

CLIMATE

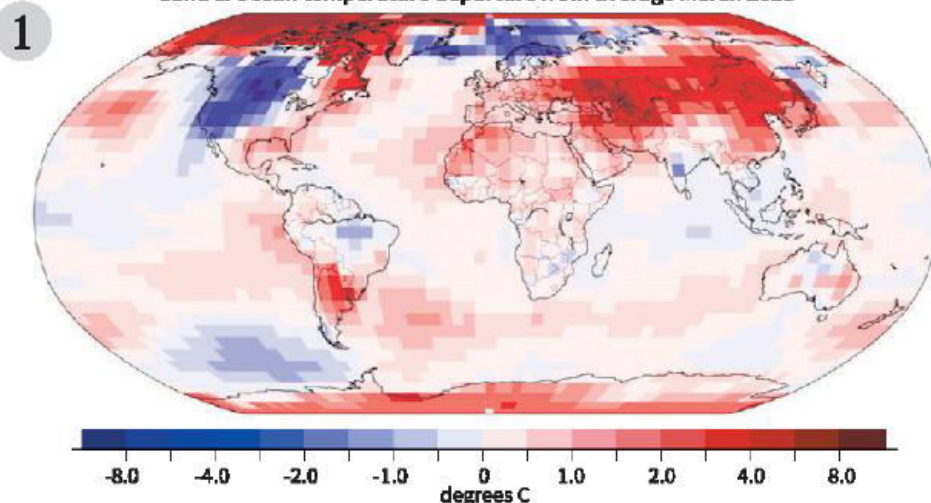
❖ **Understanding temperature anomalies**

- **CONTEXT:** There was news recently that **March 2023 was the second warmest March on record.**
- The monthly report and the subsequent end-of-the-year annual summary by the U.S. National Oceanic and Atmospheric Administration (NOAA) serves as an excellent resource to contextualise the individual month's ranking by temperature anomalies.
- **Why was March 2023 the second warmest?**
- March 2023 was indeed the second warmest in the instrumental record. The warmest March occurred just a few years ago in 2016, when the biggest El Niño of the 21st century triggered a 'mini' global warming. But the January-to-March average temperature anomaly ranks 2023 as the fourth warmest such period on record.
 - ✓ This raises some obvious questions. Why was March 2023 the second warmest and not the warmest?
- As seen in the figure, each year's March can be warmer or cooler than the March of the year before. Natural climate variability, including events like El Niño, can temporarily spike temperatures.
- The old adage (often mistakenly attributed to Mark Twain) says that climate is what we expect and weather is what we get. In India, we expect March to be the beginning of the scorching summer season. But a particular year's March may be cooler due to some other climate factors, such as a La Niña, and especially when averaged over a region as large as India or even an Indian State.

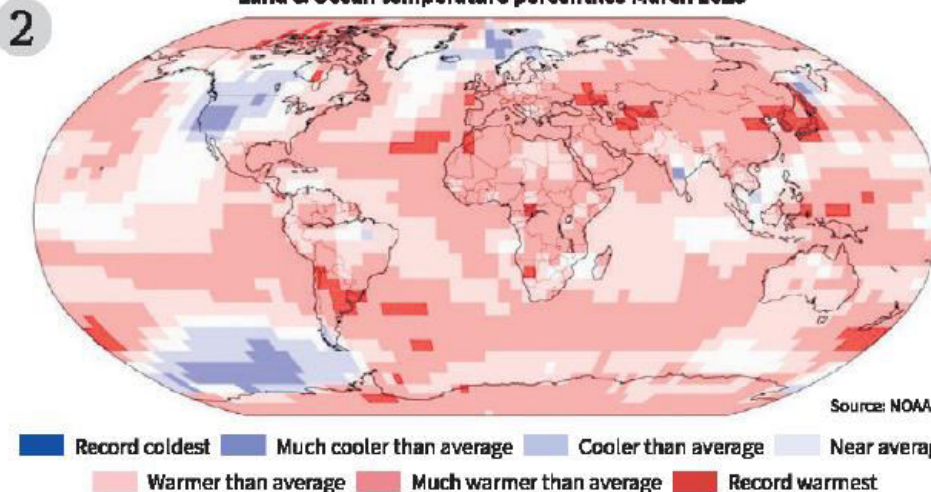
Unstable warming

Map 1 shows the distribution of temperature deviations for March 2023 from the baseline long-term average March temperature. Map 2 shows the percentile ranking of temperature anomalies

Land & Ocean temperature departure from average March 2023



Land & Ocean temperature percentiles March 2023



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- A year is an 'El Niño year' if warmer water spreads in a band from west to east over the equatorial Pacific Ocean. In a 'La Niña year', cooler water spreads east to west in the same region.
 - Both phenomena have distinct and significant effects on the global climate. (Global mean temperatures themselves represent the increasing amount of additional energy we are trapping in the earth system and preventing its escape to space by, among other things, increasing the atmospheric concentration of heat-trapping greenhouse gases.)
 - **Why is context important?**
 - The distribution of temperature deviations for March 2023 from the baseline long-term average March temperature is visible in the global map of temperature anomalies (Map 1).
 - The monstrous warming to the west to north of India begins to tell the story of the weather anomalies that rendered a cooler March over Mumbai, excess pre-monsoon rains over the northwest, and scorching heatwaves in Kerala and Odisha.
 - The Arabian Sea has also warmed more than expected this March. If this continues: it can favour a stronger monsoon but may also enhance cyclogenesis (i.e. birth of cyclonic circulation) over the Arabian Sea.
 - The global distribution of temperature anomalies is due to land-ocean-atmosphere processes that dynamically determine the weather and climate.
 - Global warming does not mean each month or each year will be warmer than the previous month or the previous year. Instead, a better place to begin would be by averaging the weather over a decade. Decade-to-decade warming clearly shows that humans are now ensuring each decade is warmer than the one before.
 - As with the temperature, precipitation anomalies for March 2023 show the impact of a warm March over Eurasia in the form of below-normal precipitation.
 - Reduced snowfall over the Eurasian landmass has historically tended to favour a stronger monsoon. As it happens, 2023 is expected to be an El Niño year, and El Niños tend to produce weaker monsoons. So this summer's El Niño effect could be blunted by the lower snow cover over Eurasia.
- In sum, climate scientists need to provide the proper context when they compare and rank individual months against each other. This will help the people at large better understand global warming as well as its cascading effects on the weather they experience every day. All global warming is local; nobody lives in the global mean temperature. And the better people understand the impact of global warming in their backyard, the likelier they can be engaged in climate action.





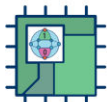

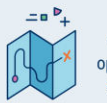

DEVELOPMENT IN SCIENCE AND TECHNOLOGY

- ❖ **A new mission for quantum computers, and what it means for India**
- **CONTEXT:** India decided to join in this global effort in a big way, by setting up a Rs 6,000 crore National Mission on Quantum Technologies and Applications. Development of homegrown quantum computers is one of the major objectives of the mission.
- **About the Mission**
- The mission will aim to seed, nurture and scale up scientific and industrial resource and development programmes, and create a vibrant and innovative ecosystem for quantum technology.
- The timeline of the mission is 2023-24 to 2030-31.
- Six ministries — Department of Space, Department of Atomic Energy, Ministry of Electronics and Information Technology, Information, Department of Telecommunication, and Department of Science and Technology — will be involved in this mission. With Department of Science and Technology will lead the mission.
- As part of the mission, four thematic hubs will be set up in top academic and the Mission will develop four broad themes — Quantum Computing, Quantum Communication, Quantum Sensing and Metrology and Quantum Material and Devices.
- The National Quantum Mission will give India a 'quantum jump' in the world.
 - ✓ Only six countries — the United States, Canada, Austria, Finland, China and France — are currently working on it. It is still in the research and development stage in those countries.
- **Scope of mission**
- The mission will look at development of satellite-based secure communications between a ground station and a receiver located with 3,000 km during the first three years.
- For satellite-based communication within Indian cities, the National Quantum Mission will lay communication lines using Quantum Key Distribution for over 2,000 km. For long distances quantum communication, especially with other countries, tests will be conducted in the coming years.
- The mission will focus on developing quantum computers (qubit) with physical qubit capacities ranging between 50 and 1,000 qubits developed over the next eight years.
- Computers up to 50 physical qubits will be developed over three years, 50 – 100 physical qubits in five years and computers up to 1,000 physical qubits in eight years.

- there are some 20-odd institutes that are carrying out research on quantum computing, apart from some private players, and on a long-term perspective some of these institutes can be included under the National Quantum Mission, if need be.

➤ **Quantum properties**

- Quantum computers are not just the next generation of faster and more efficient computers. Conventional computers, when they are more powerful and have much higher capabilities, become supercomputers. But these perform their tasks in the same way as the normal home computers or mobile phones do.
- Quantum computers are fundamentally different in the way they handle and process information. They are meant to be useful in some very specific situations where the traditional ways of computing are inadequate. For more mundane uses, like playing a video or browsing the internet, quantum computers would not offer any significant advantage over conventional computers.

Quantum Computing	Vs.	Classical Computing
 <p>Calculates with qubits, which can represent 0 and 1 at the same time</p>		 <p>Calculates with transistors, which can represent either 0 or 1</p>
 <p>Power increases exponentially in proportion to the number of qubits</p>		 <p>Power increases in a 1:1 relationship with the number of transistors</p>
 <p>Quantum computers have high error rates and need to be kept ultracold</p>		 <p>Classical computers have low error rates and can operate at room temp</p>
 <p>Well suited for tasks like optimization problems, data analysis, and simulations</p>		 <p>Most everyday processing is best handled by classical computers</p>

- Quantum computers exploit the very special properties of matter in the sub-atomic world for calculations beyond the capabilities of ordinary computers.

- Small particles, the size of atoms or its constituents like protons or electrons, exhibit a number of strange properties that go entirely against our everyday experiences.

- For example, these particles can exist at multiple locations at the same time, a phenomenon called superposition, but only till no one is looking. The moment they are observed at one place, they cease to exist at all other places. Then there is the property of entanglement, the ability of a particle to instantaneously influence the behaviour of another with whom it had an earlier 'interaction', even when they are separated by arbitrarily great distances.

✓ Research on entangled particles won the Physics Nobel in 2022.

- Conventional computers store and process information in bits.

✓ A bit is the smallest unit of data that computers can handle. It can take just two values — 0 or 1 — but only one of these at a time. A zero would result in a certain set of instructions to be carried out, while a one would lead to a different set of instructions.

✓ All data in computers, including text, pictures and videos, are broken down into a sequence of zeros and ones for purposes of storage and processing, and can be reconstructed from these.

✓ A two-bit system in a conventional computer can have four states — (0,0), (0,1), (1,0) and (1,1) — but again only one at a time. To go through each of these four states, the computer has to take four steps. A more powerful computer can speed up the process, but it would still have to go through the four steps.

- This is where the quantum computer starts to do things differently. Superposition makes it possible for the quantum bit, or a qubit as it is called, to exist in both 0 and 1 state simultaneously.

✓ Counter-intuitive as it may appear, it can be 60 per cent 0 and 40 per cent 1 at the same time, or any other combination. Similarly, the two-qubit system can be in all four states at the same time — some part (0,0), some part (0,1), some part (1,0) and remaining (1,1).

- What it means is that a quantum computer can go through these four states in one step, unlike the conventional computer that requires four steps.

➤ **Not yet perfect**

- As more qubits are added, the processing capability of the quantum computer increases exponentially. With just a few qubits, say 50, quantum computers can outpace traditional computers that perform a couple of billion operations per second.

- Tasks that conventional computers would take millions of years to finish can become a matter of seconds with a quantum computer. Such tasks are found in a variety of domains, like internet and data security, and health research, pharmaceuticals, navigation . And this is where the main use cases of quantum computers lie.

- However, it is not all straightforward. Apart from the challenges in building a quantum computer (requirements of very cold temperatures and extreme isolation) there is a significant risk of errors.
- The parallel processing happening in superposition states all lead to different results, only one of which is correct or desirable.
- In other situations, when the superposition breaks down, the final outcome is randomly selected from the range of possibilities. But this would make quantum computer totally useless. Error correction, and the ability to guide the computer to produce the correct result as the most favoured option, is one of the ongoing areas of active research.

PRELIMS

1. SWAGAT initiative

➤ **CONTEXT: Prime Minister Shri Narendra Modi will participate in a programme marking 20 years of completion of the SWAGAT initiative in Gujarat**

- SWAGAT (State Wide Attention on Grievances by Application of Technology) was started by the Prime Minister in April 2003, when he was the Chief Minister of Gujarat, a first of its kind tech-based grievance redressal programme.

➤ **About the Initiative**

- The main purpose of this programme was to act as a bridge between the citizens and the government using technology by solving their day-to-day grievances in a quick, efficient and time-bound manner. Over time, SWAGAT brought about a transformative impact in the lives of people and became an effective tool to solve woes in a paperless, transparent and hassle-free manner.

- The uniqueness of SWAGAT is that it helps common man air his grievances directly to the Chief Minister.
- It is held on the fourth Thursday of every month wherein the Chief Minister interacts with citizens for grievance redressal.

- ✓ It has been instrumental in bridging the gap between people and government through prompt resolution of grievances.

- ✓ Under the programme, it is ensured that every applicant is informed of the decision. Proceedings of all applications are available online. More than 99% of grievances submitted till date have been resolved.

- The SWAGAT Online Programme has four components: the State SWAGAT, District SWAGAT, Taluka SWAGAT and Gram SWAGAT.

- ✓ The Chief Minister himself attends public hearings during State SWAGAT.

- ✓ The District Collector is in charge of District SWAGAT while the Mamlatdar and a Class-1 Officer head the Taluka SWAGAT.

- ✓ In Gram SWAGAT, citizens file the application from 1st to 10th of every month to the Talati/Mantri. These are included in the Taluka SWAGAT program for redressal. In addition, a Lok Fariyad program is also operational for citizens wherein they file their grievances at the SWAGAT Unit.

- The SWAGAT Online Programme has been given various awards over the years, including the United Nations Public Service Award in 2010 for improving transparency, accountability and responsiveness in public service.

2. Zero Shadow Day

➤ **CONTEXT: At 12:17 pm on April 25, Bengaluru experienced a 'Zero Shadow Day', when vertical objects appear to cast no shadow.**

- This was because the sun was at its zenith, and so the shadow was directly under the object.
- On April 25, 2023, the Sun reaches exactly overhead at (12:17 pm) in Bengaluru and at all places along the 130 north Latitude. The shadow of any vertical object would disappear at that instant. Zero Shadow Day occurs on different days in places away from 130 latitude.

➤ **What is Zero Shadow Day?**

- As The Indian Express has explained earlier, for every point on Earth between the Tropic of Cancer and the Tropic of Capricorn, there are two Zero Shadow Days a year.

- For Bengaluru, the next one is on August 18. The Zero Shadow Day is restricted to locations between the tropics, and so places north of Ranchi in India are out of it.

- One falls during the Uttarayan when the Sun moves northwards, and the other is during Dakshinayan when the Sun moves southwards.

➤ **Why does a Zero Shadow Day happen?**

- Uttarayan (movement of the Sun from south to north from winter solstice to summer solstice) and Dakshinayan (back from north to south) happen because Earth's rotation axis is tilted at an angle of roughly 23.5° to the axis of revolution around the Sun.

- Ramanujam explained that the Sun's location moves from 23.5°N to 23.5°S of Earth's equator and back. All places whose latitude equals the angle between the Sun's location and the equator on that day experience zero shadow day, with the shadow beneath an object at local noon.
- The Earth's rotation axis is inclined at 23.5 degrees to the plane of its revolution around the Sun, which is why we have seasons. This also means that the Sun, in its highest point of the day, will move from 23.5 degrees south of the celestial equator to 23.5 degrees north of the equator (Uttarayan), and back again (Dakshinayan), in a year. Of course, the northern most and southern most points are the two solstices, and the crossing of the Sun across the equator are the two equinoxes.

ANSWER WRITING

Q. Discuss the role and importance of the Election Commission of India in ensuring free and fair elections in India.

Introduction

The Election Commission is a permanent and an independent body established by the Constitution of India directly to ensure free and fair elections in the country. Article 324 to article 329 of Indian constitution contains provisions related to Election Commission of India.

Role of Election Commission of India:

- **Conducting elections:** Article 324 of the Constitution provides that the power of superintendence, direction and control of elections to parliament, state legislatures, the office of president of India and the office of vice-president of India shall be vested in the election commission.
- **Ensuring a level playing field:** The ECI ensures that all political parties and candidates have a level playing field during elections.
- ✓ It does this by enforcing the Model Code of Conduct, which lays down guidelines for political parties and candidates to follow during elections.
- **Role with Respect to Political Parties:** To grant recognition to political parties and allot election symbols to them.
- ✓ To act as a court for settling disputes related to granting recognition to political parties and allotment of election symbols to them.
- **Voter education:** The ECI conducts voter education programs to increase awareness among voters about their rights and responsibilities.
- ✓ This includes educating them about the importance of voting and how to cast their vote.
- **Monitoring election expenditure:** The ECI monitors the expenditure of political parties and candidates during elections to ensure that they do not exceed the limits set by the law.
- **Addressing electoral malpractices:** The ECI takes strict action against electoral malpractices such as booth capturing, bogus voting, and intimidation of voters.

Importance of Election Commission of India:

- **Ensuring free and fair elections:** The primary responsibility of the ECI is to ensure that elections are free and fair.
- ✓ This is crucial for maintaining the credibility of the electoral process and ensuring that the people's mandate is respected.
- **Upholding democracy:** The ECI plays a critical role in upholding democracy in India.
- ✓ By ensuring that elections are conducted in a free and fair manner, it helps to maintain the democratic values of the country.
- **Ensuring peaceful elections:** The ECI's efforts to curb electoral malpractices and ensure a level playing field help to maintain peace during elections.
- ✓ This is crucial for preventing violence and maintaining law and order.
- **Promoting voter participation:** The ECI's voter education programs encourage people to participate in the electoral process.
- ✓ This helps to increase voter turnout and ensures that the voice of the people is heard.

Conclusion

The Election Commission of India has played a crucial role in ensuring free and fair elections in India. Its efforts to maintain a level playing field, curb electoral malpractices, and promote voter education have helped to uphold democracy and maintain peace during elections. The importance of the ECI in Indian democracy cannot be overstated, and it is essential that it continues to function independently and impartially in the future.

MCQs

1. The question consists of two statements, an assertion and a reason. The student must determine whether each statement is true and then whether the reason holds true to the assertion.
Assertion- A. Puri has a moderate temperature all year round.

Reason- R. Coastal regions experience the land and sea breeze phenomenon. The differential heating of land and water results in a moderate climate at the shores.

- a) **Both A and R are true and R is correct explanation of A.**
 b) Both A and R are true and R is not the correct explanation of A.
 c) A is true but R is false.
 d) A is false but R is true.
2. Recently Bengaluru experienced a ‘Zero Shadow Day’ with reference to this news answer the following question, how many times are Zero Shadow Days observed for every point on Earth between the Tropic of Cancer and the Tropic of Capricorn?
 a) **2 times**
 b) 4 times
 c) 1time
 d) 3 times
3. SWAGAT (State Wide Attention on Grievances by Application of Technology) initiative, a first of its kind tech-based grievance redressal programme often mentioned in news is associated with which of the following state?
 a) Jharkhand
 b) Himachal Pradesh
 c) Gujarat
 d) **Rajasthan**
4. The fluctuation of uric acid levels in blood and in Urine due to the lack of balancing between the production and excretion can causes several diseases like
 1. Hyperuricemia
 2. Type 1 diabetes
 3. Lesch–Nyhan syndrome
 4. Hypertension
 5. Renal disorders.
 Choose the correct answer using the codes given below?
 a) 1,2,3 and 5 only
 b) 2,3 and 4 only
 c) **1,3,4 and 5 only**
 d) 1,2,4 and 5 only
5. Terms like Qiskit, PennyLane, Cirq, and Q# (Q-Sharp) often mentioned in news are related to which of the following?
 a) Malware
 b) Exoplanets
 c) **Programming languages**
 d) Natural Satellites
6. Consider the following statements
 1. In the Quantum Key Distribution encryption keys are sent as ‘qubits’ in an optical fibre
 2. Optical fibers are capable of transmitting more data over longer distances.
 3. Optical fibers works on the principle of total internal Reflections.

Which of the above statement/s is/are correct?

- a) 1 and 2 only
 b) 2 and 3 only
 c) 1 and 3 only
 d) **1,2 and 3**
7. Consider the following statements
 1. Driverless cars that communicate securely with each other on smart roads,
 2. Sensors in the home to detect changing health conditions
 3. Improving agricultural practices
 4. Enabling scientists to address issues arising out of climate change

Which of the above is/are the application of Cyber-Physical Systems?

- a) 1 and 2 only
 b) 2 and 3 only
 c) 1 only
 d) **1,2 and 3**
8. With reference to “Out-of-pocket expenditure” consider the following statements:
 1. It is the money paid directly by households at the point of receiving health care.
 2. It mostly occurs when an individual is covered under private health insurance schemes.
 3. According to the latest National Health Accounts Estimates for India the share of out-of-pocket expenditure (OOPE) in total health expenditure has declined.

Select the correct statement using the code given below:

- a) 1 and 2 only
 b) 2 and 3 only
 c) **1 and 3 only**
 d) 1,2 and 3
9. The committee on doubling farmers’ income (DFI) was headed by:
 a) Abhijit Banerjee
 b) Amitabh Kant
 c) **Ashok Dalwai**
 d) N K Singh
10. Which of the following countries is/are associated with Price Cap Coalition (PCC)?
 1. Australia
 2. Canada
 3. EU
 4. Japan
 5. UK
 6. US

Choose the correct answer using the codes given below

- a) 1,2,3,4 and 5 only
 b) 2,3,5 and 6 only
 c) 2,3,4,5 and 6 only
 d) **1,2,3,4,5 and 6**