Reflections on the Catastrophic 2020 Yangtze River Basin Flooding in Southern China

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https://doi.org/10.1016/j.xinn.2020.100038
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During the summer of 2020, southern China suffered from catastrophic flooding, the massive basin flood mainly occurred in the Yangtze River’s middle and lower reaches. As of July 20, 2020, the cumulative precipitation since the rain season started exceeded 500 mm over most of the Yangtze River Basin, reaching >1,200 mm in some areas of the lower reaches, exceeding the same period in 1998, the severest flood year in the past 60 years. Several water gauge stations at Poyang Lake and Chaohu Lake exceeded their historical record values. The water levels in the Wuhan section of the Yangtze River were among the highest ever recorded. As of July 22, 2020, 45.5 million people had been affected by the floods, with 142 people having died or were missing, and the direct economic losses expected to be around 116 billion RMB (~16.5 billion US dollars). However, the losses from this flood are much lower than those of previous major floods. For example, the catastrophic 1998 flooding led to 1,526 deaths and economic losses of 255 billion RMB (~36.4 billion US dollars). The reasons behind this are worthy of further study and discussion, and may be used for reference in the future and for other countries.

After the historic floods in 1998, China accelerated the construction of large-scale water conservancy projects on the Yangtze River’s mainstream and its tributaries, including the Three Gorges, Xiangjiaba, Xiluodu, Wudongde, and Ertan dams, in addition to another ~100 large reservoirs. This increased the total flood control storage capacity to ~80 billion m³. Meanwhile, flood control levees along the Yangtze Rivers and affiliated lakes were updated and strengthened, with the levees on both sides of the Yangtze River mainstream now 2 m higher than the highest recorded water levels. Such an infrastructure has dramatically improved the flood control capacity of this region, and played a crucial role in responding to the catastrophic 2020 flooding in southern China.

In addition to the conventional human-engineered solutions (gray infrastructure), which depend on large-scale projects of canals, dams, levees, and other flood control facilities, concerted actions with eco-friendly solutions (or green infrastructure) to improve water resilience, have been undertaken over the past two decades. For example, in Dongting Lake, the implementation of the Converting Farmland to Lake policy has increased the areas of lakes by around 800 km². Since 2015, it has become a national policy to create “sandbox cities,” which involves improving the water storage capacity of lakes, parks, wetlands, and beaches. This has changed the nation’s strategy dealing with extreme rainstorm events, but leaving them almost abandoned during long-term dry periods. Therefore, the appropriate utilization and maintenance of these facilities is key to the long-term sustainable development of the whole river basin.

Moreover, China’s urbanization level has increased rapidly, from 33.4% in 1998 to 60.6% in 2019, with an average annual growth rate of 1.3 percentage points (http://data.stats.gov.cn), leading to the size of the urban built-up land area by the end of 2018 to be 2.7 times of that in 1998. Furthermore, the Yangtze River Basin has developed into one of the most populated and economically developing regions in the world, with several super urban agglomerations, and large numbers of residential areas and industrial production facilities distributed on both banks of the river and around the lakes. Even in some regions, the lake that was previously reclaimed from farmland, has now returned to farming and other uses. About 6,056.9 km² (41.6%) of the total lake area has been reclaimed since the 1970s for the 112 lakes in the Yangtze River Basin, leading to a decrease of ~13 billion m³ (30%) of the total lake storage. The reduction in the extent of natural flood discharge areas and buffer zones can, therefore, lead to conditions conducive to more disastrous flooding under the same rainfall conditions.
In addition, climate change is making the situation more complicated and severe. According to the recent report of the World Meteorological Organization, the past 10 years have been the warmest since observational records began. Climate change is expected to increase the frequency of extreme precipitation events, and also change the distribution of rainfall, with the frequency of light rain decreasing, and that of heavy rain increasing. With the intensification of climate change, the frequency of heavy rains will increase in the future, and the impact of large-scale floods should not be underestimated.

Within the context of potential disasters and uncertain forecasts, the general population's awareness of risk plays a vital role in disaster risk reduction. Society needs to understand when houses or properties are in a risk area, and that there is a responsibility to reduce or avoid enhancing or falling into such risk. Meanwhile, improved awareness of risk can encourage people to buy insurance, which is an effective way to recover from flood (or any) disasters. Governments can also use financial means to purchase or transfer those properties in high-risk zones to lower-risk areas. It is well known that the higher the awareness of risk, the more possibilities there are to avoid risk.

In summary, despite the record-breaking rainfall and floods in southern China in 2020, the magnitude of the disaster was much lower than in 1998 or other extreme years. The response to this disaster has provided a reference for all countries to cope with the more extreme consequences of climate change. Although it is most likely that climate change will increase the risk of extreme disasters, we can still reduce the impact and losses caused by disasters with active adaption and mitigation measures.

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ACKNOWLEDGMENTS
Funded by the Strategic Priority Research Program of the Chinese Academy of Sciences (grant no. XDA23090303), the NSFC Major International (Regional) Joint Research Project (grant no. 41520104002), and the Youth Innovation Promotion Association.