How will Climate Change affect China?

BY MARC GRONWALD

Abstract

China faces increasing exposure to extreme heat and is also going through a rapid urbanisation process. It is the combination of these two that poses a particular challenge.

Answering the question of how climate change will affect China begins, in good old statisticians' tradition, with a look at the data. Figure 1 displays global and Northern hemispheric temperature anomalies from 1850-2020 as well as those for China and Jiangsu province.[1]

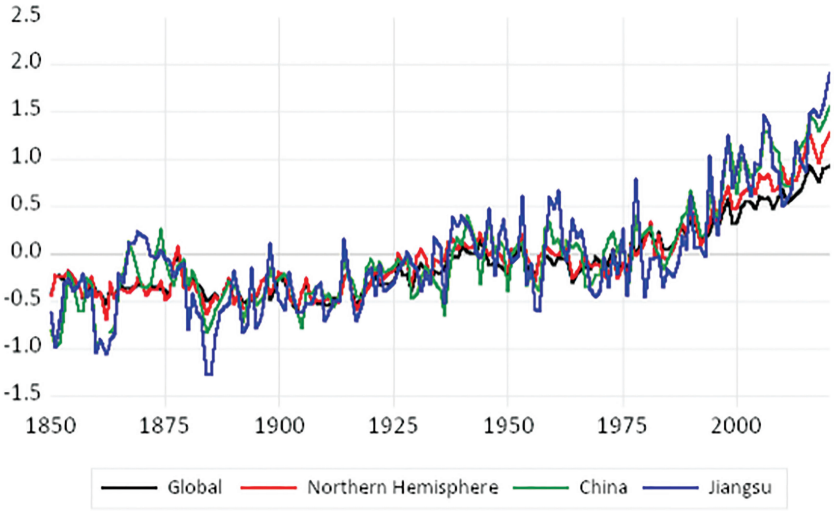

Figure 1: Temperature anomalies: Global vs China

The familiar picture emerges: up until around 1980, global temperatures fluctuated somewhat, but overall did not change dramatically. This has now changed; the increase since 1980 is evident. What is worth highlighting is that the increase in temperatures China witnessed during this period is even larger.[2]

Further interesting insights emerge from studying not only aggregate data, but also regional data from China. Jiangsu province, where the author of this article is based, witnessed even larger temperature increases.[3] It is also apparent, however, that up until 1980, the temperature anomaly in both China and Jiangsu province roughly followed the global trend; the deviation from that only started when the increase of temperatures began. Overall, it seems as if climate change seems to affect China stronger than other regions in the world.

How strong that effect is, however, depends crucially on which region in China we talk about.

The comparison of provinces from Northern and Southern China in Figure 2 and 3 show that there are enormous differences across this large country: while temperature increases in Heilongjiang province, located in the North, where China shares a border with Russia, are considerably larger than in Hainan, a tropical island in the South China Sea. The same applies to temperature increases in Inner Mongolia Autonomous Region compared to those in Yunnan province, which borders with Myanmar, Laos, and Vietnam.

This brief discussion of temperature data from China vividly illustrates that there is considerable heterogeneity in terms of changes in temperatures. The same can be said about health effects of climate change in China: as Cai et al. (2021) state, "every province in the country" is affected and "each province faces unique risks". The authors provide a very comprehensive assessment of the situation; they report 25 indicators within five domains. The summary they provide does not sound very optimistic: "climate-related health threats are worsening in China".

To give just a few examples: the authors document that, first, there is an increased exposure to heatwaves in China. In 2020, they find,

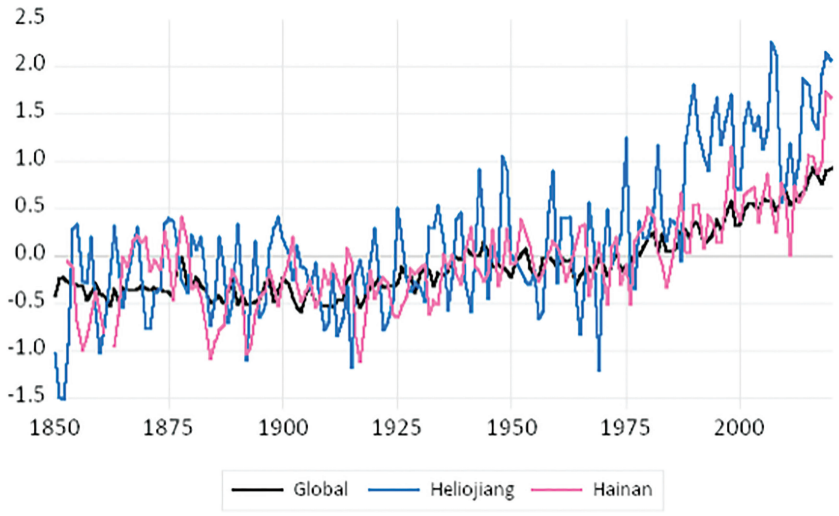

Figure 2: Temperature anomalies: Northern vs Southern China

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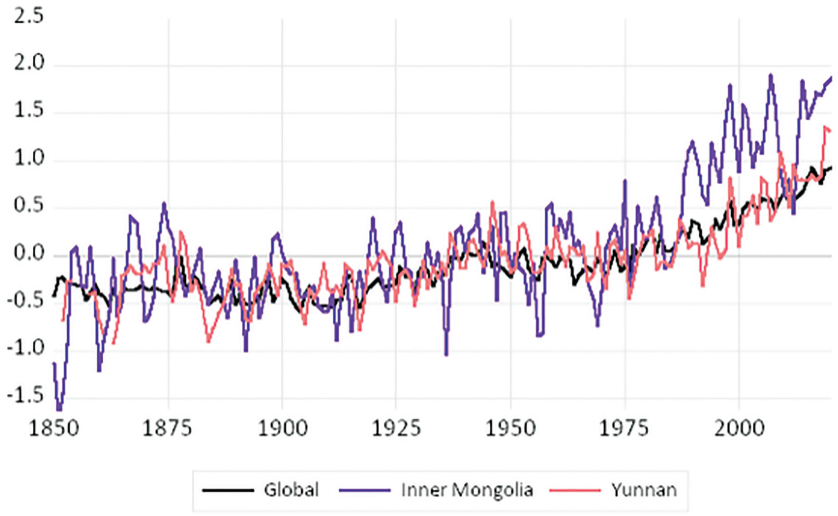

Figure 3: Temperature anomalies: Northern vs. Southern China, continued.

that heatwave exposure per person increased by 4.51 days, compared to the 1986-2005 average. The consequence is an increase in heatwave-related deaths of 92%. The number of deaths related to heatwaves in 2020 is estimated to be 14,500; which implies economic cost of $176 million. Not only that, increased temperatures also result in 31.5 billion hours lost work time, equivalent to 1.3% of the work hours of the total national workforce. This implies economic losses of 1.4% of China's annual GDP. Second, Cai et al. (2021) document that dengue risk is likely to going to be of increasing concern.[4] Third, flood events became more frequent and more intense; the 2021 Henan floods in July is still remembered by many. Obviously, there are differences across provinces in the extent to which they are affected by those threats: while heat-related mortality, labour loss and dengue risk is a particular concern in Guangdong province in China's South, flood and draught risk in particular affects Sichuan province, according to Cai et al. (2021).

The above-mentioned effect of heatwaves is of particular concern in China because of so-called total urban warming: increased exposure to extreme heat in combination with the heat-island effect experienced in urbanised areas. According to Tuholske et al. (2021), total urban warming "threatens the sustainability of rapidly growing urban settlements worldwide".

It is generally known that China went through a period of, as the United Nations (2018) document, rapid urbanization since the late 1970s; the numbers are nevertheless worth mentioning again.[5] The share of population in urban environments increased from about 20% in 1980 to about 60% in 2018. This relentless increase is not expected to end in the future: in 2030, this share is expected to be 70%, and 80% in 2050. China is expected to increase its urban population by 255 million people. Together with India and Nigeria, they account for 35 per cent of the growth in the world's urban population between 2018 and 2050. The level of urbanisation in China is now comparable to that of high-income countries. China stands out in Asia, where today the level of urbanisation is 50% - much lower than in Northern America (82%) and Europe (74%).

Tuholske et al. (2021) produce estimates of daily urban population exposure to extreme heat at global as well as regional levels. Their approach allows them to separate the contribution to exposure trajectories from urban population growth and total urban warming. Their key finding is that global exposure to extreme heat increased nearly 200% from 1983 to 2016. Total urban warming elevated the annual increase in exposure by 52% comparted to urban population growth alone. The authors, unsurprisingly, also state that there is a considerably degree of spatial heterogeneity, but their overall finding is that previous research underestimates extreme heat exposure.

In short, how climate change affects China depends on which part of China one has in mind. It seems to matter if it is Northern or Southern China, it also seems to matter if it is an urban or a rural area. However, the combination of being located in an area which already witnesses large temperature increases and the urbanisation process which is still ongoing, means climate change will have a considerable impact on China.

Footnotes

[1] Global and Northern hemispheric temperature anomalies are from the HadCRUT5 data set; see Morice et al. (2021). These anomalies are measured relative to a 1961-1990 reference period. Data for China and Chinese provinces are from Berkeley Earth; see www.berkeleyearth.org. Anomalies from this source are relative to a 1951-1980 average.

[2] It is well-documented that the Northern Hemisphere heats up faster than its Southern counterpart. The increase in temperatures in China also exceeds this additional benchmark.

[3] The larger fluctuation of regional temperature anomalies is attributable to the smaller number of stations this temperature data is based on.

[4] The exact finding is that "the vectorial capacity for the transmission of dengue by Aedes mosquitoes has increased by 25.4% in 2016–19 compared with 2004–07".

[5] All data in this paragraph is from United Nations (2018).

References

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