Taking The Pulse

Insights on Climate Developments in China

Winter 2023 Newsletter

Welcome to Taking the Pulse!

Taking the Pulse (TTP) provides the global climate community with access to the latest thinking inside China on the low-carbon transition.

In this newsletter, we gather recently published Chinese-language opinions, quotes, news articles, and reports to give readers a glimpse into the multi-faceted discussion on climate taking place in China.

In focus: Chinese climate scientists' recent studies on impacts and attribution

Highlighting the negative impacts of climate change is an important way to raise awareness and motivate action. However, a common challenge in climate communications is the lack of local stories that readers can relate to and resonate with.

The situation is improving, including in China, as climate impacts become more visible and the volume of related studies keeps growing. Climate attribution, a method of quantifying the link between a specific extreme weather event and climate change, has made a special contribution.

In this winter edition of the TTP newsletter, we collect recent studies carried out by Chinese scientists that explain how climate change is affecting China and its various regions and examine the role of climate change in specific local extreme weather events.

Frozen river in Longqing Gorge in Beijing. Image: Jiacheng

Climate Impacts in China

 ***The impact of extreme heat on lake warming in China***

Researchers at the Chinese Academy of Sciences

Research on temperature variations from 1985 to 2022 shows that China's national trend of extreme high temperatures displayed an overall increase, albeit with marked spatial variability: the southern regions of China exhibited the highest frequency of heat extremes while the eastern coastal and western regions of China had the lowest frequency.

Heat extremes exert a considerable influence on long-term lake surface temperature changes, contributing 36.5% of the warming trends within the studied lakes. The increase in lake surface water temperature caused by heatwaves can rapidly impact the physical, chemical, and biological characteristics of lakes, thereby exerting long-term effects on the entire lake ecosystem.

 ***Hotter days, dirtier air: The impact of extreme heat on energy and pollution intensity in China***

Researchers at Nankai University and Tsinghua University

This paper reveals that extreme heat increases energy demand, diminishes energy efficiency, and amplifies coal consumption, consequently elevating pollution intensity. Drawing upon the SSP126 and SSP585 climate modelling scenarios (scenarios representing high and low ambition, respectively) for future Chinese cities in the short-term (2041–2060), mid-term (2061–2080), and long-term (2081–2100), simulation outcomes demonstrate that the escalating frequency of hot days will perpetuate an adverse impact on pollution intensity across China.

 ***Economic burden of premature deaths attributable to different heatwaves in China: A multi-site study, 2014–2019***

Researchers at the Chinese Center for Disease Control and Prevention

Based on mortality, meteorological, air pollutants, and socioeconomic data of 24 study sites from 2014 to 2019, the research team conducted stratified analyses considering age, gender, and region. The overall findings underscored significant economic losses associated with mortality due to heatwaves. Females and individuals aged ≥ 65 years were more sensitive. However, the vulnerability to heatwaves varied with subpopulation and heatwave definition.

Men and individuals aged ≥ 65 years were identified as vulnerable populations with a prominent economic burden of deaths attributable to heatwaves. Heatwaves with lower temperature thresholds contributed to a greater economic burden of deaths in northern and temperate regions, while heatwaves with higher temperature thresholds exhibited a higher economic burden in southern and tropical regions. Additionally, cities were more susceptible to heatwave impacts than rural areas, with rural areas experiencing a higher economic burden of mortality in low-intensity heatwaves.

Precipitation combination patterns and their concentration degree determine the risk of dengue outbreaks in China

Researchers at Sun Yat-sen University and Tsinghua University

This study confirms that different precipitation concentrations have different effects on dengue risk under the same amount of precipitation. For the same amount of precipitation, the dispersed precipitation in the pre-summer rainy season leads to a higher dengue risk while excessive concentrated precipitation can reduce dengue risk. From 2005 to 2020, the amount of dispersed precipitation increased in southern and southwestern China and posed high risk of dengue in central China.

Causes of 2022 summer marine heatwave in the East China Seas

Researchers at the Ministry of Natural Resources

Recent occurrences of marine heatwaves in coastal China seas have caused serious impacts on marine ecosystem services and socioeconomics. In this study, the research team reported an extreme marine heatwave event in the East China Seas that lasted 75 days (about 2 and a half months) during the summer 2022. This extreme weather event was caused by various anomalous atmospheric and oceanic conditions.

The future likelihood and intensity of marine heatwaves in the East China Seas are likely to increase substantially in the coming decades, largely due to broad scale warming attributed to anthropogenic climate change. Consequently, there is an urgent need to develop marine heatwaves forecasting and early warning systems, and robust approaches to address climate change.

How does Mei-yu precipitation respond to climate change?

Researchers at Nanjing University of Information Science and Technology

Mei-yu is a unique summertime weather phenomenon in East Asia. In China, Mei-yu in the middle-lower Yangtze River valley (YRV) region is typically characterized by continuous rainy weather from mid-June to early July, significantly impacting agriculture, the economy, and people's daily lives. In the context of global warming, abnormal Mei-yu weather has led to severe meteorological disasters in recent years.

Over the past 60 years, there has been a noticeable increase in the number of rainless days, precipitation intensity, and the frequency and intensity of extreme rainfall events during the Mei-yu season in the YRV region. The most pronounced trend has been the increase in precipitation intensity. This shows that with global warming, the weather during the Mei-yu season has become more unpredictable and extreme.

Climate Attribution Studies

Rapid attribution of extreme cold event in East China in late 2023

Researchers at the Chinese Academy of Science

Since the middle of December 2023, North China, the Huang-Huai area, Northeast China, and Inner Mongolia have experienced the coldest regional average temperatures for this period since 1961. However, it is likely that the severe cold would be even more common and extreme in the absence of anthropogenic climate change. A rapid attribution study on the recent extreme cold weather shows that, if anthropogenic climate change were not a factor, an event of this kind would be 14 times more likely and around 1.9°C colder.

But the team behind this research highlights the complex impact of anthropogenic climate change on the weather. While the chances of extreme cold weather events have decreased, there has been a rise in both the frequency and intensity of other extreme events like heatwaves and heavy precipitation-heatwave combinations, posing a significant threat to human life.

Rapid attribution of the record-breaking heatwave event in North China in June 2023 and future risks

Researchers at the Chinese Academy of Science

A record-breaking heatwave event occurred in North China from 22 to 24 June 2023, with temperatures >40 °C at many meteorological stations. Both the empirical and coupled model approaches consistently showed that the intensity of 2023-like three-day heatwave events has significantly increased by at least 1.0 °C (range 0.8 °C–1.3 °C) due to anthropogenic climate change.

Even under the carbon neutrality scenario, future projections indicate that 2023-like events in North China are likely to occur at least 1.6 (range 1.3–2.1) times more often throughout the remainder of this century and be 0.5 °C (range 0.2 °C–0.8 °C) more intense than those under the 2023 climate.

Understanding and attribution of extreme heat and drought events in 2022: Current situation and future challenges

Researchers at the Chinese Academy of Sciences

The research team analyzed the attribution results for the hot days of 2022 in China's Yangtze River region, using GAMIL3.0 coupled with the land surface model CAS-LSM, two state of the art Chinese climate models. The study revealed that anthropogenic forcing could lead to an 11-fold increase in the risk of similar high-temperature events. As all sectors of society become increasingly concerned about the impacts of climate change, this study provides an important reference for advancing our understanding, prediction, and attribution of extreme weather events.

On the role of anthropogenic warming and wetting in the July 2021 Henan record-shattering rainfall

Researchers at Chinese Academy of Sciences and Chinese Academy of Meteorological Sciences

The research team adopted a new method for analyzing the attribution of extreme precipitation events in monsoon regions, trying to answer to what extent the known human-induced climate warming has influenced the intensity of Henan record-shattering rainfall in July 2021.

The study indicates that, compared to the climate conditions before the industrial revolution, the ongoing atmospheric warming and increased moisture due to human activities have contributed to an approximately 7.5% rise in the total precipitation during this extreme event. Given the extraordinary nature of Henan extreme rainfall, an average of 7.5% precipitation increase is a significant factor. Certain areas have experienced a more substantial increase of up to 15–20%. Hence, the impact of global climate warming on the Henan heavy rainfall in July 2021 should not be underestimated.

Heavy rainfall event in mid-August of 2020 in southwestern China: contribution of anthropogenic forcings and atmospheric circulation

Researchers at Chinese Academy of Sciences

In August 2020 (11th to 20th), frequent heavy rainfall in the Sichuan Basin led to localized damages and destruction, making it one of the most severe natural disasters in China that year. The region witnessed its highest total precipitation since 1960, with a statistically rare return period of 306 years.

The research team estimated that large-scale atmospheric circulation explained 47% of the event's intensity in mid-August 2020 in southwestern China. In similar weather conditions, climate change amplified the occurrence of intense precipitation. Model simulations revealed that anthropogenic forcings have roughly doubled the likelihood of such heavy rainfall. This increased risk resulted from an elevated precipitation variability rather than a modification in the long-term trend.

Human influences on spatially compounding flooding and heatwave events in China and future increasing risks

Researchers at the Chinese Academy of Sciences

Taking the spatially compounding heavy precipitation (in the middle and lower reaches of the Yangtze River) and heatwave event (in the neighboring South China regions) during June and July 2020 in China as a showcase, the research team found that anthropogenic climate change has substantially increased the likelihood of similar events by at least tenfold. Under a high-emissions scenario, such events will become 10 times more likely by the middle of the 21st century and 14 times more likely by its end, compared to the current climate. However, in a carbon-neutral scenario, this probability would decrease by 7 times.

Thank you for reading!

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