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29 May, 2024

Onset of Monsoon

Context: *IMD forecasts normal progress of southwest monsoon, expected to reach Kerala coast within five days.*

- **Definition of Monsoon Onset:**
  - The monsoon onset over Kerala marks the commencement of the four-month southwest monsoon season in India, responsible for over 70% of the country's annual rainfall.
  - It holds significant economic importance in India.
- **IMD Criteria for Monsoon Onset:**
  - The IMD identifies specific parameters, adopted in 2016, to declare the monsoon onset.
  - Specific parameters regarding rainfall, wind speed, and temperature are considered for the declaration.
- **Rainfall Criteria:**
  - Monsoon onset occurs when at least 60% of 14 designated meteorological stations in Kerala and Lakshadweep report a minimum of 2.5 mm of rain for two consecutive days post-May 10.
  - If specific wind and temperature criteria are met, the onset is declared on the second day.
- **Wind Field Criteria:**
  - The depth of westerlies, spanning from the equator to 10ºN latitude and between 55ºE to 80ºE longitude, should extend up to 600 hectopascal (hPa).
  - Zonal wind speed between 5-10ºN latitude and 70-80ºE longitude should range from 15-20 knots (28-37 kph) at 925 hPa.
- **Heat Criteria:**
  - The Outgoing Longwave Radiation (OLR) value, determined from INSAT data, should be below 200 watt per sq.m. (wm2) within the region bound by 5ºN and 10ºN latitudes and 70ºE and 75ºE longitudes.
- **Factors Influencing South-West Monsoon:**
  - **Differential Heating and Cooling:** Land heating and sea cooling lead to low pressure over India and high pressure over surrounding seas.
  - **Inter Tropical Convergence Zone (ITCZ) Shift:** The ITCZ moves northward over the Ganga plain during summer, acting as the monsoon-trough.
  - **High-Pressure Area East of Madagascar:** The position and intensity of this high-pressure area impact the Indian Monsoon.
  - **Tibetan Plateau Heating:** Intense heating of the Tibetan plateau creates low pressure at high altitudes, influencing monsoon dynamics.
  - **Jet Stream Movement:** The westerly jet stream moves north of the Himalayas, while the tropical easterly jet stream forms over the Indian peninsula during summer, affecting monsoon patterns.
- **Southern Oscillation (SO):**
  - SO involves shifts in wind and sea surface temperature between the tropical eastern Pacific Ocean and the Indian Ocean.
  - La Nina (cooling phase) generally has a positive impact on the Indian Monsoon, while El Nino (warming phase) has the opposite effect.
- **Indian Ocean Dipole (IOD):**
  - IOD refers to temperature differences between the eastern (Bay of Bengal) and western (Arabian Sea) Indian Ocean.
  - A positive IOD brings more rainfall to India, while a negative IOD has a negative impact.

Polar Radiant Energy in the Far-InfraRed Experiment

Context: *A climate satellite, the first of a pair intended for studying heat emissions at Earth's poles, was successfully launched.*

- **Satellite Details:**
  - **Developed by:** NASA and the University of Wisconsin-Madison.
  - **Launch Service:** Provided by NASA.
  - **Objective:** Measure far-infrared (IR) radiation from Earth's poles.
  - **Mission:** Gather data on heat emissions from the Arctic and Antarctica and their impact on global climate.
- **Satellite Specifications:**
  - Consists of two shoebox-size CubeSats along with the spectrometer TIRS.
  - Each satellite is a 6U CubeSat, measuring approximately 90 cm in height and nearly 120 cm in width.
  - Features Thermal Infrared Spectrometer (TIRS) with specially shaped mirrors and detectors for measuring IR light.
- **Placement:**
  - Satellites will be placed in a near-polar orbit at an altitude of about 525 km.
- **Significance:**
  - Helps understand Earth's heat balance and energy budget.
  - Provides insights into how Polar Regions influence Earth's energy absorption and release.
  - Data aids in predicting changes in weather, sea ice loss, ice sheet melt, and sea level rise.
  - Crucial information for farmers, fishing fleets, and coastal communities building resilience to climate change.
- **Polar Amplification:**
  - Polar amplification is a phenomenon where any alteration in the net radiation balance, such as greenhouse intensification, results in a greater temperature change near the poles compared to the planetary average.

- It refers to the ratio of warming experienced at the poles relative to the tropics in response to changes in the net radiation balance.
- On a planet with a greenhouse effect, where the atmosphere can limit the emission of longwave radiation to space, surface temperatures are warmer than predicted by simple planetary equilibrium calculations.
- Heat transport by the atmosphere or extensive ocean circulation leads to warmer poles and cooler equatorial regions compared to their local net radiation balances.
- Poles experience significant cooling when global-mean temperatures are lower relative to a reference climate.
- Conversely, the poles undergo substantial warming when global-mean temperatures are higher.
- Venus has experienced a substantial increase in greenhouse effect over its lifetime, resulting in its poles warming to the point where surface temperature differences between poles and equator are minimal.
- Earth exhibits polar amplification due to factors such as water vapor and trace gases contributing to a greenhouse effect, along with efficient poleward heat transport by the atmosphere and oceans.
- Arctic amplification refers to polar amplification at the Earth's North Pole.
- Antarctic amplification refers to polar amplification at the South Pole.

Transient Astronomy

Context: *Caltech's Srinivas Kulkarni clinched the 2024 Shaw Prize in Astronomy for pioneering research on variable and transient celestial objects.*

- Astrophysical phenomena that exhibit changes in brightness over a relatively short period.
- Arise from various sources and exhibit distinct characteristics depending on their origin.
- Classified into galactic and extragalactic transients.

Extragalactic Transients:

- **Supernovae:**
  - Explosive end stages of stars' lives, crucial for chemical evolution.
  - Types include Thermonuclear (Type Ia) and Core-collapse (Types Ib, Ic, and II).
  - Important for cosmology as standardizable candles.
  - Superluminous supernovae (SLSNe) are exceptionally bright and long-lasting.
- **Gamma-ray Bursts (GRBs):**
  - Highly energetic events, with short and long durations.
  - Associated with compact object mergers and massive star deaths.
  - Offer insights into high-energy astrophysical processes.
- **Active Galactic Nuclei (AGN):**
  - Supermassive black holes actively accreting matter.
  - Emit strong radiation across the electromagnetic spectrum.
  - Varied in observational and physical characteristics.
- **Tidal Disruption Events (TDEs):**
  - Occur when stars are torn apart by supermassive black holes' tidal forces.
  - Produce luminous flares, exhibiting strong UV and optical emission.
  - Promising targets for multi-messenger astrophysics.
- **Fast Radio Bursts (FRBs):**
  - Energetic radio emissions lasting milliseconds.
  - Classified as repeaters and non-repeaters, originating from unknown sources.
  - Potential to emit across multiple wavelengths.
- **Kilonovae:**
  - Bright bursts resulting from neutron star mergers.
  - Produce gravitational waves and rapid nucleosynthesis.
  - Differentiated from general compact object mergers by their neutron star involvement.

Galactic Transients:

- **Novae:**
  - Bright outbursts occurring in binary systems with a white dwarf and a main sequence star.
  - Material from the star accretes onto the white dwarf, triggering a runaway fusion reaction.
  - Novae can exhibit significant increases in luminosity, with some recurring as recurrent novae.
- **M-dwarf Flares:**
  - Common occurrences on M-dwarf stars due to magnetic reconnection.
  - Emit large-scale brightness increases, sometimes multiple times per day.
  - Important for understanding stellar magnetic fields and potential habitability of exoplanets.
- **Variable Stars:**
  - Stars exhibiting changes in brightness over time.
  - Intrinsic variables include pulsating (e.g., Cepheid, RR Lyrae) and eruptive (e.g., novae, cataclysmic variables).
  - Extrinsic variables include eclipsing binaries and rotational variables (e.g., starspots).
- **Rotating Radio Transients (RRATs):**
  - Erratic radio pulses emitted by rapidly rotating neutron stars.
  - Unlike regular pulsars, RRATs exhibit sporadic radio emissions with varying intervals.
  - First discovered in 2006 through the Parkes Multibeam pulsar survey.

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NEWS IN BETWEEN THE LINES

Pravaah Portal

Reserve Bank of India (RBI) Governor Shaktikanta Das recently unveiled three major initiatives of the Reserve Bank of India, namely the Pravaah portal, Retail Direct Mobile App and a FinTech Repository.

About Pravaah Portal:

- The Pravaah (Platform for Regulatory Application, Validation and AutHorisation) portal is a **secure** and **centralized web-based portal launched by the Reserve Bank of India** (RBI).
- It **facilitates individuals or entities to apply online** for various regulatory approvals seamlessly.
- The portal aims to enhance the efficiency of various processes related to **granting regulatory** approvals and clearances by RBI.
- It **provides a streamlined mechanism** for seeking authorization, licenses or regulatory approvals.
- It contributes to regulatory transparency by providing a **centralized platform** for regulatory interactions with RBI.
- It **promotes greater accountability** and **standardization** in the regulatory approval process.
- The Retail Direct Mobile App will provide retail investors **ease of transacting in G-Secs.**
- The Fintech Repository will contain information on **data of Indian FinTech firms**.

National Archives of India

Recently, the Indian Embassy in Muscat and the National Archives of India (NAI) successfully completed a first-of-its-kind project to archive historical documents of the Indian diaspora in Oman.

About National Archives of India:

- The National Archives of India (NAI) was **established on March 11, 1891** at Calcutta (now Kolkata) as the Imperial Record Department.
- It is the **biggest archival repository in South Asia**.
- It functions as the **custodian of the country's archival heritage** and is responsible for preserving, protecting and making accessible the records of enduring value to the nation.
- It houses a **vast collection of historical records**, including official documents, **manuscripts**, **maps**, photographs and **audiovisual** materials.
- It **preserves records dating back to the 11th century**, providing insights into India's rich cultural, political, and administrative history.
- It **offers research facilities**, reference services and access to **digitized records** through its website and online portals.
- It was **transferred from Kolkata to New Delhi in 1911**.

Mullaperiyar Dam

Recently, members of various farmers' organisations protested at the Tallakulam head post office in Madurai, condemning Kerala's plan to construct a new dam across Mullaperiyar.

About Mullaperiyar Dam:

- The Mullaperiyar Dam, a **masonry gravity dam** is located in **Kerala**.
- It was constructed across the **Periyar River** and serves the purpose of diverting water for irrigation and hydroelectric power generation.
- The dam is owned and **operated by the state of Tamil Nadu under a lease agreement** with the erstwhile princely state of Travancore.
- The **lease agreement, signed in 1886,** is a source of contention **between Kerala and Tamil Nadu** due to concerns over dam safety and water sharing.
- The construction of dam began in **1887** was completed in **1895**, making it over a century old.
- It was constructed with **limestone** and "**Surkhi**" (burnt brick powder and a mixture of sugar and calcium oxide).

Red Sea

Recently, a missile attack damaged a ship in the Red Sea off the coast of Yemen.

About the Red Sea:

Location: The Red Sea is a **semi-enclosed tropical basin**, located between **Africa and Asia.**

Boundaries: The Red Sea is bordered by **Egypt**, **Saudi Arabia**, **Yemen, Sudan**, **Eritrea** and **Djibouti**.

Features:

- The Red Sea is one of the **saltiest bodies** of water in the world.
- It is underlain by the **Red Sea Rift,** which is part of the Great Rift Valley.
- **It has large coral reefs** that are home to a **variety of plants and animals**, including hawksbill turtles, red lionfish and clownfish.
- It is connected to the **Mediterranean Sea** through the **Suez Canal** in the north.
- It was important in early **Egyptian maritime commerce** and was used as a water route to India.

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Genetically Modified Mosquitoes

Recently, Genetically modified (GMO) mosquitoes were released in Djibouti, East Africa to fight malaria.

About Genetically Modified Mosquitoes:

- Genetically modified mosquitoes are **engineered to combat vector-borne diseases** like **malaria**, **dengue fever**, **Zika virus**, etc., by reducing the population of disease-carrying mosquito species.
- These mosquitoes are **created by introducing genetic modifications** that either reduce their ability to transmit diseases or suppress their population growth.
- These mosquitoes are designed to specifically target disease-carrying mosquito species, such as **Aedes aegypti** and **Anopheles stephensi**, while minimizing harm to other organisms in the ecosystem.

Place in News

Libya

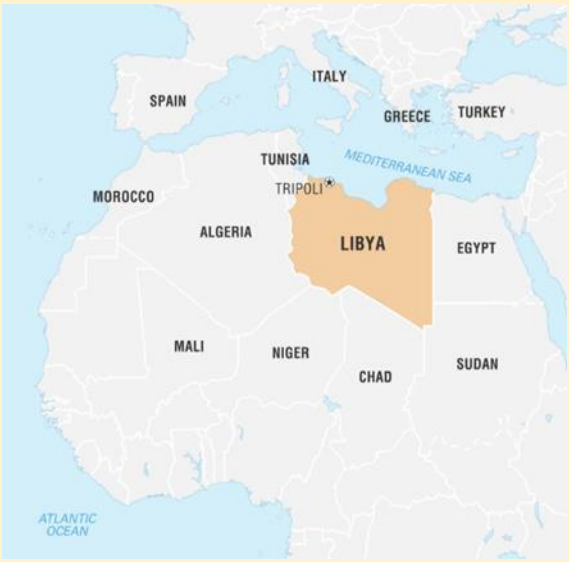
Recently, India and Libya discussed various aspects to strengthen their bilateral relations.

Libya (Capital: Tripoli)

Location: Libya is a country in the Maghreb region of **North Africa**.

Boundaries: Libya shares its borders with **Egypt** (East), **Algeria** (West), the **Mediterranean Sea** (North), **Chad** (South), **Sudan** (Southeast), **Niger** (Southwest) and **Tunisia** (Northwest).

It also shares **maritime borders** with **Greece**, **Italy** and **Malta** (North).



Physical Features:

- The highest point in Libya is **Bikku Bitti,** also known as Bette Peak.
- Libya, primarily a desert nation, features intermittent rivers and wadis such as **Wadi Al-Hayaa**, **Wadi Al-Shatii**, **Wadi Al-Kuf** and **Wadi Al-Hamad**.
- Libya possesses vast oil reserves and is a significant exporter of crude oil.

POINTS TO PONDER

- Who secured the first-ever gold medal for an Indian gymnast at the 2024 Asian Gymnastics Championships? **– Dipa Karmakar**
- Which state is home to the Nyishi Tribe, the largest ethnic group recently making headlines? **– Arunachal Pradesh**
- At the ESA/EU Space Council, how many countries recently endorsed the Zero Debris Charter? **– 12**
- In which area of Madhya Pradesh did GAIL (India) Ltd. launch its inaugural Green Hydrogen Plant? **– Vijaipur**
- Where is Mount Mungalo situated, which recently faced a landslide? **– Papua New Guinea**