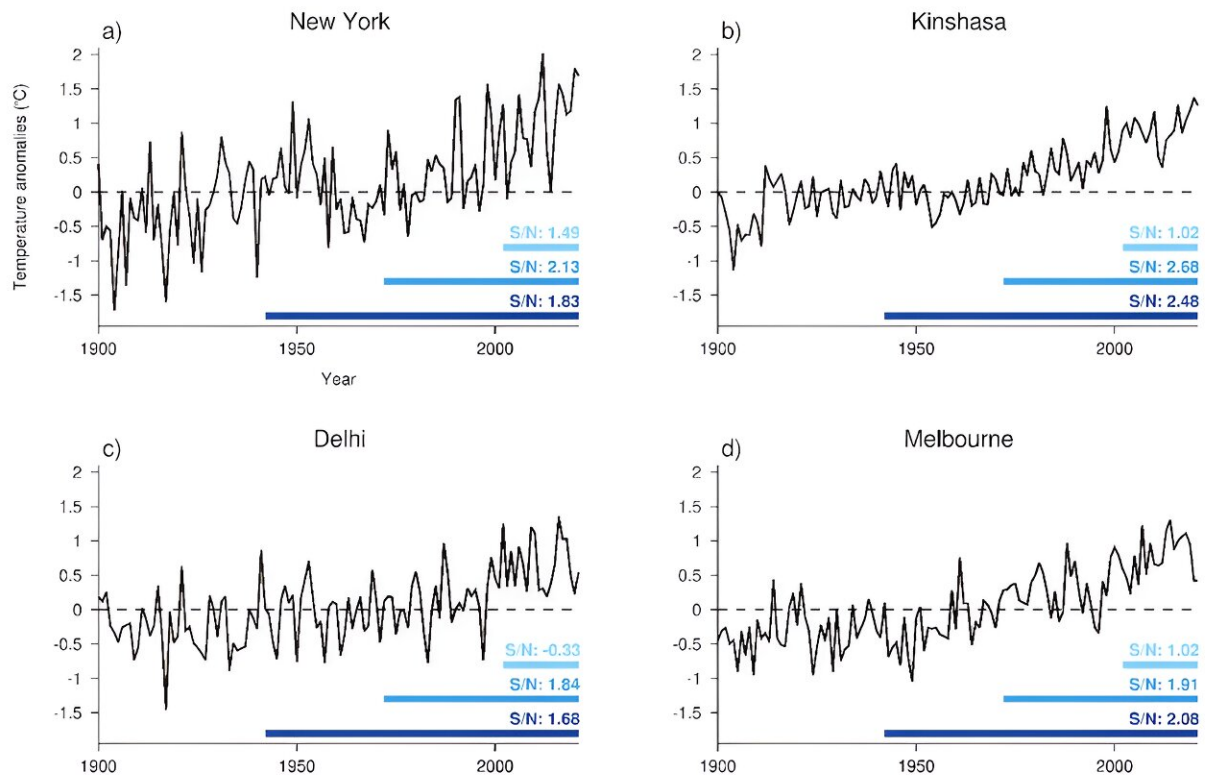


Research reveals who's been hit hardest by global warming in their lifetime, and the answer may surprise you

August 15 2023, by Andrew King, Ed Hawkins, Hunter Douglas and Luke Harrington



Annual-average temperatures at four major cities with signal-to-noise ratios shown for 20, 50 and 80 years up to 2021. Credit: Andrew King, Ed Hawkins, Hunter Douglas and Luke Harrington

Earth is warming and the signs of climate change are everywhere. We've seen it in the past few weeks as temperatures hit record highs around the world—both in the Northern Hemisphere and the warm Australian winter.

Global [warming](#) is caused by humanity's greenhouse gas emissions, which continue at near-record pace. These emissions are predominantly generated by people in the world's wealthiest regions.

Our world-first analysis, [published today](#), examines the experience of [global warming](#) over the lifetimes of people around the world: young and old, rich and poor. We sought to identify who has perceived [warmer temperatures](#) most keenly.

We found [middle-aged people](#) in equatorial regions have lived through the most perceptible warming in their lifetimes. But many young people in lower-income countries could experience unrecognizable changes in their local climate later in life, unless the world rapidly tackles climate change.

Measuring the climate change experience

We examined temperature data and population demographics information from around the world.

Key to our analysis was the fact that not all warming is due to human activity. Some of it is caused by natural, year-to-year variations in Earth's climate.

These natural ups and downs are due to a number of factors. They include variations in the energy Earth receives from the sun, the effects of volcanic eruptions, and transfers of heat between the atmosphere and the ocean.

This variability is stronger in mid-to-high-latitude parts of the world (those further from the equator) than in low-latitude areas (in equatorial regions). That's because the weather systems further away from the equator draw in hot or cold air from neighboring areas, but equatorial areas don't receive cold air at all.

That's why, for example, the annual average temperature in New York is naturally more variable than in the city of Kinshasa (in the Democratic Republic of Congo).

To account for this, we applied what's known as the "[signal-to-noise ratio](#)" at each location we studied. That allowed us to separate the strength of the climate change "signal" from the "noise" of natural variability.

Making this distinction is important. The less naturally variable the temperature, the clearer the effects of warming. So warming in Kinshasa over the past 50 years has been much more perceptible than in New York.

Our study examined two central questions. First, we wanted to know, for every location in the world, how clearly global warming could be perceived, relative to natural temperature variability.

Second, we wanted to know where this perceived change was most clear over human lifetimes.

Our results

So what did we find? As expected, the most perceptible warming is found in tropical regions—those near the equator. This includes developing parts of the world that constitute the Global South—such as Africa, Latin America and the Caribbean, and Asia.

Household incomes in the Global South are typically lower than in industrialized nations (known as the Global North). We might, then, conclude people in the poorest parts of the world have experienced the most perceptible global warming over their lifetimes. But that's not always the case.

Why? Because most parts of the Global South have younger populations than wealthier regions. And some people under the age of 20, including in northern India and parts of sub-Saharan Africa, haven't experienced warming over their lifetimes.

In these places, the lack of recent warming is likely down to a few factors: natural climate variability, and the local cooling effect of particles released into the atmosphere from [pollution](#) and changes in land use.

There's another complication. Some populated regions of the world also experienced slight cooling in the mid-20th century, primarily driven by human-caused [aerosol emissions](#).

So, many people born earlier than the 1950s have experienced less perceptible warming in their local area than those born in the 1960s and 1970s. This may seem counter-intuitive. But a cooling trend in the first few decades of one's life means the warming experienced over an entire lifespan (from birth until today) is smaller and less detectable.

So what does all this mean? People in equatorial areas born in the 1960s and 1970s—now aged between about 45 and 65—have experienced more perceptible warming than anyone else on Earth.

Rich countries must act

Our findings are important, for several reasons.

Identifying who has experienced significant global warming in their lives may help explain [attitudes to tackling climate change](#).

Our findings also raise significant issues of fairness and equity.

Humanity will continue to warm the planet until we reach global net-zero emissions. This means many [young people](#) in lower-income countries may, later in life, experience a [local climate](#) that is unrecognizable to that of their youth.

Of course, warming temperatures are not the only way people experience climate change. Others include sea-level rise, more intense drought and rainfall extremes. We know many of these impacts are felt most acutely by [the most vulnerable populations](#).

Cumulative greenhouse gas emissions are much higher in the Global North, due to economic development. To address this inequality, rich industrialized nations must take a leading role in reducing emissions to net-zero, and helping vulnerable countries adapt to [climate](#) change.

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