

# Text & Context

## NEWS IN NUMBERS



### GST returns

**28** In percentage, the rise in the Goods and Services Tax (GST) collection touching the second-highest level of ₹1.49 lakh crore in July on the back of economic recovery and steps taken to curb tax evasion, the Government said. GST collection stood at ₹1,16,393 crore in the same month a year ago. GST, introduced in July 2017, touched a record high of ₹1.68 lakh crore in April 2022. This is the sixth time that the monthly GST collection crossed the ₹1.40-lakh-crore mark since the inception of GST, the Ministry said in a statement. P11

### 5G spectrum auction

**1.5** In ₹ lakh crore, the worth of the 5G telecom spectrum sold in a seven-day auction that ended on Monday. The mop-up from the 5G spectrum, capable of offering ultra-high speed mobile Internet connectivity, is almost double at ₹77,815 crore worth 4G airwaves sold last year. Reliance Jio was the top bidder for the airwaves capable of offering speeds about 10 times faster than 4G and enable billions of connected devices to share data in real-time. It was followed by Bharti Airtel and Vodafone Idea Ltd. P11

### ITRs filed

**5.83** In crore, the number of Income Tax Returns (ITR) received by the Income Tax Department, by the end of the FY22 filing season. The latest numbers are about the same as FY21. The due date for filing of ITRs by salaried class and individual category taxpayers, who do not have to get their accounts audited for the fiscal ending March 31, 2022, was July 31. A late fee of ₹5,000 would be payable by those (with an annual income of over ₹5 lakh) who file their ITR by December 31 of the assessment year 2022-23. P11

### Power consumption

**128.38** In billion units (BU), India's power consumption in July 2022, rising by 3.8% amid widespread rains in the country, according to the data of Power Ministry. Power consumption in July 2021 was recorded at 123.72 BU while it was 112.14 BU in July 2020. However, the peak power demand met, which is the highest supply in a day, during the month of July dipped to 190 GW. The peak power supply stood at 200 GW in July 2021 and 170 GW in July 2020. P11

### Rojgar Andolan

**200** The number of student bodies, trade unions, teachers' associations and intellectuals to gather at Jantar Mantar on August 16 as part of the week-long 'Rojgar Andolan' to demand a national employment policy in India. The *Rojgar Andolan* will be organised under the banner of the Sanyukta Rojgar Andolan Samiti (SRAS) and continue till August 22. The step comes after "no response" from the Prime Minister's Office about the implementation of the National Employment Policy, a draft given to PMO on December 20, 2021. P11

## EXPLAINER

# What is causing Arctic warming?

Why is the Greenland ice sheet melting at an alarming rate? How is it affecting the monsoons?

RASHMI RAMESH

## THE GIST

Due to global warming, any change in the surface air temperature and the net radiation balance tends to produce larger changes at the north and south poles. These changes are more pronounced at the northern latitudes and are known as the Arctic amplification

In May 2021, the Arctic Monitoring and Assessment Programme had warned that the Arctic has warmed three times quicker than the planet

For several years, the Greenland ice sheet has been melting at an alarming rate. Between July 15 and 17, 2022, the Greenland ice sheet saw a sharp spike in the rate and extent of melting

A study by a group of Indian and Norwegian scientists have found that the reduced sea ice in the Barents-Kara sea region can lead to extreme rainfall events in the latter half of the monsoons, in September and October

**The story so far:** On August 11, Finnish Meteorological Institute researchers published their study in the *Communications Earth & Environment* journal, concluding that the Arctic is heating four times faster than the rest of the planet. The warming is more concentrated in the Eurasian part of the Arctic, where the Barents Sea north of Russia and Norway is warming at an alarming rate – seven times faster than the global average. Other studies in 2021 (the American Geophysical Union) and in 2022 (*Geophysical Research Letters*) indicate that the Arctic amplification is four times the global rate. While earlier studies have proved that the Arctic is warming two or three times faster, recent studies show that the region is fast changing and that the best of climate models may not be able to capture the rate of changes and predict it accurately.

### What is Arctic amplification? What causes it?

Global warming, the long-term heating of the earth's surface, hastened due to anthropogenic forces or human activities since pre-industrial times and has increased the planet's average temperature by 1.1 degrees Celsius. While changes are witnessed across the planet, any change in the surface air temperature and the net radiation balance tend to produce larger changes at the north and south poles. This phenomenon is known as polar amplification; these changes are more pronounced at the northern latitudes and are known as the Arctic amplification.

Among the many global warming-driven causes for this amplification, the ice-albedo feedback, lapse rate feedback, water vapour feedback and ocean heat transport are the primary causes. Sea ice and snow have high albedo (measure of reflectivity of the surface), implying that they are capable of reflecting most of the solar radiation as opposed to water and land. In the Arctic's case, global warming is resulting in diminishing sea ice. As the sea ice melts, the Arctic Ocean will be more capable of absorbing solar radiation, thereby driving the amplification. The lapse rate or the rate at which the temperature drops with elevation decreases with warming. Studies show that the ice-albedo feedback and the lapse rate feedback are responsible for 40% and 15% of polar amplification respectively.

### What do the previous studies say?

The extent of Arctic amplification is debated, as studies show various rates of amplification against the global rate. Studies have shown that the Arctic was warming at twice the global rate prior to the beginning of the 21<sup>st</sup> century. With revised figures, the Intergovernmental Panel on Climate Change released a 'Special Report on the Ocean and Cryosphere in a Changing Climate' in 2019, which said that the "Arctic surface air temperature has likely increased by more than double the global average over the last two decades."

In May 2021, the Arctic Monitoring and Assessment Programme (AMAP) warned that the Arctic has warmed three times quicker than the planet, and the chance of the sea ice completely disappearing in summers is 10 times greater, if the planet is warmer by two degree Celsius above the pre-industrial levels. The report also said that the average annual temperature in the region increased by 3.1 degrees Celsius compared to the 1 degree Celsius for the planet.

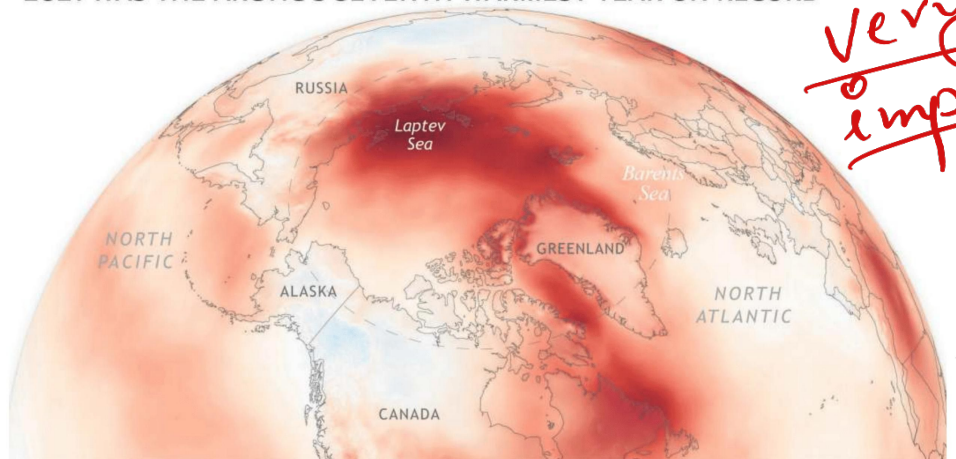
However, recent studies have shown that the mean Arctic amplification saw steep changes in 1986 and 1999, when the ratio reached 4.0, implying four times faster heating than the rest of the planet.

### What are the consequences of Arctic warming?

The causes and consequences of Arctic amplification are cyclical – what might be a cause can be a consequence too.

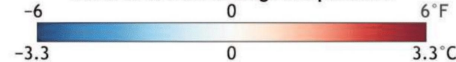
The Greenland ice sheet is melting at an

## 2021 WAS THE ARCTIC'S SEVENTH WARMEST YEAR ON RECORD



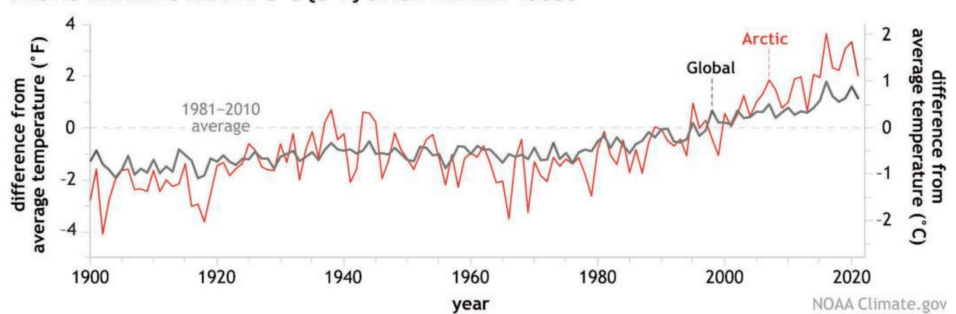
Oct 2020-Sep 2021

Difference from average temperature



NOAA Climate.gov  
Data: C3S ERA5

## ARCTIC WARMING NEARLY 3°C (5°F) SINCE THE MID-1960s



NOAA Climate.gov  
Data: CRUTEM5

alarming rate, and the rate of accumulation of sea ice has been remarkably low since 2000, marked by young and thinner ice replacing the old and thicker ice sheets. The Greenland ice sheet saw a sharp spike in the rate and extent of melting between July 15-17 this year. The unusual summer temperatures resulted in a melt of 6 billion tonnes of ice sheet per day, amounting to a total of 18 billion tonnes in a span of three days, enough to cover West Virginia in a foot of water.

Greenlandic ice sheet holds the second largest amount of ice, after Antarctica, and therefore it is crucial for maintaining the sea level. In 2019, this was the single biggest cause for the rise in the sea level, about 1.5 metres. If the sheet melts completely, the sea level would rise by seven metres, capable of subsuming island countries and major coastal cities.

The warming of the Arctic Ocean and the seas in the region, the acidification of water, changes in the salinity levels, are impacting the biodiversity, including the marine species and the dependent species. The warming is also increasing the incidence of rainfall which is affecting the availability and accessibility of lichens to the reindeer. The Arctic amplification is causing widespread starvation and death among the Arctic

fauna. The permafrost in the Arctic is thawing and in turn releasing carbon and methane which are among the major greenhouse gases responsible for global warming.

**Greenlandic ice sheet holds the second largest amount of ice, after Antarctica, and is crucial for maintaining the sea level. In 2019, this was the single biggest cause for the rise in the sea level, about 1.5 metres.**

Experts fear that the thaw and the melt will also release the long-dormant bacteria and viruses that were trapped in the permafrost and can potentially give rise to diseases.

### What is the impact on India?

In recent years, scientists have pondered over the impact the changing Arctic can have on the monsoons in the subcontinent. The link between the two is growing in importance due to the extreme weather events the country faces, and the heavy reliance on rainfall for water and food security.

A study titled 'A possible relation between Arctic sea ice and late season Indian Summer Monsoon Rainfall extremes'

published in 2021 by a group of Indian and Norwegian scientists found that the reduced sea ice in the Barents-Kara sea region can lead to extreme rainfall events in the latter half of the monsoons – in September and October. The changes in the atmospheric circulation due to diminishing sea ice combined with the warm temperatures in the Arabian Sea contribute to enhanced moisture and drive extreme rainfall events. In 2014, India deployed IndARC, India's first moored-underwater observatory in the Kongsfjordner fjord, Svalbard, to monitor the impact of the changes in the Arctic Ocean on the tropical processes such as the monsoons.

According to the World Meteorological Organization's report, 'State of Global Climate in 2021', sea level along the Indian coast is rising faster than the global average rate. One of the primary reasons for this rise is the melting of sea ice in the polar regions, especially the Arctic. The Arctic amplification furthers the idea that "what happens in the Arctic does not remain in the Arctic" and can substantially affect tropical processes far south.

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- On August 11, Finnish Meteorological Institute researchers published their study in the Communications Earth & Environment journal, concluding that the Arctic is heating four times faster than the rest of the planet.
- The warming is more concentrated in the Eurasian part of the Arctic, where the Barents Sea north of Russia and Norway is warming at an alarming rate – seven times faster than the global average.
- Other studies in 2021 (the American Geophysical Union) and in 2022 (Geophysical Research Letters) indicate that the **Arctic amplification** is four times the global rate. While earlier studies have proved that the Arctic is warming two or three times faster, recent studies show that the region is fast changing and that the best of climate models may not be able to capture the rate of changes and predict it accurately.

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### Arctic amplification:

- Over the past 30 years, the Arctic has warmed at roughly twice the rate as the entire globe, a phenomenon known as

## Arctic amplification.

- **Global warming**, the long term heating of the earth's surface, hastened due to anthropogenic forces or human activities since preindustrial times and has increased the planet's average temperature by 1.1 degrees Celsius.

- While changes are witnessed across the planet, any change in the surface air temperature and the net radiation balance tend to produce larger changes at the north and south poles. This phenomenon is known as polar amplification; these changes are more pronounced at the northern latitudes and are known as the Arctic amplification.

### **Reasons for Arctic Amplification:**

- Among the many global warming driven causes for this amplification, the ice albedo feedback, lapse rate feedback, water vapour feedback and ocean heat transport are the primary causes.
- Sea ice and snow have **high albedo** (measure of reflectivity of the surface), implying that they are capable of reflecting most of the solar radiation as opposed to water and land.
- In the Arctic's case, global warming is resulting in diminishing sea ice. As the sea ice melts, the Arctic

Ocean will be more capable of absorbing solar radiation, thereby driving the amplification.

- The **lapse rate** or the rate at which the temperature drops with elevation decreases with warming. Studies show that the ice albedo feedback and the lapse rate feedback are responsible for 40% and 15% of polar amplification respectively.

## Consequences of Arctic warming:

### 1. Greenland ice sheet

- It is melting at an alarming rate, and the rate of accumulation of sea ice has been remarkably low since 2000, marked by young and thinner ice replacing the old and thicker ice sheets.
- Greenlandic ice sheet holds the second largest amount of ice, after Antarctica, and therefore it is crucial for maintaining the sea level. In 2019, this was the single biggest cause for the rise in the sea level, about 1.5 metres.
- If the sheet melts completely, the sea level would rise by seven metres, capable of subsuming island countries and major coastal cities.

## **2. Reduced biodiversity in the Arctic:**

The warming of the Arctic Ocean and the seas in the region, the acidification of water, changes in the salinity levels, are impacting the biodiversity, including the marine species and the dependent species.

## **3. Rainfall patterns:**

The warming is also increasing the incidence of rainfall which is affecting the availability and accessibility of lichens to the reindeer.

## **4. Access of wildlife to food:**

The Arctic amplification is causing widespread starvation and death among the Arctic fauna.

## **5. Green house gas emission:**

The permafrost in the Arctic is thawing and in turn releasing carbon and methane which are among the major greenhouse gases responsible for global warming.

## **6. Other consequences:**

Experts fear that the thaw and the melt will also release the longdormant bacteria and viruses that were trapped in the permafrost and can potentially give rise to diseases.

## Impact on India:

- The impact of the changing Arctic on the monsoons in the Indian subcontinent is reflected in the extreme weather events. India also has heavy reliance on rainfall for water and food security.
- A study titled 'A possible relation between Arctic sea ice and late season Indian Summer Monsoon Rainfall extremes' published in 2021 by a group of Indian and Norwegian scientists found that the reduced sea ice in the Barents- Kara sea region can lead to extreme rainfall events in the latter half of the monsoons – in September and October.
- The changes in the atmospheric circulation due to diminishing sea ice combined with the warm temperatures in the Arabian Sea contribute to enhanced moisture and drive extreme rainfall events.
- In 2014, India deployed IndARC, India's first moored underwater observatory in the Kongsfjorden fjord, Svalbard, to monitor the impact of the changes in the Arctic Ocean on the tropical processes such as the monsoons.

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