Greenpeace maps climate risk for extreme weather in China's major cities

Beijing, 14 July 2021 - A new report from Greenpeace East Asia analyzed climate risk from extreme heat and rainfall across the major metropolitan regions of Beijing, Shanghai, and Guangzhou-Shenzhen, finding risk is now highest in dense city centers but often growing fastest for communities outside the urban center. Press release.

The briefing summarizes findings from the report (link in Chinese), including:

1. Key findings
2. Beijing-Tianjin-Hebei risk analysis
3. Shanghai Yangtze Delta risk analysis
4. Guangzhou-Shenzhen Pearl River Delta risk analysis
5. Climate risk index framework

For any inquiries, contact August Rick august.rick@greenpeace.org.

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1. Key findings

➢ Extreme heat increased from 1961 to 2019 in all three cities, and intensified in the 1990s. The frequency and duration of heat waves have both increased in all three cities.

➢ Extreme rainfall increased from 1961 to 2019 in Shanghai and Guangzhou-Shenzhen, though the linear trajectory of this increase fluctuated from periods of extreme rainfall to relative drought. Annual accumulated rainfall and the frequency and duration of torrential rain storms increased.

➢ Climate risk from these extreme weather events is currently concentrated in the city centers, where population density is highest and where economic activity also concentrates. Climate risk is often growing fastest, however, outside of the city centers in more remote, less developed parts of the metropolitan region .

- ➢ Under the RCP4.5[1] emissions scenario mapped by the IPCC, our results suggest:
    - Average temperature change for Beijing-Tianjin-Hebei would be +2.2 - 2.4°C by 2100, with the most impacted areas increasing around +2.6° C. This would effectively extend summer by 28 days.
    - Average temperature change for the Shanghai Yangtze Delta would be +2.0 - 2.2°C by 2100. This would effectively extend summer by 24-28 days. Extreme rainfall would increase by 10% for most areas. In the central areas of the metropolitan region, it could increase by more than 25%.
    - Average temperature change for the Guangzhou-Guangdong Pearl River Delta would be +1.9 - 2.0°C. This would effectively extend summer by more than 40 days. In southeastern Guangdong province, where Shenzhen is located, extreme rain would increase dramatically, with the hardest hit areas having more than 25% more extreme rainfall.

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2. Beijing-Tianjin-Hebei risk analysis

- ➢ The Beijing-Tianjin-Hebei is experiencing the greatest increase in average temperature, with temperatures rising at a rate of +0.32°C every ten years.
- ➢ Measuring from the Beijing Weather Station, we tracked at least 50 heat waves. The increase in heat wave frequency has increased considerably since the year 2000. The average duration of heat waves also increased.
- ➢ An assessment of extreme heat and related factors contributing to climate risk in the Beijing-Tianjin-Hebei metropolitan region from 2000 to 2017 show that risk is currently highest in the Beijing and Tianjin city centers.

[1] The RCP 4.5 scenario was described by the IPCC as the “intermediate scenario” in 2014, where global average temperature is is “more likely than not” to increase +2°C by 2100: https://ar5-syr.ipcc.ch/topic_futurechanges.php

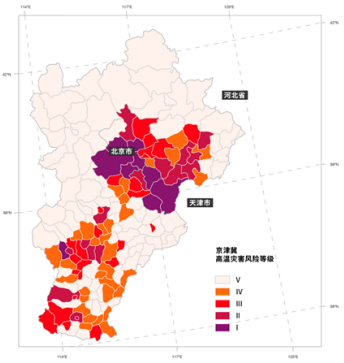

Figure 5: Extreme heat climate risk zones in Beijing-Tianjin-Hebei based on the areas with the highest climate risk (left).

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3. Shanghai Yangtze Delta risk analysis

➢ Current climate risk is highest in Shanghai, Suzhou, Wuxi, Changzhou, and Ningbo. These cities are the highest-density areas in terms of population and economy. They are particularly at risk of hazards from extreme rainfall.

➢ The next most at risk areas include Hefei and Ma'anshan in Anhui province, located on the Yangtze and Qiantang river banks, and the eastern coastal area of Zhejiang province.

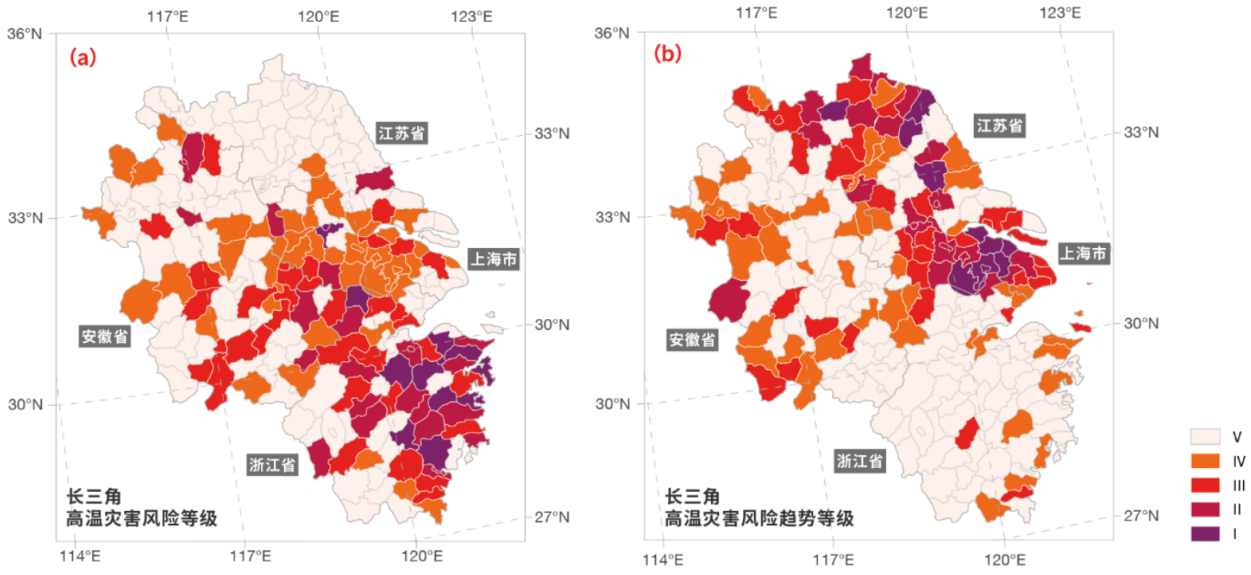

Figure 3: Extreme heat climate risk zones in the Shanghai Yangtze Delta based on the areas with the highest current climate risk (left) and the fastest rise in climate risk (right).

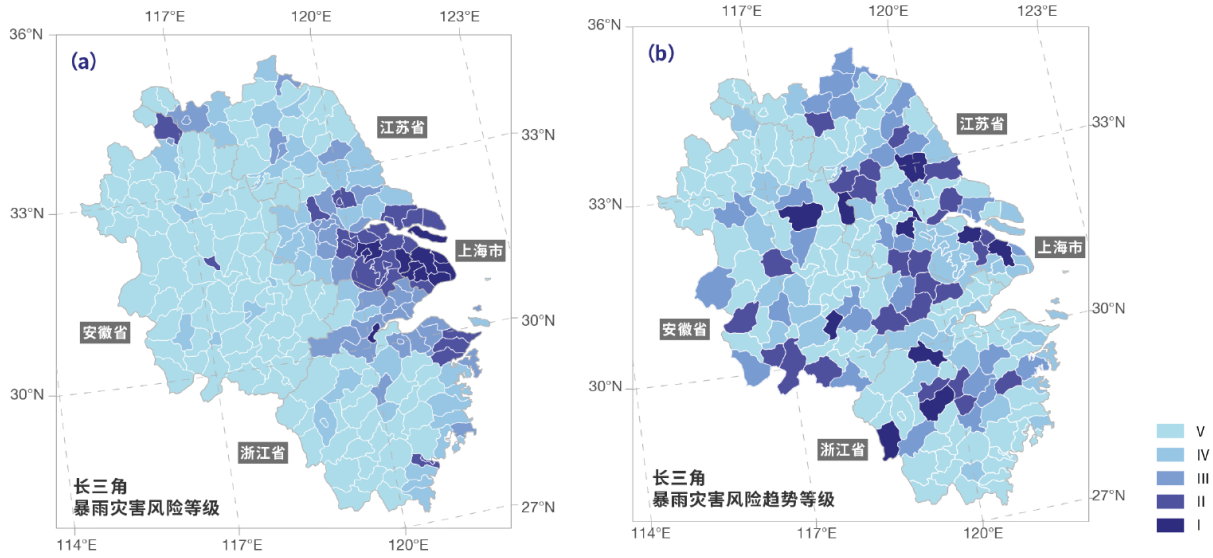

Figure 4: Areas at risk from extreme rain in the Shanghai Yangtze River Delta based on the areas with the highest current climate risk (left) and the fastest rise in climate risk (right).

- From 1961 to 2019, average annual temperatures have increased, with this trend accelerating dramatically since 1990, with most years surpassing the 1961-2019 average annual temperature average of 16°C.

- Temperatures around the Hangzhou Weather Station reached 35°C or above 429 times in the last 60 years, with 177 of those occurring since 2001, 41% of the total.

- The highest recorded temperature at the Hangzhou Weather Station was 41.6°C in 2013, followed by 41.3°C in 2017, 40.3°C in 2003 and then again in 2016, and 39.9°C in 1978.

- From 1961 to 2019, the average accumulated rainfall for Shanghai Yangtze Delta was 1225.6 mm, a measure that fluctuated but steadily increased at an overall rate of +34.6 mm/10 years. The year with the highest rainfall was 2016, with 1666.9 mm of total accumulated rainfall.

4. Guangzhou-Shenzhen Pearl River Delta risk analysis

➢ The current highest extreme heat climate risk zones are in Meizhou, Heyuan, Shaoguan. All of these areas are inland.

➢ The fastest increase in extreme heat climate risk is in Meizhou, Zhanjiang, and Zhaoqing.

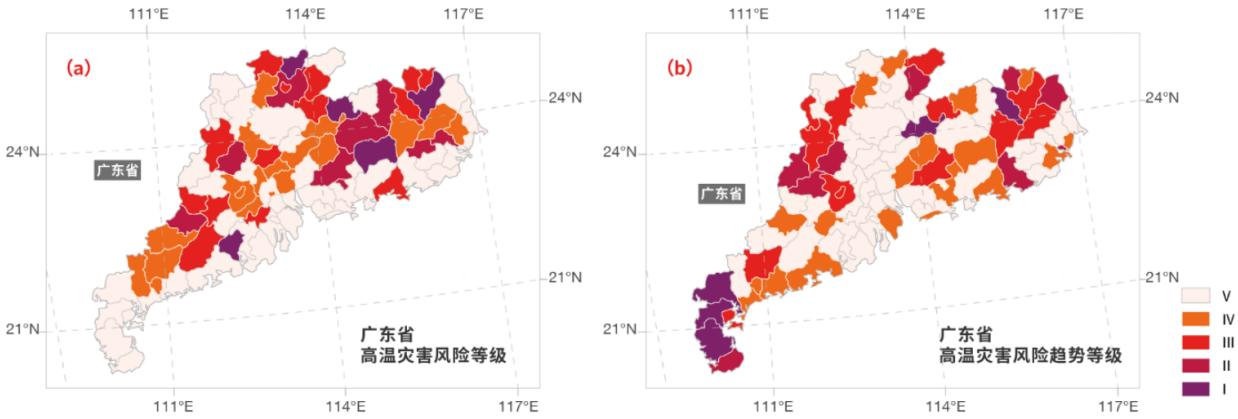

Figure 1: Extreme heat climate risk zones in the Guangzhou-Shenzhen Pearl River Delta based on the areas with the highest current climate risk (left) and the fastest rise in climate risk (right).

➢ The current highest current extreme rainfall climate risk is in Guangzhou, Foshan, Dongguan, and Shenzhen. These constitute the urban centers of the city.

➢ The areas of the Guangzhou-Shenzhen Pearl River Delta with the fastest increase in climate risk from extreme heat are Meizhou, Zhanjiang, and Zhaoqing.

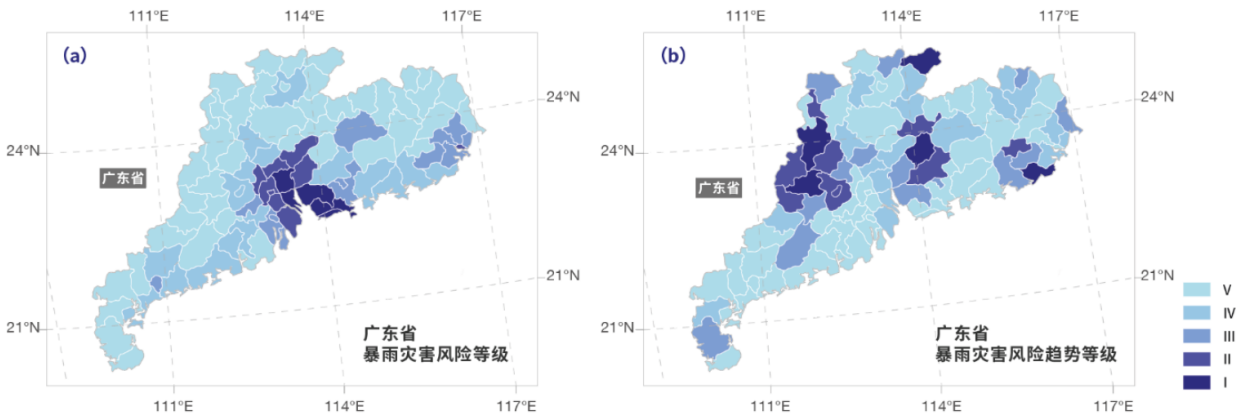

Figure 2: Extreme rainfall climate risk zones in the Guangzhou-Shenzhen Pearl River Delta based on the areas with the highest current climate risk (left) and the fastest rise in climate risk (right).

- The average number of days with extreme heat (35°C or higher) in a year over the last 60 years was 16.5 days/year. Since 1998, it was 23.7 days/year. The most days with extreme heat in a single year 31.5 days[2] in 2014, 29.4 days in 2018, 28 days in 2016, 27.8 days in 2004, and 27.6 days in 2009.
- The most days with temperatures at 38°C or above in a single year were 2.3 days in 2003, 1.5 days in 2004, 1.4 days in 2005, and 1.2 days in 2008.
- There have been 98 heat waves at the Guangzhou Weather Station in the past 60 years. Seventy-three of them occurred after 1998, 74% of the recorded total.

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5. What is a climate risk index?

- The climate risk index compared hazard, exposure, and vulnerability among local population, economy, and ecology.
- Hazard from extreme heat included six factors: extreme daily temperature highs, average daily temperature highs, days with temperatures above 35°C, days with temperatures above 38°C, the intensity of periods with multiple high temperature days, and the duration of periods with multiple high temperature days.
- Hazard from extreme rainfall included four factors: days with extreme rainfall, accumulated rainfall, intensity of periods with multiple days of extreme rainfall, and accumulated rainfall in periods with multiple days of extreme rainfall.

[2] This number contains a fraction because it is an average of multiple readings over a single day from measuring stations around the metropolitan area.

- Exposure derived from four factors: the net population, population density, local GDP, and ecological area coverage (mitigating factor).
- Vulnerability derived from five factors: percentage of elderly in the population, percentage of minors in the population, local employment GDP, per capita GDP, nonporous surface area coverage, and per capita hospital beds (mitigating factor).