



France was on high alert on July 18 as the peak of a punishing heatwave gripped the country, while wildfires raging in parts of south-west Europe showed no sign of abating. In the south-western Gironde region, firefighters over the weekend continued to fight to control forest blazes that have devoured nearly 11,000ha since July 12. PHOTOS: AGENCE FRANCE-PRESSE

## ScienceTalk

# Record-breaking heatwaves show climate change is already here

July 2022 is a wake-up call for govts and a warning of what is to come

**Benjamin Horton**

In 2018, I wrote an article for The Straits Times. It was titled Heatwaves: A Sign Of Things To Come?

I could not imagine that just four years later, I would be living in a world where more than 100 million people in the United States are facing excessive heat conditions, and where temperature records in England are being smashed by the ongoing heatwave.

Record high temperatures have been set across much of the world this month, as an unusually prolonged and broad heatwave

intensifies concerns about the climate emergency.

A heatwave is a period of excessively hot weather that occurs when a system of high atmospheric pressure moves into an area.

In such a high-pressure system, air from upper levels of our atmosphere is pulled towards the ground, where it becomes compressed and increases in temperature.

This high concentration of pressure makes it difficult for other weather systems to move into the area, which is why a heatwave can last for several days or weeks.

The longer the system stays in an area, the hotter the area becomes.

The high pressure inhibits winds, making them faint to non-existent.

Because the high pressure system also prevents clouds from entering the region, sunlight can become punishing, heating up the system even more.

What is unusual is the global scale of the heatwaves.

Britain has recorded temperatures of over 40 deg C for the first time. Thermometers hit 40.3 deg C at Coningsby in Lincolnshire, while 33 other locations went past Britain's previous highest temperature of 38.7 deg C, set in 2019.

In the United States, 100 million Americans from New York City to Las Vegas were under heat warnings last week as temperatures rose well above 38 deg C. Temperatures were expected to break daily records across Texas, Louisiana and Arkansas.

In March, an intense heatwave swept through northern India with temperatures hitting a record 49.2 deg C in parts of the capital, Delhi. This was the fifth heatwave in the capital since March.

The states of Himachal Pradesh, Haryana, Uttarakhand, Punjab and Bihar have all witnessed soaring temperatures in the past few months.

### LINKS TO CLIMATE CHANGE

Attributing any extreme heatwave event to climate change is challenging because these events are by definition rare and therefore hard to evaluate reliably.

Such events can also be affected by patterns of natural climate variability.

For example, the scorching temperatures that reached into England and Wales last week were caused in part by a region of upper-level low-pressure air that had been stalled off the coast of Portugal for days.

It is known as a "cut-off low", because it was cut off from a river



A coal-electricity power station in Shanghai. The Asia-Pacific accounts for three-quarters of global coal consumption, even as it struggles with the impacts of global warming.



A street sweeper from heatstroke cooling off at a fountain. The death of a Madrid sweeper from heatstroke shows the dangers that outdoor workers face from extreme temperatures.

This reflects the ability of moisture to evaporate, which is the mechanism required for the human body to maintain its internal temperature through the evaporation of sweat.

At a wet-bulb temperature of 35 deg C, the human body cannot cool itself enough to survive more than a few hours.

Heat creates a cascade of negative economic and social effects.

The economic costs of extreme heat are already significant and recent analysis suggests that annual economic losses in the US have already mounted to US\$100 billion (S\$139 billion) due to reductions in labour productivity.

The International Labour Organisation projects that heat stress will reduce the world's gross domestic product (GDP) by US\$2.4 trillion in 2030.

Globally, the effects of heat will strip approximately 1.5 to 2 per cent of annual GDP from local economies.

July 2022 is a warning of what we will have to deal with.

The risks are massive. Currently, more than a billion people are at risk from a lack of air-conditioning and refrigeration to keep them cool and to preserve food and medicines as global warming brings more high temperatures.

Britain is a country largely without air-conditioning and is struggling to cope in the heat.

Rail services were limited for fear the tracks would buckle, and flights at Britain's largest airbase were halted.

The country is under a widespread "red" warning for heat issued by the government for the first time in history.

Officials urged people to use public transportation only if necessary, and to work from home on Monday and Tuesday - a plea reminiscent of the depths of the coronavirus pandemic.

Hospitals and nursing homes were a major cause of concern, officials said, with many older and other vulnerable patients in buildings without air-conditioning.

Officials urged schools, in their final week of classes before a break, not to close because it would leave children unsupervised in the heat - a directive that some education districts were ignoring.

Scientists have been sounding the alarm for decades, in every way they could, that climate change will make the planet warmer, wetter, harder to predict, and in many ways so much more dangerous for humans and ecosystems.

But despite clear warnings, scientists dedicated to informing the public have struggled to get their voices heard.

The small "silver lining" of these heatwaves may be the wake-up call that governments need to really focus on reducing greenhouse gases immediately.

Professor Benjamin Horton is the director of the Earth Observatory of Singapore at Nanyang Technological University

of westerly winds, the mid-latitude jet stream, that circles the planet at high altitudes.

In contrast, heatwaves in South-east Asia are accompanied by the weakening of the Asian-Australian monsoon with suppressed rainfall and hot and subsiding conditions in the Indochina Peninsula.

The El Niño-Southern Oscillation is the most critical factor influencing the precipitation and temperature over South-east Asia.

But natural cycles by themselves cannot explain the recent number of record-breaking extreme weather events.

Something else is happening too. The earth is getting warmer.

Climate change makes heatwaves hotter, longer and more common.

Climate change made the record-breaking temperatures in India in March 30 times more likely.

The planet's average temperature has risen by 1.1 deg C since pre-industrial levels, largely because of the huge increase in greenhouse gases human activity has unleashed.

Carbon dioxide is the biggest contributor to global warming; its concentration in the atmosphere has soared by 48 per cent between 1750 and 2020.

The years 2016 and 2020 ranked above the 20th century average. The years 2013 to 2021 all rank among the 10 warmest years on record.

Last year was the sixth warmest year on record for the globe with a temperature that was 0.84 deg C above the 20th century average. The years 2016 and 2020 ranked globally and here in Singapore,

which had a mean annual temperature of 28.4 deg C.

2016 was an El Niño year, and mainland South-east Asia encountered its warmest monthly mean surface air temperatures in April 2016 since record-keeping began.

Apart from surpassing national temperature records in mainland South-east Asia, this event disrupted crop production, imposed societal distress and resulted in peak energy consumption.

### WHAT ABOUT THE FUTURE?

Unfortunately, the global scale of heatwaves is a sign of things to come.

Results from a wide range of climate model simulations suggest that our planet's average temperature could be between 1.1 and 5.4 deg C warmer in 2100 than it is today.

Even a small change in average global temperature leads to a dramatic change in the frequency of extreme events, such as heatwaves.

In a normal climate, the probability for extreme events can be visualised like a traditional bell curve.

Moderate weather events are much more common than extreme events. But climate change shifts the curve to the hotter side, moving the average over.

Emissions just keep on rising, the heatwaves will intensify - heatwaves could affect 85 per cent of the global land area by 2100.

Another study found that the chances of record-breaking heatwave in north-west India and Pakistan has been made more than 100 times more likely because of climate change.

Hot weather's most deadly effects for humans come from a combination of high temperature and high humidity, an index which is measured by a reading known as wet-bulb temperature.

## Green Pulse Podcast

**ST**  
PODCASTS

### Taking the heat out of climate change

Global temperatures are rising because humans are pumping carbon dioxide (CO2) into the air. The race is now on to rapidly cut carbon emissions to limit the pace of global warming. In this episode, The Straits Times' environment correspondent **Audrey Tan** and climate change editor **David Fogarty** discuss the growing importance of CO2 removal technology with **Dr Oliver Geden**, a lead author for the UN's Intergovernmental Panel on Climate Change.

Follow The Straits Times' climate change coverage at [str.sg/climate-change](http://str.sg/climate-change)