern Hills or Purvanchal



Coastal Vulnerability Index

Why in News?

Recently, the **Indian National Centre for Ocean Information Services (INCOIS)** has carried out a coastal vulnerability assessment for the entire Indian coast at States level.

- The assessment has been conducted to bring out an **Atlas comprising 156 maps on 1:1,00,000 scales** to prepare a **Coastal Vulnerability Index (CVI)**.

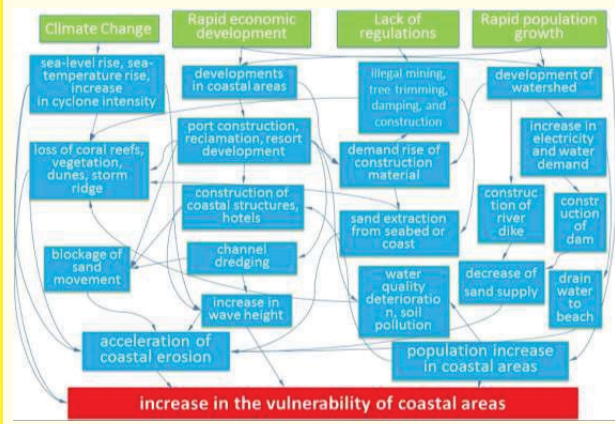
What is the Coastal Vulnerability Index?

- The maps will **determine the coastal risks due to future sea-level rise** based on the physical and geological parameters for the Indian coast.
- The CVI **uses the relative risk that physical changes will occur as sea-level rises are quantified based on parameters like:**
 - Tidal range
 - Wave height
 - Coastal slope
 - Coastal elevation
 - Shoreline change rate

- Geomorphology
- Historical rate of relative sea-level change.

What is Coastal Vulnerability?

- Coastal vulnerability is a **spatial concept that identifies people and places that are susceptible to disturbances** resulting from coastal hazards.
- Hazards in the coastal environment, **such as coastal storms, sea level rise and erosion**, pose significant threats to coastal physical, economic, and social systems.



What is a Coastal Multi-Hazard Vulnerability Mapping?

- A coastal Multi-Hazard Vulnerability Mapping (MHVM) was also **carried out using above mentioned parameters**.
- These **parameters were synthesised to derive the composite hazard zones** that can be inundated along the coastal low-lying areas due to extreme flooding events.
- This MHVM mapping was carried for the entire mainland of India on a **1:25000 scale**.

What is the Significance of CVI?

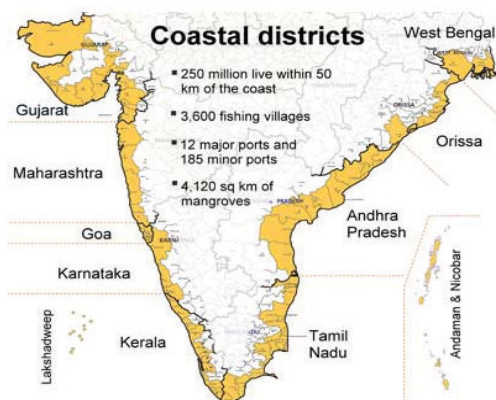
- Coastal vulnerability assessments can be **useful information for coastal disaster management and building resilient coastal communities**.
 - India has a coastline of 7516.6 Km i.e. 6100 km of mainland coastline plus coastline of 1197 Indian islands touching 13 States and Union Territories (UTs).

What is INCOIS?

- INCOIS is an **autonomous organisation under the Ministry of Earth Sciences (MoES)**.

Note:





- It is **located in Hyderabad & was established in 1999**. It is a unit of the Earth System Science Organisation (ESSO), New Delhi.
 - The ESSO operates as an executive arm of the Ministry of Earth Sciences (MoES) for its policies and programmes.
- It is **mandated to provide the best possible ocean information and advisory services** to society, industry, government agencies and the scientific community through sustained ocean observations and constant improvement through systematic and focused research.

Bomb Cyclone

Why in News?

Recently, 'Bomb cyclone' hits eastern US, which triggers transport chaos, outages.

What is a Bomb Cyclone?

- **About:**
 - A bomb cyclone is a **large, intense midlatitude storm** that has low pressure at its center, weather fronts and an array of associated weather, from blizzards to severe thunderstorms to heavy precipitation.
 - Bomb cyclones put forecasters on high alert, because they can **produce significant harmful impacts**.
- **Reasons for the Formation:**
 - This can happen when a cold air mass collides with a warm air mass, such as air over warm ocean waters. The formation of this rapidly strengthening weather system is a process called **bombogenesis**.
 - It occurs when a midlatitude cyclone rapidly intensifies, dropping at least 24 millibars over 24 hours.
 - A millibar measures atmospheric pressure.

How does a Bomb

Cyclone differ from a Hurricane?

- **Hurricanes** tend to form in **tropical areas and are powered by warm seas**. For this reason, they're most **common in summer or early fall**, when seawater is warmest.
- **Bomb cyclones** generally **occur during colder months** because cyclones occur due to cold and warm air meeting. During the summer, there's generally not much cold air across the atmosphere; this means a bomb cyclone is much less likely to occur.
- Hurricanes form in tropical waters, while bomb cyclones form over the northwestern Atlantic, northwestern Pacific and sometimes the Mediterranean Sea.

Tectonic Evolution of Greater Maldivé Ridge

Why in News?

In a recent study, an Indian researcher **traced the tectonic evolution** and the nature of the Greater Maldivé Ridge (GMR).

- It is a **very crucial geodynamic feature in the western Indian Ocean** whose origin has been the centre of many a scientific debate.
- The study was conducted by the **Indian Institute of Geomagnetism**, Mumbai, an autonomous institute of the **Department of Science & Technology**, Govt. of India.

What is a Tectonic Plate?

- A tectonic plate (also called lithospheric plate) is a **massive, irregularly-shaped slab of solid rock, generally composed of both continental and oceanic lithosphere**.
- The lithosphere **includes the crust and top mantle** with its thickness range varying between 5-100 km in oceanic parts and about 200 km in the continental areas.
- The concept of Tectonic Plates was **first introduced in 1967**.
- A tectonic plate may be a continental plate or an oceanic plate, depending on which of the two occupies the larger portion of the plate.
 - The **Pacific plate is largely an oceanic plate** whereas the **Eurasian plate is a continental plate**.

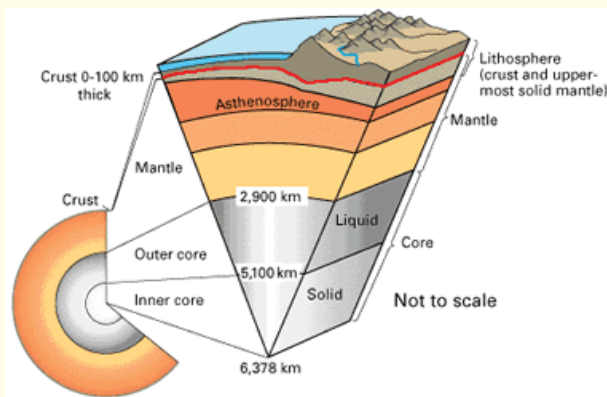
- The **tectonic plates are not fixed but constantly move horizontally over the Asthenosphere** as rigid units.
 - Sometimes these plates collide, move apart, or slide next to each other which leads to Earthquakes or Volcanic Eruptions.

What is a Mid-Ocean Ridge?

- A mid-ocean ridge or mid-oceanic ridge is an **underwater mountain range**, formed by plate tectonics.

What is the Mohorovičić Discontinuity?

- The Mohorovicic Discontinuity, or “Moho,” is the **boundary between the crust and the mantle**. The red line in the diagram shows its location.
- In geology the word “**discontinuity**” is used for a **surface at which seismic waves change velocity**.
- One of these surfaces exists at an average depth of **8 kilometres beneath the ocean basin** and at an average depth of about **32 kilometres beneath the continents**.



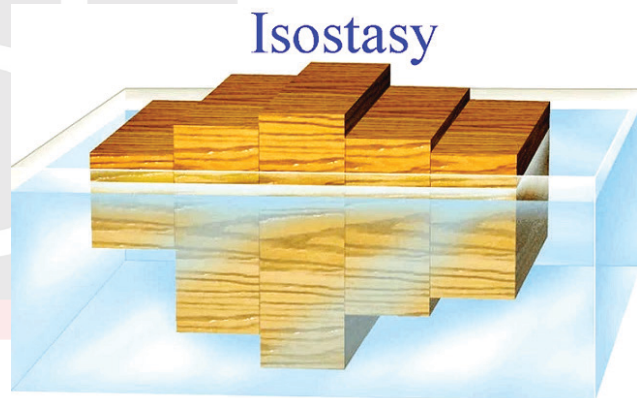
- At this discontinuity, **seismic waves accelerate**. This surface is known as the Mohorovicic Discontinuity or often simply referred to as the “Moho.”
- The Mohorovicic Discontinuity was **discovered in 1909 by Andrija Mohorovicic**, a Croatian seismologist.

What is the Greater Maldivé Ridge?

- The Maldivé Ridge is an **aseismic ridge that is not associated with earthquake activities**. This ridge, located in the western Indian Ocean, southwest of India, is not well investigated.
- It is of **paramount importance to gain knowledge on the structure and geodynamics** of aseismic ridges (as it provides valuable inputs towards understanding the evolution of ocean basins).

What is the Study About?

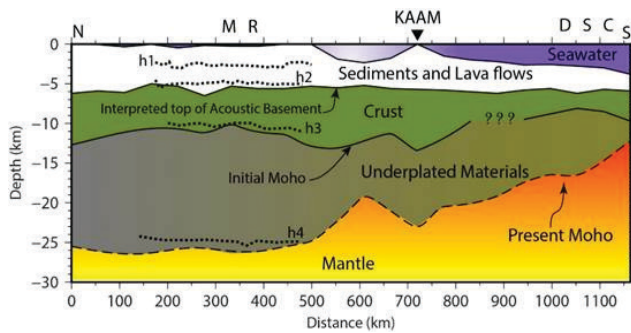
- It has **chalked the possible geological cross-sections along the GMR for the first time** with the help of satellite-derived high-resolution gravity data.
 - Satellite-derived gravity anomalies are very **helpful in deciphering the crustal architecture** where traditional shipborne geophysical data are either not available or scanty.
- The researchers postulated that the **GMR may be underlain by an oceanic crust**.
- It **provides the crustal architecture and the state of gravitational equilibrium** between Earth's crust and mantle (**isostasy**) of the Greater Maldivé Ridge segment of the larger Chagos-Laccadive Ridge (CLR) system.
 - **Isostasy** is the **rising or settling of a portion of the Earth's lithosphere** that occurs **when weight is removed or added in order to maintain equilibrium** between buoyancy forces that push the lithosphere upward and gravity forces that pull the lithosphere downward.



- Their study, **based mainly on the interpretation of gravity anomalies** (small differences in the pull of gravity caused by the lateral variations of density within the subsurface) with broadband seismic and refraction seismic data, **provided for the first time a three-dimensional picture of the variation of Moho** along the Greater Maldivé Ridge and the adjoining ocean basins.
- The depth to the boundary between the earth's crust and the mantle or the **Mohorovicic discontinuity (Moho)** over the GMR was systematically mapped along with the finer variation of effective elastic thickness (T_e) at the place.
- The study found that **Moho is deeper over the MR segment and shallows southwards in the Deep Sea Channel region (DSC)**.

Note:





What is the Significance of the Study?

- The study can help reconstruct the original Gondwanaland break up and dispersal that led to present-day configuration of continents, continental fragments, and formation of ocean basins in the Indian Ocean.
- The results from their study can provide additional constraints in understanding the plate-tectonic evolution of the Indian Ocean, better.



Note:



Key Points

Details

[illegible]

Summary

Key Points

Details

Summary

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