Floods in Henan, China: A Case Study

Introduction

One year after the outbreak of COVID-19, China has been hit by another of the severest floods in the country's history[1]. In July 2021, 140 towns and townships in 31 counties and districts in China's Henan Province were affected by heavy rainfall, causing extreme floods that led to massive death and economic losses, with Zhengzhou city being the most severely affected[2]. Nearly 14.786,000 people were affected by the disaster[1,2]. The national weather station in Zhengzhou recorded 7.95 inches of rain per hour, and flooding occurred, leaving 398 people dead or missing[1,2]. In addition, the flood increased the spread of COVID-19 in the local area, and the resulting physical and psychological trauma to the public[3].

Facts of the Case

From July 16 to 21, 2021, a series of consecutive extreme rainstorms caused unprecedented flooding in China's Henan Province. The relevant meteorological data shows the possibility of heavy rainfall over Henan before the flood occurred[4]. On July 21, 2021, two water vapor transport channels over Henan province, typhoon "Fireworks" and subtropical high provided the necessary water vapor conditions for the occurrence of rainstorm[4]. In Addition, Typhoon "Cempaka" in Guangdong pulled water vapor from the South China Sea into the land. Under the influence of terrain uplift, it accumulated a large amount of rain in Henan, causing floods[4].
From July 19 to 20, Zhengzhou received an average of 9.96 inches of precipitation, with the maximum hourly rainfall of 7.95 inches occurring at around 4 p.m on July 20[1,2]. Zhengzhou received its previous average annual rainfall of 25.2 inches in just one day on July 20 and 21[1,2].

Epidemiological aspects of the event

The heavy rain caused internal flooding in Zhengzhou, causing severe waterlogging on roads and almost complete suspension of traffic. Most of the casualties occurred in a large number of tunnels, subway stations, underground shopping malls, and underground parking lots, most of which were flooded[2]. One of the worst storms left a train of subway Line 5 stranded and flooded, with water up to passengers' necks. Fourteen people were killed and five injured[1,2]. From July 16 to August 2, the heavy rainfall affected 13,912,800 people in 150 urban areas of the province, leaving 302 dead and 50 missings. Zhengzhou, 292 people were killed, 47 missings; In Xinxiang, 7 people were killed and 3 were missing. 2 deaths in Pingdingshan; 1 person was killed

in Luohe[2].
By September 20, floods and secondary disasters caused by the rainstorm had affected 14.786,000 people in Henan province, leaving 398 people dead and missing, 380 of them in Zhengzhou. Crops were affected by over 10,485 thousand hectares, 18,000 houses collapsed and direct economic losses reached 21.04 billion US dollars[1]. The flood affected the prevention and control of COVID-19 in Zhengzhou. Nosocomial infections occurred in Zhengzhou Sixth People's Hospital, and 28 cases of infected patients with Delta variant strain were reported in one day[1,3]. However, according to the study, there was no correlation between precipitation and local COVID-19 cases, suggesting that heavy rainfall did not affect disease spread. Zhengzhou, however, was affected by both[1].

Management of the event

On July 16, 2021, the Henan Provincial Flood Control headquarters issued a directive on severe rainfall disaster weather, and the Meteorological Bureau also launched a level III emergency response for major meteorological disasters, which was upgraded to Level I on July 21[1,2]. On July 21st the government announced an emergency evacuation of more than 160,000 people. On July 20, the Ministry of Emergency Management dispatched 1,800 fire and rescue workers from seven neighboring provinces to provide emergency relief in Henan[2]. About 20,000 Chinese troops and fire brigades were sent to assist in major areas such as embankments and reservoirs. In response to the communication interruption caused by the rainstorm, the Ministry of Emergency Management assigned a drone to fly over Zhengzhou to carry out communication succession[2]. The Ministry of Finance allocated $9.44 million in advance for disaster relief and $6.29 million for agricultural rehabilitation and repair facilities[1,5]. Local governments in Zhengzhou have purchased security insurance for the residents of the whole district, and the insurance compensation amount is 290 million US dollars[1,5]. In addition, a number of hotels have announced free reception for stranded customers[6], and all sectors of society have donated materials and financial assistance[1].

Communications of the event

Meteorological authorities have issued five warnings ahead of the heavy rain. However, the local government did not take specific measures to suspend school and underground transportation, and the emergency response was seriously delayed, believing that the rain would not be too heavy in the north[2]. When the danger of Changzhuang Reservoir appeared on the 20th, Zhengzhou city still did not start the level I emergency response[2]. There is an obvious disconnection between meteorological disaster forecast information and flood control response mechanism, which leads to the lag of danger prevention. I think it’s a pity for not saving more lives.

The flood caused a large area of Zhengzhou city power, water, and communication signal interruption, widely affecting communication capacity[2,7]. Authorities also scrambled to repair power and water supplies[1,7]. The breakdown of communications has made relief efforts more difficult.
In addition, the number of deaths due to the disaster is also under-reported, data is not accurate, it is likely to lead to the delayed rescue of missing people[2].

Summarize

The heaviest rain in Henan since the establishment of a weather station led to the major flooding in Hunan Province. The flooding reflected many aspects of poor preparedness, including inadequate communication of the severity of information, delayed emergency response, inaccurate public access to information, and inadequate pre-disaster mobilization[1,2]. The unusual heavy rains suggest climate change may have been exacerbating the disasters[1].

References

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