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Research Article

Study on the reconstruction of flood disaster in the Yangtze River Basin in 1860

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Abstract

The Yangtze River Basin is highly susceptible to severe flood disasters, yet instrumental records are too short to capture long-term flood dynamics. This study reconstructs the flood event of 1860 AD in the Yangtze River Basin using multiple historical sources, including Qing Dynasty archives, local chronicles, hydrological inscriptions, and survey data. We systematically compile precipitation records, water level information, and disaster descriptions to characterize the rainfall pattern, flood progression, and spatial distribution of impacts. The results show that in 1860 AD, the Yangtze Basin experienced a climate anomaly with prolonged rain and snow in spring and intense summer rainfall concentrated in the upper and middle reaches. The flood peaked at Yichang Station on 18 July with a discharge of 92 500 m^3 s^{-1} and a water level of 58.32 m, making it the second largest flood of the Qing Dynasty after the 1870 AD event. The most severe inundations occurred in Sichuan, Hubei, and around Dongting Lake, where embankments collapsed, farmlands were destroyed, and numerous casualties were reported. The Qing government's relief efforts were constrained by fiscal deficits and internal unrest, forcing reliance on local fundraising. This reconstruction extends the flood record of the Yangtze River and provides a quantitative basis for understanding historical hydroclimatic extremes and their societal responses.

Introduction

The sixth assessment report released by IPCC points out that the intensification of global warming will increase the intensity and frequency of extreme events such as extreme temperature, heavy precipitation and drought [1]. There are many rivers in China and most of them are located in the monsoon region. Flood disasters are frequent, the impact range is wide, and the economic losses are large. During more than two thousand years from 206 BC to 1949 AD, the number of large flood disasters in China can reach 1092 times, with an average of once every two years [2]. It is of great significance to study the flood disaster process, disaster mechanism, and response and impact on disaster prevention and the work deployment of national flood control and disaster relief. Due to the short period of instrumental data in China 's flood disaster research, it is difficult to explore the deeper rules of flood events only in the period of instrumental data. Reconstructing historical flood events through various historical documents and fully excavating the hydrological information contained in historical data can extend the research period. The information of many important historical flood events is incomplete and unsystematic. Therefore, it is necessary to comprehensively use various historical records to improve and quantify the historical flood events as much as possible.

The floods in the Yangtze River Basin are mostly rainstorm floods, which are affected by many factors such as monsoon activity, subtropical high, Tibetan Plateau and topography. With the intensification of extreme rainfall events, the Yangtze River Basin is also facing increasing

flood risk. Flood control and disaster relief in flood season is a major problem. The complex geographical environment and climatic factors make the causes of floods in the Yangtze River Basin very complex. The short scale of modern observation records greatly limits the depth of many studies on flood events in the Yangtze River Basin [3]. Therefore, the study of historical flood events in the Yangtze River Basin is of great value. The upper reaches of the Yangtze River have a large number of long-standing and widely distributed flood and drought hydrological inscriptions. These existing water level inscriptions in the upper reaches of the Yangtze River can provide extremely valuable historical hydrological data support for various application studies such as river hydropower project construction, flood control and disaster reduction [4]. Since the Ming and Qing Dynasties, the records of local chronicles and other archival historical materials have been more systematic and complete. The study of typical flood events can be done by combining various historical archives with hydrological inscriptions to verify and supplement with each other. In summary, it is of great significance to study the flood disasters in the Qing Dynasty based on rich historical documents, which is helpful to deepen the understanding of historical flood disasters, study deeper laws and mechanisms, and provide reference for disaster relief.

The research on flood disasters in foreign countries focuses on the occurrence mechanism, risk assessment, flood monitoring and prediction, social impact and recovery of historical flood events. For example, Disse et al. [5] analyzed the hydrological characteristics of the Rhine River Basin and studied the causes and effects of recent flood disasters in the basin. Piadeh et al. [6] studied the role of CDVT (digital visualization tool) in flood disaster risk assessment. Some scholars fitted historical climate and historical flood events to assess the severity and risk level of floods [7-10]. Stamataki and Kjeldsen used hydrodynamic models to reconstruct historical flood events in the British city of Bath [8]. Haque studied the emergency measures and social response to the 1997 flood in Canada [9]. Bathrellos et al. used historical data and ancient topographic maps to extract historical flood in the Pinios River basin, Greece [10].

The research of domestic scholars focuses on the compilation of historical data of flood disasters, as well as the time series and case studies of flood disasters. By sorting out and analyzing a variety of historical data and other data, a large number of works on flood disasters have been obtained. These include the 'Yearly Charts of Dryness/Wetness in China for the Last 500-year a large Period' [11], 'Compendium of Chinese Meteorological Disasters' [12], 'Chinese Three Thousand Years Meteorological Records Collection' [13], 'China's great floods: A summary of disastrous floods' [14], 'Modern China Famine Annals' [15], Historical Materials of Floods Archives in Southwest International Rivers in the Yangtze River Basin in the Qing Dynasty' [16], 'Research on the Laws and Causes of Drought and Flood in the Yellow River Basin' [17]. It is of great help to study the mechanism of historical floods in the Yangtze River Basin.

The case study focuses on the flood disaster in a specific year, through the reconstruction of the process of flood events in the historical period, the reconstruction of rain, water, disaster and other aspects. Based on local chronicles, archives and other historical documents, Ma reconstructed the process of flood events in the Haihe River Basin in 1917 AD and 1939 AD, and analyzed the response process of flood disasters in these two years [18], Ye et al. reconstructed the precipitation process, flood process and flood response process of the flood in 1801, and studied the three links of flood situation-disaster relief-post disaster response [19], Hao et al. reconstructed the spatial and temporal distribution, disaster impact and social response of flood disasters in the Qing Dynasty in 1823 AD and 1849 AD [20]. Zhang analyzed and studied the basic situation, disaster mechanism and social and economic impact of the flood in Daoguang three years (1823 AD) [21]. Based on historical data, Fang et al. sorted out and reconstructed the impact of flood disasters and the process of social response in the Haihe River Basin in 1917 AD [22]. Zhao et al. reconstructed and analyzed the flood events in Jiangsu and Anhui provinces in 1755 AD and 1849 AD based on historical data such as archives of the Qing Dynasty, and conducted a comparative study of the disaster situation in the two years on this basis [23]. Some other scholars have established a long-term sequence for research and analysis, such as combined with the rain and snow archives of the Qing Dynasty and modern agricultural meteorological observation records, and established the seasonal precipitation sequence of Shandong from 1736 AD to 2000 AD according to the model [24]. Zhang et al. systematically reconstructed the interannual and seasonal precipitation series of Nanjing, Suzhou and Hangzhou in the 18th century based on the historical records of 'Qingyulu' [25]. Ge et al. reconstructed the Meiyu change sequence in the middle and lower reaches of the Yangtze River from 1736 AD to 1911 AD by using the rain and snow archives, and analyzed the intensity change of the

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East Asian monsoon since 1736 [26]. Based on historical data and hydrological data, Zhang constructed the grade sequence of drought and flood disasters in Fuhe River Basin from 1470 AD to 1949 AD, and systematically discussed the impact and social response mechanism of drought and flood disasters [27]. Li et al. integrated local chronicles, archives and other data to establish a long-term sequence of flood events in the Yangtze River Basin in the past 2000 years [3], Chen drew the distribution map of drought and flood years in the upper and middle reaches of the Yangtze River from 961 AD to 1980 AD, and discussed the climatic characteristics and influencing factors of drought and flood [28]. Shi et al. discussed the relationship between the Yangtze River flood and climate change since 1840 [29]. The above research provides a data basis, ideas and methods for the reconstruction of the flood disaster process in 1860 AD. The case studies of historical flood years in the Yangtze River Basin are more concentrated in 1870 AD [30-33] and 1998 AD [34-36]. Other typical flood years have also been studied by many scholars. Wang's research results on floods in the Yangtze River Basin are many: the study of historical floods in the Jinsha River is also more detailed [37-38]; the persistent drought and flood in Sichuan Basin in 1937 AD were studied [39]. The spatial and temporal distribution characteristics of the Yangtze River flood rainstorm in 1788 AD and its previous climate anomalies were analyzed and discussed [40]. Through the collection of historical materials, county annals and inscriptions, the process and climate anomalies of the Yangtze River flood in 1860 AD were summarized [41]. Zhang et al. reconstructed 12 typical flood years in the Yangtze River Basin, and studied the flood characteristics and evolution rules of each year based on multi-source data [42].

According to the historical records of major flood events in the Yangtze River Basin during the historical period, the research of flood disasters in 1788 AD, 1849 AD, 1860 AD, 1870 AD, 1931AD, 1954 AD and 1998 AD was sorted out. There are a large number of continuous hydrological inscriptions in the upper reaches of the Yangtze River, including flood hydrological inscriptions and dry hydrological inscriptions across the main stream. It has great research significance and value, and has a strong reference for the study of droughts and floods that are not particularly detailed in historical data records. The hydrological inscription itself contains rich hydrological information, which can reflect the development process of flood events in the historical period, but there are few achievements in using it to help reconstruct the flood process. This paper intends to make full use of the inscriptions with high reliability in the upper reaches to reconstruct the flood development process in the upper reaches of the Yangtze River.

In the historical flood survey data of Yichang station, the flood peak in 1860 AD is second only to that in 1870 AD, which belongs to the catastrophic flood in the upper reaches of the Yangtze River. The flood disaster in this year had a great impact on the coastal areas of the Yangtze River and caused great damage to the towns along the river. However, there are few systematic studies on this year, and the previous studies on the reconstruction of the rainfall, water regime and disaster situation of the flood disaster in these two years are relatively simple and mainly based on historical data, lacking quantitative analysis. It is worth discussing how the differences in natural and social backgrounds in 1860 AD will affect the impact and response process of flood disasters. However, the historical materials of flood disasters in this year are abundant, and the number of various local chronicles, archives and inscriptions is abundant. It is very meaningful to use these data to reconstruct the two-year flood disaster process, and it can also supplement the case study of flood disasters in the Yangtze River Basin in the Qing Dynasty. Therefore, this paper chooses the flood disaster in 1860 AD to carry out research.

Data Sources and Research Methods

The Study Area

The Yangtze River Basin starts from Tibet in the west, reaches Jiangsu and Zhejiang in the east, and flows into the East China Sea. It flows through many provinces and cities in China. It has a wide basin, many tributaries and abundant water. It is divided into the upper, middle and lower reaches by the Yichang station and Hukou station. The topography of the Yangtze River Basin is complex and diverse, and the overall terrain shows a ladder-like distribution characteristic of high in the west and low in the east. The climate of the basin is warm and humid, the rain and heat are in the same period, the monsoon climate is significant, the precipitation is concentrated and abundant, and floods are prone to occur. According to statistics, from 100 AD to 1991 AD, there were 176 floods and 113 severe droughts in the Yangtze River Basin. Among them, the frequency of floods was significantly higher than that of droughts [43], with an average of 9.3 floods per century. 90 % of the flood in the Yangtze River Basin comes from the upper and middle reaches, of which the water volume in the upper reach's accounts for 50 % of the total water volume of the Yangtze River [44]. Therefore, it is

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necessary to study the flood process in the upper reaches of the Yangtze River. There are few historical records of the upper reaches of the Yangtze River, so it is necessary to study the occurrence and development process of the upstream flood and its influence in combination with hydrological inscriptions.

The Yangtze River water network is dense, the main and tributary water systems are developed, and the tributaries are abundant: including Jinsha River, Mintuo River, Jialing River and many other tributaries, with abundant water. The section from Yibin to Yichang in the main stream of the Yangtze River is the upstream section, which mainly flows through mountainous areas and has a large terrain gap. The section from Yichang to Hukou is the middle reaches of the river, flowing through the low-lying plains of the two lakes; the downstream section is from Hukou to the estuary. From Yibin to Yichang, this part of the main stream is called the Chuanjiang River. Taking Chongqing as the point, it is divided into the upper Chuanjiang River and the lower Chuanjiang River. The section from Yichang to Yueyang of the Yangtze River is called Jingjiang. Therefore, this paper selects the area flowing through the Yangtze River in Sichuan Province, Hubei Province, Hunan Province and the lakeside area of Jiangxi Province, and the area along the Yangtze River in Anhui Province as the main research area (Figure 1). The provinces, prefectures, states, and counties in the study area are all based on the 1911 data of the Chinese Historical Information System jointly developed by Fudan University and Harvard University (CHGIS, the data are in the v6 version, and the source website is: https://chgis.fas.harvard.edu/data/ chgis/v6

Data Sources

The various types of data collected and extracted in this article are mainly as follows (Table 1)

The 'Construction of the integrated database of natural disaster information in the Qing Dynasty' collects various elements of historical disaster data and includes all recorded disaster types, including the whole process before, during and after the disaster, and basically includes all kinds of literature related to disasters, impacts and responses in the Qing Dynasty [47]. The database contains historical documents such as official history, factual records, and local gazetteers. The source of information

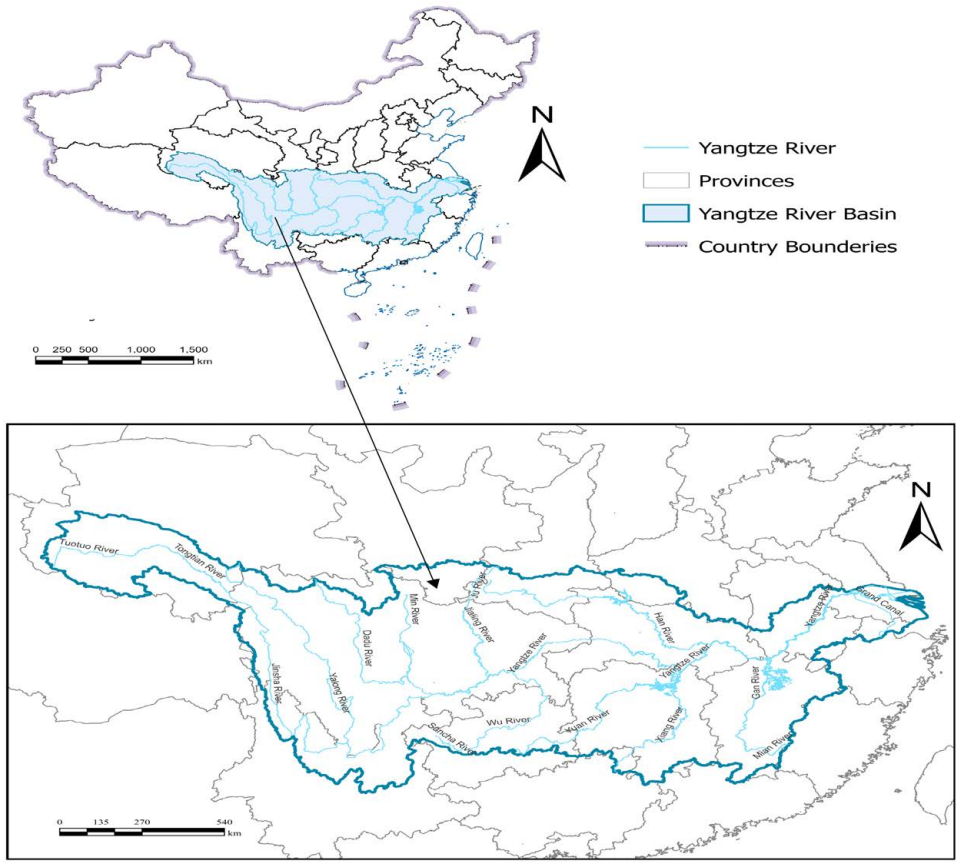

Figure 1: The Yangtze River Basin.

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Table 1: The data sources used in this paper and the extraction contents.

Data sources	Brief introduction	Extraction contents
The Information Integration Database of Natural Disasters in Qing Dynasty [45]	It contains all kinds of literature on the time, place, process, impact and response of disasters in the Qing Dynasty, involving precipitation, flood development, disaster situation, government and public response, etc.	Rain, flood, disaster and disaster relief situation
'Historical Materials of Floods Archives in Southwest International Rivers in the Yangtze River Basin in the Qing Dynasty' [16]	It includes the historical data of floods in the counties of thef Yangtze River Basin from 1736 to 1977.	Related situation of disaster, disaster relief
'The Compilation of China's Historical Flood Survey Data' [46]	The water level and flood discharge in the historical period were investigated according to the basin and water system.	The water level and flood discharge
'Hydrologic inscription cultural relics in Three Gorges Reservoir Area' [4]	The recorded extreme water level data of flood and low water along the main stream of the Yangtze River were collected.	Flood extreme water level, time and place
'Compendium of Chinese meteorological disasters' [12]. 'Chinese Three Thousand Years Meteorological Records Collection' [13]	Records of the historical natural disaster information, weather anomalies, etc.	Rain, flood and disaster-related records

is wide, covering disasters in various parts of the Qing Dynasty. Based on the database, this paper extracts the Actual Records of the Qing Dynasty, the History of the Qing Dynasty, Imperial Edict Archives of the Qing Dynasty and the local gazetteers of the provinces, etc., collects the information related to the flood events in the Yangtze River Basin in 1860 AD, extracts the meteorological and hydrological disasters of the disaster category as rainwater and floods according to time, and collects and collates the natural anomalies, disaster-causing processes, and disaster impacts and responses in the disaster process.

According to the administrative divisions of the Qing Dynasty, 'The Historical Materials of Floods Archives in the Southwest International Rivers of the Yangtze River Basin in the Qing Dynasty' [16] collected and compiled the historical materials of floods and waterlogging in the water systems of the Yangtze River Basin from 1736 AD to 1911 AD. In the historical records of 1860 AD, there are 11 records describing the water situation in Hubei Province and 5 records describing the water situation in Sichuan Province. There are many records related to rainfall in this year, but they are scattered in various provinces, Jiangxi, Hunan and other places.

'The Compilation of China's Historical Flood Survey Data' [46] systematically sorted out the historical flood data of various basins in China. The Yangtze River Basin is divided into Jinsha River system, upstream (Yibin to Yichang interval), Min-Tuo River system, Jialing River system, middle reaches (Yichang to Hankou interval) and other regions. The book takes the river basin and the river section as the basic unit, and collects the data obtained from the field investigation in various regions, including the flood water level and flood peak flow recorded in different historical periods of each river section, and has more reliable flood extreme water level and maximum flow data of each river section of the Yangtze River in 1860 AD.

'Hydrological Inscription Cultural Relics in Three Gorges Reservoir Area collected valuable physical images of hydrological inscriptions in the upper reaches of the Yangtze River [4]. The number of flood inscriptions is large, and the records span a long time and are widely distributed. In the specific flood years, there are 15 places of flood inscriptions in 1860 AD and 6 places have elevation records, which can better reflect the change of flood level along the way. 'The Compilation of Historical Materials of Flood Disasters in Sichuan for Two Thousand Years' summarizes the flood time process of the main stream and branches of the upper reaches of the Yangtze River, and sorts out the historical materials of floods in the past dynasties, flood inscriptions and literature excerpts [48]. The book collects 32 flood data of 1860 AD, and the sources of historical materials are mostly county gazetteers, state gazetteers or government gazetteers and other compilations. In addition, 16 inscriptions from 1860 AD were collected, which can be complemented with the hydrological inscriptions in the Three Gorges Reservoir area.

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'Compendium of Chinese Meteorological Disasters' [12] records the natural disasters in the history of various provinces and cities, including rainstorms, floods, droughts, hail, etc., and collects the records of meteorological disasters in various regions by year. This study collected the meteorological records related to the flood disaster in 1860 AD. Among them, the historical records are relatively rough, need other more detailed historical records to support. Some records can be specific to the day, and there are flood mark water level data, but the number of such records is small.

'Chinese Three Thousand Years Meteorological Records Collection' [13] collects various meteorological records in China's historical period, covering nearly 3000 years, covering the Yellow River, the Yangtze River and other major basins in space, including various weather phenomena. The records related to the 1860 AD flood event in the meteorological records of the Qing Dynasty were extracted and sorted out. The book sorted out the meteorological data in the county gazetteers by year, and the content of the weather phenomenon was less and the time was rough. 'China's great floods: A summary of disastrous floods' [14] summarizes the typical flood events in Chinese history, and briefly describes the rain area, flood process and disaster area of the Yangtze River Basin in 1860 AD. The 'Yearly Charts of Dryness/Wetness in China for the Last 500-year Period' [11] transformed the climate-related contents recorded in various ancient books into drought and flood grades, and plotted the spatial distribution map of drought and flood grades on an interannual scale. Most of the Yangtze River Basin had different degrees of flood in 1860 AD.

Research methods

This paper collects and summarizes the contents of the above-mentioned historical materials, data compilations and atlases, compares and verifies with each other, selects more detailed and accurate contents of the records, and extracts the time, place, precipitation information, water information and other keywords into the Excel table.

Precipitation process and flood spatial distribution reconstruction

According to the time, the precipitation information of the study area in 1860 AD was sorted out, and the description of the rain was extracted, such as 'rain', 'heavy rain', 'continuous rain', etc., and the characteristics of precipitation in the basin were summarized. According to the time and location of river water level rise in various places, the time development process of flood in 1788 AD was sorted out, and the records of water situation in two years were sorted out. Keywords such as 'flood', 'big flood', 'steep mountain flood', 'overflow of rivers' were extracted and input into ArcGIS to show the characteristics of the spatial distribution of flood.

Table 2: classification standard of disaster degree.

Disaster grade	Disaster degree	Example of materials	Classification standard
0	no	No record, the disaster record is not mentioned; 'Fifty-three years by the water survey not disaster area'	There are no records related to flood disasters such as 'flood', 'heavy rain' and 'tax remission' in the data, or it is clearly stated that there is no disaster.
1	minor	'Solar eclipse in May of Fifty-three years, flood in June'	There are slight disaster records such as 'big flood' and 'heavy rain', which have no great influence on people 's life and social economy, with short duration and small scope.
2	moderate	'Flood, floating more houses in June'; 'There was a collapse of houses, and the population was not damaged'	The disaster lasted for a long time and had a wide range, destroying facilities, houses and farmland. The government exempted taxes and the disaster affected people 's lives without casualties.
3	severe	'On June 19 of Fifty-three years, the flood entered the city, and there were countless drifting houses, and the embankments on all states were broken'; ' big flood in Luotian, city wall collapse, many people drowned'	The disaster has a wide range of impact and serious damage. A large number of farmlands have been flooded, city walls have collapsed, and casualties have occurred. It has a huge impact on people 's lives and social economy.

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Grading method of disaster degree and spatial reconstruction of disaster

The records of the disaster in the data are the most, and the classification and grading method [49] is used to determine the classification standard of the disaster degree level according to the description of the disaster situation in each place, and the historical disaster description is transformed into the grade value expressing the degree of disaster. According to the previous criteria for the three-level division of the disaster degree [50-51], combined with the characteristics of the disaster situation in the study area, the disaster degree is classified and graded, as shown in (Table 2).

Taking the county level as a unit, if the data clearly indicate that there is no disaster in the area or there is no record of relevant rainfall, flood, disaster and government relief, and there is no key information such as 'heavy rain', 'heavy flood', 'tax remission' and 'relief', the disaster grade of this kind of state and county is set to 0, that is, the county is not affected by flood disaster. When there are records of rain, flood or disaster in the data, with a short duration and a small scope of influence, there is no record of government relief, and the disaster is not serious, which has not had a greater impact on the people and the social economy, the disaster severity is 'minor', that is, the county is slightly affected by floods. Correspondingly, if the data show that the rainfall, flood and disaster in the area are more serious, the disaster lasts for a long time, the scope of influence is wider, the urban infrastructure such as dams, city walls and houses is destroyed, and the people and social economy are affected but there are no casualties, and if there is record of government tax remission or relief, the county 's disaster grade is 'moderate'. When the above effects are present, and the description of the disaster situation is more serious, such as 'a large number of farmlands flooded', 'coastal cooking smoke cut off', 'countless floating houses' and other serious and wide-ranging records, and there were casualties, which had a huge impact on people 's lives and social economy, the county 's disaster severity is 'severe'. In this way, the disaster degree of each state and county is quantified, and the disaster grade map is drawn by ArcGIS software to study the disaster area and disaster characteristics of the flood disaster in 1860 AD.

Study on the impact and response of flood disaster

Organize the time and specific strategies of disaster relief and post-disaster reconstruction activities, sort out disaster relief measures and disaster relief procedures, the main body of measures and follow-up effects, to study how the direct and indirect effects of flood disasters are transmitted in the subsystems of production, facilities and population, and how to further affect the social subsystem and economic subsystem.

Results Analysis

Characteristics of rainfall in the Yangtze River Basin in 1860 AD.

The precipitation characteristics of the Yangtze River Basin in 1860 AD were mainly characterized by anomaly, spatial concentration and persistence.

According to the historical records of various places, rain, snow and hail weather frequently occurred in the spring period of the Yangtze River Basin in 1860 AD. As shown in (Table 3), there are records of 'rain and hail' and 'rain and snow' in the county gazetteers of Sichuan, Hubei and

Table 3: The climate anomaly in the early 1860s.

Province	Prefecture/State/County	Precipitation Information (Lunar Time)
Sichuan	Youyang Directly-Administered State; Xindu County; Pingshan County etc.	March hailstorm
Hubei	Yuan'an County	Heavy snowfall during the Beginning of Summer Festival
Hunan	Xiangtan County; Xiangxiang County; Hengyang County etc.	March rain and snow
Hunan	Shaoyang County	March, intercalary March, and April had over sixty days of rainy weather
Jiangxi	Hukou County; Yugan County; Jinxi County	March rain and snow; April rain and hail
Anhui	Wuwei County	March rain and snow
Jiangsu	Suzhou Prefecture; Kunshan County; Wuxi County; Jiangyin County, etc.	Spring is overcast with continuous rain; heavy snow falls for days in March; summer brings torrential rains.
Zhejiang	Hangzhou Prefecture; Tongxiang County; Changxing County, etc.	March snow

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Anhui provinces. Even Yuan'an County, which belongs to Jingmen Prefecture in Hubei Province, experienced heavy snow in the beginning of summer. In some areas of Jiangxi Province, such as Yugan County and Hukou County, there are still hail weather in late May (Lunar April). Shaoyang County, Hunan Province has experienced more than 60 days of rainy weather from March, leap March and April. Such abnormal weather phenomena generally appear in the provinces of the Yangtze River Basin, involving a wide area and a long duration. The long rain and snow weather in spring brings a lot of precipitation. In short, there were abnormal rain and snow weather in the Yangtze River Basin in the early 1860 AD, and it was cold and rainy for a long time in spring, and it was rare to have snow in the beginning of summer.

After entering summer, the precipitation in the Yangtze River Basin is still quite abundant. According to the situation of each province (Table 4), Yunnan Province has been rainy from July to September; the number of rains in Hubei Province varies from 1 to 6 times a month since the beginning of summer; the precipitation and sunny days in various regions in Hunan and Jiangxi provinces during summer follow the seasonal solar terms, with favorable weather conditions, well-distributed rainfall, and reasonable allocation in both time and space. According to historical records, the 'heavy rain', that is high-intensity precipitation, is mainly concentrated in Sichuan Province, Hubei Province and parts of Jiangxi Province, lasting up to 4 days, causing the river water level to rise. The summer heavy rainfall areas are mainly concentrated in the upper and middle reaches of the Yangtze River. The recorded period spans from Sichuan Province to Hubei Province and then to Jiangxi Province, with heavy rainfall occurring from July 6th to July 28th, showing a gradual transition from top to bottom in terms of timing, characterized by long duration and high intensity. There are also rainfall records in some downstream areas, such as Jiaxing Prefecture, Zhejiang Province. The rainfall intensity is not as strong as that in the upper and middle reaches. For example, it is recorded that there were two consecutive days of continuous rain

Table 4: Summer precipitation in 1860.

Rainfall duration (Lunar calendar)	Rainfall duration (Gregorian calendar)	Rainfall location	Precipitation level
June to July	mid-July to mid-September	Yunnan Province	Rainny for ten days
May to early September	late June to early September	Hubei Province	In Man and June, there were one, two, three, four and five or six times of rain in each state; in the first and middle ten days of July, it rained one, two, three or four times. In the last ten days, it didn't 't rain.
After May	July 18th and after	Hunan Province	The provincial capital and its subordinate regions have had timely rain and sunshine since May.
June to August	July-September	Jiangxi Province	Well-distributed rainfall
May 18th to 22nd	July 6-10th	Sichuan Province	Continuous heavy rain caused the stream to rise suddenly.
Since the beginning of summer	After June	Hubei Province (Jingzhou Prefecture and Yichang Prefecture)	Rainy for days on end, with heavy rain pouring down ceaselessly day and night.
May 25th to 9th	July 13-17th	Hubei Province (Donghu County in Yichang Prefecture)	Rainy for days on end, the heavy rain did not stop until 5-7 pm on the 29th.
mid-June	After July 28th	Jiangxi Province (Jiujiang Prefecture)	Continuous heavy rain
June	June-July	Anhui Province (Yizhou Prefecture)	Heavy rain
May 22-23rd June 10th	July 10-11st July 27th	Zhejiang Province (Jiaxing prefecture)	Rain pouring down heavily Pouring rain

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from July 10 to 11, and only one day of heavy rain fell on July 27. Therefore, the summer precipitation in 1860 AD was mainly concentrated in the upper and middle reaches of the Yangtze River, and the rainfall intensity was also large, with spatial concentration.

After the fall, 'heavy rain' and 'hail' were recorded in many areas of the provinces, and it can be seen that some areas continue to rain in autumn (Table 5). The counties of Sichuan Province, Hubei Province and other provinces, such as Xiushan County, Pingshan County and Hanchuan County, are superimposed with rain and hail after autumn. Chongyang County in Hubei Province, Ningxiang County in Hunan Province and Nanchang County in Jiangxi Province still have more rainwater after October (Lunar September). From the above analysis, it can be seen that when spring and summer are connected, there is continuous rain in the Yangtze River Basin. After entering summer, it is generally rainy in all parts of the country. Some provinces still have abundant rainwater in autumn, which shows the long duration of precipitation. Therefore, another significant feature of precipitation in the Yangtze River Basin in 1860 was its persistence, and rain, snow and hail weather were common from spring to autumn.

In summary, in the early-stage of 1860 AD, there was a climate anomaly in the Yangtze River Basin, with rainy and snowy weather. In summer, the concentrated rainfall intensity was large and concentrated in Pingshan, Yichang to Jingzhou, and the precipitation lasted for a long time.

Flood process in the Yangtze River basin in 1860 AD

The flood in 1860 AD was caused by persistent heavy rainfall in the upper and middle reaches. The flood in the tributaries of the upper reaches of the Jinsha River flowed into the main stream of the Yangtze River, and met with the rainstorms in Kuizhou Prefecture, Yichang Prefecture and Jingzhou Prefecture to form a catastrophic flood. In the advancing process of the flood, Pingshan County, Qijiang County, Fengdu County, Wan County, Shishou County, Jianli County and other places along the Yangtze River showed the phenomenon of rising river water level, large water entering the city and inundating the town. Many embankments along the bank were destroyed by floods. In 1860 AD, floods washed out the Ouchikou on the south bank of the Jingjiang River and formed the Ouchi River, resulting in a large number of floods flowing into the Dongting Lake and affecting the surrounding areas of the lake.

According to the historical data (Table 6), the flood in 1860 AD took a long time to advance from the upstream to the middle reaches. In Zhongxian County, Sichuan Province, there are records of rising water from July 9 to July 11, and there are still relevant water records until July 21. Since

Table 5: Autumn precipitation in 1860.

Province	Prefecture/State	County	Precipitation information (time for the lunar calendar)
Sichuan	Youyang Directly-Administered State; Xuzhou Prefecture	Xiushan County; Pinshan County etc.	Autumn heavy rain
Hubei	Hanyang Prefecture	Hanchuan County	July excessive rain
Hubei	Huangzhou Prefecture	Luotian County, Macheng County, Huang'an County	Heavy rain and hail in autumn and July
Hubei	De'an Prefecture	Yingcheng County	On the night of lunar July 13th, there was a sudden thunderstorm accompanied by hail in places such as Changjiangbu to the east of the county.
Hubei	Wuchang Prefecture	Chongyang County	Spring brings excessive rain, autumn sees salt prices soar, September brings great floods, and winter suffers from relentless rain and snow. On 20th of December, heavy rain falls ceaselessly from dawn till night.
Hunan	Changsha Prefecture	Ningxiang County	Rain black spots outside the city in September, like beans
Jiangxi	Nanchang Prefecture	Nanchang County	September has more rainfall
Zhejiang	Hangzhou Prefecture; Jiaxing Prefecture; Huzhou Prefecture etc.	Renhe County; Tongxiang County; Changxing County etc.	After long autumn rains, the downpour continues ceaselessly day and night.

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July 15, the flood in Pingshan County, Sichuan Province, the upper reaches of the river, has risen sharply, inundated the county, and has been rising for three consecutive days. Flow of the water has become more serious, and it began to recede on July 17. From Qijiang County of Chongqing Prefecture to Wushan County of Kuizhou Prefecture, the areas along the upper reaches have been flooded one after another, and there are relevant records of 'continuous rising water' and 'increasing river water'. In the middle reaches of Yichang and Jingzhou Prefectures in Hubei Province, the phenomenon of 'Chuan water flowing into Chu' began to appear in mid-July, and after July 18 (early June of the lunar calendar), river water began to overflow into the city.

The records of the hydrological inscriptions in the Three Gorges Reservoir area in the upper reaches of the Yangtze River in 1860 AD are shown in (Table 7):

Table 6: Records of floods in the Yangtze River Basin in 1860.

Time	Province	Prefecture/State	County	Water records
July 15-17th	Sichuan	Xuzhou Prefecture	Pingshan County	On May 27th, the water rose significantly, flooding into the city and reaching the stone steps of the county office's main gate and the foundation of the Confucian Temple's official wall. On the 28th and 29th, the water level surged even higher, submerging up to the eaves of the pavilion at Yu Temple and continuing to rise.
July 16th	Sichuan	Chongqing Prefecture	Fuling County; Qijiang County	Great flood; the river swelled mightily, rising continuously for days; floodwaters entered the city
July 18th-August 16th	Sichuan	Kuizhou Prefecture; Zhongzhou Directly-Administered state	Fengjie County; Wan County; Yunyang County; Fengdu County	June flood; flood enters the city
After July 11rst	Hubei	Jingzhou Prefecture; Yichang Prefeture		The river water is increasing day by day, and the height of the river water entering Chu reaches more than 20 Zhang
July 13rd	Hubei	Jingzhou Prefecture	Zhijiag County	The river surged dramatically, breaching the western city gate and flooding the city to a depth of over ten feet.
July 14-15th	Hubei	De'an Prefecture; Hayang Prefecture	Yunmeng County; Hanchuan County; Mianyang State	The Xiang River and Han River rose over two Zhang in water level; flooding occurred in early summer and autumn floods surged.
July 18th-August 17th	Hubei	Jingzhou Prefecture	Shishou County	Flood, June summer flood with abnormal increase, and the collapse of the Golden Embankment project
July 22-23rd	Hubei	Jingzhou Prefecture	Jianli County	On lunar June 5th and 7th, the river water suddenly rose by more than ten Zhang, spreading widely
July 18th-August 17th	Hubei	Yichang Prefecture	Guizhou	June floods, rivers and gorges suddenly rose, water submerged temple halls and lapped at city walls
July 18th-August 17th	Jiangxi	Ningdu Directly-Administered state	Ruijin County	June floods, the dragon flood surged, entering the city several feet deep.
July-August	Hunan	Yuezhou Prefecture; Changsha Prefecture; Changde Prefecture; Lizhou.. Directly-Administered state, etc.	Pingjiang County; Yiyang County; Wuling County; Li County	In late May, the rivers and lakes rose sharply, and the flow of water trend to down entirely; June flood

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Table 7: Flood inscription record table of the Three Gorges reservoir area in 1860[4].

Number	Gregorian calendar time(Rising/ Falling Water)	Place	Elevation (m)	Inscripted text
1	July 15th/July 17th	Roadside by Tangfang , Pingshan County, Sichuan Province,		On May 27th, 28th, 29th in the tenth year of the Xianfeng reign of the Qing Dynasty, the Great River was flooded and the Great Master's Tianyi was washed away□□……Auspicious Time in Autumn month in the Tenth Year of Xianfeng in the Qing Dynasty
2	July 15th/July 17th	Stone Pillar of Yuwang Palace in Pingshan County, Sichuan Province		On Gengshen May 27th and 28th of the tenth year of Xianfeng the flood is here, the flood receded on the 29th
3	July 20th	Hongyuan Second Community, Maliu Town, Jiangbei County, Sichuan Province		On Gengshen June 3rd of the tenth year of the Xianfeng, there was a long (rising) flood, and Feng Eryuan divinated
4	July 11th/July 21st	Dayan Village Group 6, Yangdu Town, Zhong County, Sichuan Province	155.39	On Gengshen May 23rd, there was heavy rain and long (rising) water. On the morning of June 4th, the water was flooded again. This is five feet less than the water in old Wushen
5	July 9th	Zhangjia Zui, Yangdu Town, Zhong County, Sichuan Province	155.53	On Gengshen May 21st, there was a great flood
6		eilong Village, Feilong Town, Yunyang County, Sichuan Province	143.73	In the year of Gengshen, the flood ceased
7		Xiaoquyuan Temple, Zigui County, Hubei Province		In May of Gengshen, the water of the lower Huanjiang River surged rapidly, and the houses everywhere were all drifting. Fortunately, the temple and the golden body were all made of solid stones. Although the central beam was submerged for about twenty days and the huge waves could not shake them, only the back wall and kitchen were damaged... In the summer month in the fourth year of Tongzhi, the year of Yichou, is the auspicious day for upper Huanjiang, and the stonemason Zheng Qiwu carved and erected them
8		Dongmentou Village, Guojia Dam Town, Zigui County, Hubei Province,		The Great Flooding of Gengshen in the Qing Dynasty collapsed……
9	July 18	Dongmentou Village, Guojia Dam Town, Zigui County, Hubei Province	97.66	Great flood in June 1st in the tenth year of Xianfeng
10	July 18	Wuma Bridge, Dongmentou Village, Guojia Town, Zigui County, Hubei Province		The tenth year of Xianfeng flood reached this bridge and stopped in June 1st

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11		Bazimen Village Group 2, Xiangxi Town, Zigui County, Hubei Province		During the Genshen of Xianfeng, and the Gengwu of Tongzhi, the flood caused by the flooding of the upper dam leveled the riverbed
12		Ancestral tablet of Zhang Qizheng's family in Taipingxi, Yichang City, Hubei Province	92.03	During the Gengsheng, Xianfeng period of the Qing Dynasty, there was a great flood that reached the foot of the Qingliu tree. In the Gengwu of Tongzhi period, there was a great flood. In the year of Gengshen, there was over ten feet of water and heavy rain pouring down
13		The stone inscriptions in Huangling Temple, Yichang City, Hubei Province		Floods disasters in the Gengshen and Gengwu year.
14		The stone inscriptions in Huangling Temple, Yichang City, Hubei Province		Due to two floods in Gengshen of Xianfeng, Gengwu of Tongzhi, the collapse was unbearable
15	July 18	Huangling Temple in Yichang City, Hubei Province	58.37	On June 1st in the tenth year of Xianfeng, it was flooded here.
16	July 18	Huangjinkou , Yaoping Village, Liantuo Town, Yichang City, Hubei Province		On June 1st in the tenth year of Xianfeng, self-growing soil arrived, and on March 15th in the year of Gengshen, it began to snow in the beginning of summer

The analysis shows that the phenomenon of rising water is concentrated in July in the upper reaches of the Yangtze River. The Zhangjiazui section of Yangdu Town in Zhongxian County, Sichuan Province, appeared on July 9. From July 15th to July 17th, the river water in Pingshan County continued to rise, and it began to recede on July 17th. The water level of the Dayancun section of Yangdu Town in Luozhong County rises and falls from time to time, five feet lower than that in 1788 AD. The extreme water level of Zigui County and Huangling Temple in Yichang City mostly appeared on July 18th, when the flood peak appeared at Yichang Station.

The flood in 1860 is an important catastrophic flood event in the historical records of Pingshan Station. On July 17th, the flood peak of Pingshan Station appeared. The flood peak flow and water level were 92500m^3/s and 306.29 m, respectively, which was second only to the flood peak flow of 36900 m^3/s in 1924 AD. It was a catastrophic flood in the Qing Dynasty. The 1860 AD flood ranked fourth in the survey data of Yichang station over the years. The peak flow and water level were 92500 m3 / s and 58.32m, respectively. The historical survey data along the Yangtze River show that the data of the flood in 1860 AD at Yichang station is only 1.18 m lower than the extreme water level in 1870 AD.

The 1860 AD flood data is rich. The flood mainly occurred in July, which lasted for a long time and the water receded slowly. Pingshan Station is located in the upstream tributary inflow area, reaching the flood peak on July 17th, and Yichang Station reached the flood peak on July 18th. In July, the mainstream and tributaries of the Yangtze River Basin and Dongting Lake generally have records of river rising and overflowing (Figure 2). With the evolution of floods in the upper and middle reaches of the Yangtze River, some tributaries such as the Hanjiang River and the Xiangjiang River have flooded, making the water level in the Hubei section of the middle reaches and the Dongting Lake area rising, and the water overflows into the city and inundates the surrounding counties and fields. Therefore, the flood mainly occurred in Pingshan County of Sichuan Province, the Three Gorges area (Chongqing Prefecture-Kuizhou Prefecture), Yichang Prefecture and Jingzhou Prefecture of Hubei Province, as well as the surrounding areas of Dongting Lake, and there were few records of water situation in the downstream area.

The disaster area and disaster situation of the Yangtze River Basin in 1860 AD.

From July to August 1860 AD, the flood affected many counties in the upper and middle reaches of the Yangtze River and around the Dongting Lake area. From Pingshan County to Hukou County and other counties along the upper and middle reaches of the Yangtze River, there are

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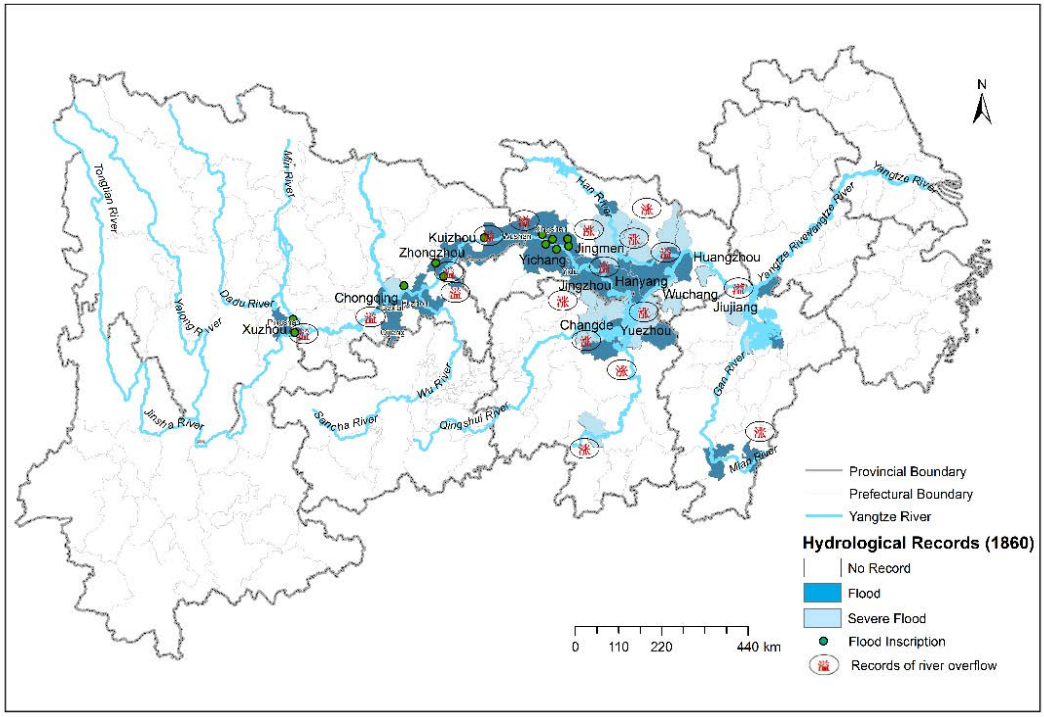

Figure 2: Spatial distribution map of hydrological records of counties in the Yangtze River Basin in 1860.

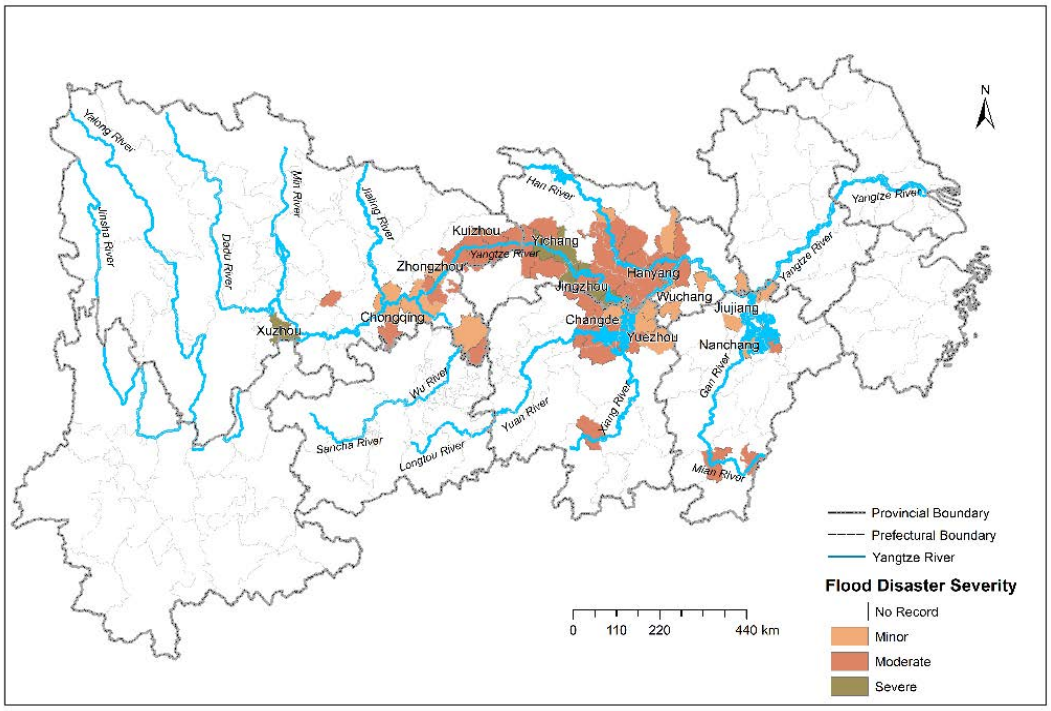

Figure 3: Distribution of flood disaster grade in each county of Yangtze River Basin in 1860.

minor, moderate and severe disasters (Figure 3). Some areas without historical records or clear records are not included in the study. The flood inundated low-lying fields along the coast, destroyed urban buildings, destroyed transportation facilities, drowned people, and affected people's social life.

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The counties along the lower reaches of the Sichuan section of the upper reaches of the Yangtze River are the core affected areas. The flood of the Jinsha River first affected Pingshan County. On July 15th, the flood inundated Pingshan County. The water level rose day by day, destroying houses and residents' properties, drowning men and women, etc., resulting in severe disaster in Pingshan County. The tributary flood meets the main stream flood, and the water level rises sharply. The upstream main stream area has different degrees of disaster from Chongqing to Yichang along the Yangtze River. The urban facilities in Zhongxian County, Qijiang County, Fuzhou, Wanxian County, Yunyang County and Wushan County have been destroyed. Wanxian County flood into the city to destroy the bell and drum tower. The gates and walls of Yunyang County were destroyed by floods. The flood of Fengjie County flooded into the city and submerged until the main street in the city. Most of the neighborhoods along the road in Wushan County have collapsed and so on. Among them, Pingshan County, located in the lower reaches of the Jinsha River, was severely affected. Most counties along the Sichuan River from Chongqing to Kuizhou were moderately affected, and a few were slightly affected.

Yichang Prefecture and Jingzhou Prefecture in Hubei Province in the middle reaches of the Yangtze River were the most seriously affected. Gong'an County and Donghu County of Yichang Prefecture were severely affected. Floods poured into the county town, causing the city wall to collapse, inundating countless houses, county government offices, prisons, etc. Tens of thousands of residents are sheltering from floods in the city. On July 15th, it was poured in from south gate and Wenchang gate, which coincided with the rise of heavy rain water level. It was not until July 20th that the flood began to recede slightly and rose again. On July 21st-22nd, the flood began to recede slowly, and the flood submerged for a long time. According to historical records, the flood disaster in Donghu County had a wide impact, and the houses of Tianhe were destroyed by flood. After that, the epidemic disease prevailed and the people were miserable. The rivers and lakes in Gong'an County are connected, and the people are in the roof to escape the flood for several nights without rescue, and the people are extremely poor. Shishou County and Zhijiang County of Jingzhou Prefecture were severely affected. The river embankments along the Jingjiang River were broken, and many of the civil embankments collapsed into mouths, and the nearby fields were flooded. The whole county of Zhijiang County was flooded, only Yufu and Jinji mountains were not flooded, and all the houses were flooded, drowning countless people, and the county town was flooded for more than 20 days. Other counties along the river in Hubei Province, such as Jiangling, Songzi, Jianli, Tianmen, Mianyang and Hanchuan, were also affected to varying degrees. The water level of rivers and lakes rose, and many embankments along the line collapsed. Hanchuan County, Hanyang County and Mianyang Prefecture of Hanyang Prefecture coincided with the rise of Jianghan and the surrounding ocean. The flood was not released in time and the water receded late, which affected the harvest. There were also collapses of houses, but there were no records of drowning people or clear records of 'no damage to the population (Hanchuan County)', so it was a moderate disaster. The county records of Wuchang Prefecture are mostly simple water conditions, occasionally affecting the autumn harvest, but the situation is light, not serious, which is mildly affected.

The Jingjiang River was washed away, and a large number of floods rushed into the Dongting Lake, resulting in water accumulation in Wuling County and Huarong County of Hunan Province along the river and the lakeside area. People's life and agricultural production were severely damaged. The affected area of the lake area was wide, but it was mainly moderate or mild. Other areas in the middle and lower reaches, such as Anhui Province and Jiangxi Province, are also affected by the low-lying areas along the river, but the disaster is lighter than that in the upper reaches and Dongting Lake area. The low-lying areas along the Yangtze River Plain in Anhui Province are affected by waterlogging. Small-scale waterlogging occurs in Pengze County and Hukou County of Jiujiang Prefecture in Poyang Lake area of Jiangxi Province, but the overall disaster is light and the disaster area is also small.

Discussion

Climatic background of flood disaster in the Yangtze River Basin in 1860 AD

ENSO events affect most of the global climate change. La Nina years often mean more precipitation on the global land [52], and the probability of floods in the upper reaches of the Yangtze River is greater in La Nina years [53]. According to the ENSO event chronology of [54], 1860 was a strong La Niña year, 1858 AD before 1860 AD had a moderate El Niño event, and 1860 AD was a weak El Niño event and a strong La Niña event. Under this climate background, the Yangtze River Basin is prone to flood disasters: the position of the Western Pacific subtropical high is biased to the west and south compared with previous years, resulting in the long-term stability of the summer monsoon rain belt in the Yangtze River and Huaihe River Basin. At the same

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time, the low-frequency oscillation of the Indian Ocean is strong, which enhances the water vapor transport in the southwest, and a large amount of water vapor accumulates in the Yangtze River Basin [55]. In 1860 AD, the flood area was mainly distributed in the Yunyang section of the upper reaches of the Yangtze River to the Yueyang section of the middle reaches. The rest of the upper reaches and the Yueyang-Wuhan section were mostly waterlogging areas, and the rest of the middle and lower reaches were mostly at the norma level. Even in some areas of Anhui in the lower reaches of the Yangtze River, there was a drought phenomenon with less precipitation. Based on the analysis of the research results of Ge et al. [26] and Hao et al [56, 57] on the change of Meiyu in the Yangtze River Basin, it can be seen that from 1821 AD to 1870 AD, the Meiyu period in the middle and lower reaches of the Yangtze River was shorter and the East Asian monsoon was stronger.

Combining the above analysis and the results of the previous chapters, we can get the climate background of 1860. In early 1860 AD, there was a climate anomaly. In the spring of 1860 AD, snow fell in many places, even in the summer of Yuan'an County and Nanjing [41]. In the early 1860 AD, the precipitation in the basin was relatively sufficient, and the rainfall intensity in summer was relatively large, mainly concentrated in the upper and middle reaches, and the rainfall area was small, including the upper tributary basins such as the Jinsha River and Wujiang River, the Three Gorges section and the Jingjiang section of the Yangtze River and the lakeside area of Hunan.

In summary, the natural background of the flood disaster in 1860 AD is similar to that in 1788 AD [58]. A strong La Nina event occurs in both years, and the basin has abundant precipitation. In the early stage, there were climate anomalies of rainy and snowy in spring and heavy precipitation in summer. The middle and lower reaches of the Yangtze River are early into Meiyu period. However, the East Asian monsoon was stronger in 1788, and the East Asian monsoon was stronger in 1860 AD. The precipitation in the middle and lower reaches of the Yangtze River was more in 1788 AD, the rainfall time was concentrated and the intensity was large, and the rainfall area was wider. In 1860 AD, the southwest airflow was strong, so the precipitation in that year was more concentrated in the upper reaches of the Yangtze River, and the water level of the upper reaches was higher.

The social background of the flood disaster in the Yangtze River Basin in 1860 AD

In the early 1860 AD, the climate was abnormal, and there were many records of rain and snow in the Yangtze River Basin. Even in the beginning of summer, there were still snowfalls, such as Yuan'an County. In this year, the strong southwest monsoon brought abundant precipitation to the upper reaches of the Yangtze River [59]. At the same time, the middle and lower reaches of the Yangtze River entered the Meiyu early and out of the Meiyu late, and the precipitation time was long, resulting in the meeting of the upstream flood with precipitation of the middle and lower reaches of the Yangtze River. The water level rose and overflowed, and the coastal area was submerged. At this time, the Qing government was facing a double crisis of internal and external problems. The second Opium War was defeated; the Qing government was forced to sign the 'Beijing Treaty' and needed to compensate for a large amount of money. At the same time, the internal repression of the Taiping Heavenly Kingdom movement consumed a lot of military expenditure, the treasury was empty and the fiscal deficit. War reparations, military expenditure superimposed on natural disasters, the Ministry of household deposit silver urgent [60]. At the end of the Qing Dynasty, government corruption, official corruption prevailed and did not attach importance to water conservancy, resulting in disrepair of water conservancy in various places. In the early Qing Dynasty, the government strongly encouraged the reclamation of lakes for farmland. The rapid population growth in the Yangtze River Basin and the excessive reclamation of lakes for farmland led to a decline in the ability of rivers and lakes to regulate floods, and the siltation of Dongting Lake increased [61]. The superposition of natural disasters and the complex social background at that time led to serious damage to the flood disaster in the Yangtze River Basin in 1860 AD and slow recovery in the later period.

As shown in (Figure 4), the impact and response process of flood disaster in the Yangtze River Basin in 1860 AD is sorted out. In 1860, the flood disaster in the Yangtze River Basin mainly affected the upper and middle reaches of the Yangtze River, which destroyed many dams along the coast of Jiangling County, Songzi County, Shishou County, Gong'an County and Jianli County, inundated the farmland and affected the harvest. The crops planted in Gong'an County and Songzi County were destroyed by floods, the autumn harvest was disappointed, and the people were very distressed. The flood disaster destroyed many urban infrastructures, prisons of the Civil Housing Bureau and so on. Pingshan County was washed away dozens of houses, the water flow was rapid, the people were washed away and no one dared to save. Most of the streets in Wushan

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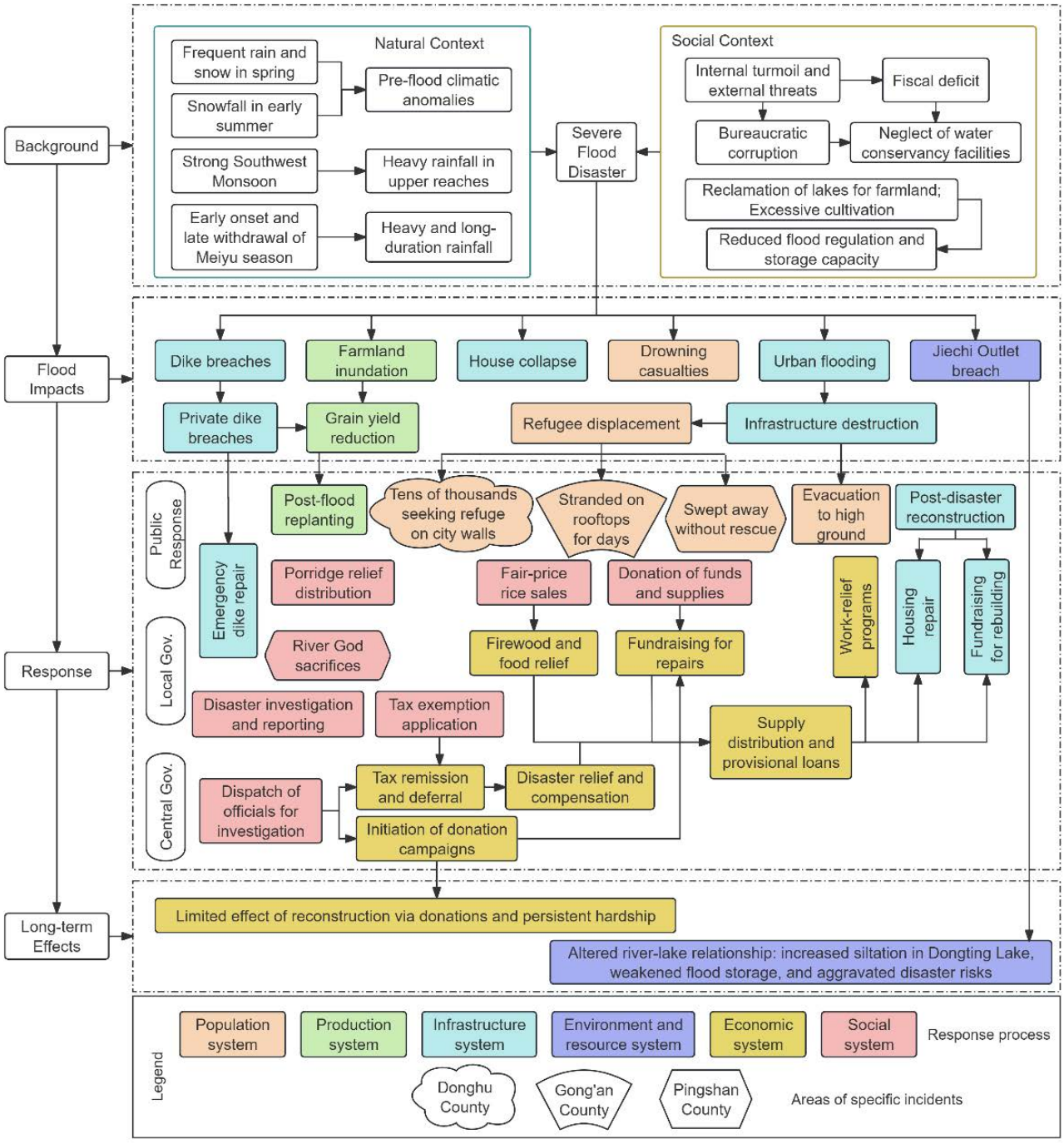

Figure 4: Impact-response process of flood disaster in the Yangtze River Basin in 1860.

County were washed down. In Donghu County, Zhijiang County, the flooded population cannot be counted, almost all houses were destroyed. In addition, the flood broke through the mouth of the Ouchi River in the Jingjiang section, forming the Ouchi River [14]. It can be seen that the flood disaster first affected the production system and infrastructure system such as farmland and dam walls, and then affected the population system. By reducing the grain harvest and destroying the commercial center of the county, it gradually affected the economic system. The people have no fixed place, lack of clothing and food, and at the same time, epidemic diseases appear in some areas, people are panicked, and the people are distressed, which further affects the social system.

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In response to the above floods, people, local governments and the central government have different response processes. The most direct response measure for the affected people to cope with the flood is to move to the high place to avoid water. For example, the victims in Donghu County gather at the height of the city building to avoid the flood, and the people in Gong'an County climb up the roof to avoid water. The most important part of the public response part is the social assistance force, local gentry and businessmen boil porridge to relieve the disaster, send shelter or food, rice relief, donations and so on. The local government is mainly rescuing embankment in the flood disaster, trying to rescue the affected people, such as Songzi County magistrates to prepare ships to save the county and Linxian County victims, while purchasing mats for distribution. The local government urgently investigated and reported the disaster situation in various places, and applied to the central government for support and relief and subsequent exemption. All counties have raised donations from the rich merchants and gentry to raise funds for repairs and relief to appease the victims and the post-disaster reconstruction. The main measures are to work instead of relief, and to borrow money to build urban infrastructure and destroyed dams. If there are excess private donations, they will be used to distribute the poor who are unable to repair their houses and help them build houses. The central government's main response measures were slightly weak, sending officials to carefully investigate the disaster situation, giving relief to the affected residents in Donghu County, Jiangling County, Songzi County and other affected residents in Hubei Province, and relieving the old and new taxes, and subsidizing the affected people in Huarong County, Anxiang County, Xiangyin County and other affected people in Hunan Province. The Qing government advocated local officials to raise donations and relief, raise funds and pensions. Donghu County, Zhijiang County, Wushan County and other counties all raised donations for local governments, and local gentry and businessmen organized donations to help the victims, borrow money to build dams and so on.

Due to the financial constraints in 1860 AD, the court's disaster relief measures were relatively weak, relying too much on local fund-raising and repairs, resulting in slow post-disaster reconstruction, lack of food and clothing for the victims, and weak relief effects. Many victims lived hard, and the people were poor and lasted for a long time. The Malin River embankment has not been built since the breach in 1852 AD (the second years of Xianfeng period). In 1860 AD, the flood washed away the breach again, and the river below the breach was washed away to form the Ouchi River [62]. The diversion of the Jingjiang River to the Dongting Lake brings a large amount of sediment to deposit in the Dongting Lake, resulting in a decrease in the lake volume of the Dongting Lake due to the accumulation of a large amount of sediment, and the flood regulation ability and flood storage capacity are weakened. The Ouchi River formed by the flood in 1860 AD had a very far-reaching impact on the relationship between the Yangtze River and the Dongting Lake. The formation of the Ouchi River led to a decrease in the flow of water in the Jingjiang section and also had a certain impact on the development and evolution of the Jingjiang River.

Conclusions

This research collects and sorts out the precipitation data, flood data, the impact of flood disasters on each county and the response process of the Yangtze River Basin in 1860 AD from various archives and historical materials, analyzes the precipitation characteristics and flood process of the Yangtze River Basin in 1860 AD, studies the impact of flood disasters in 1860 and the spatial distribution characteristics of the affected areas, sorts out the distribution map of the disaster level of each county, and sorts out the impact and response process of flood disasters in the Yangtze River Basin in 1860 AD.

(i) The characteristics of precipitation in the Yangtze River Basin in 1860 AD. There were climate anomalies in various places. There was rain and snow in spring. After summer, the rainfall in the basin was concentrated and the rain was strong, mainly concentrated in the upper and middle reaches of the Yangtze River. In some areas, the rain is still very abundant after autumn, and the precipitation is lasting. The climate anomalies of 1860 AD were related to Meiyu change and East Asian Monsoon.

(ii) The summer flood process in 1860 AD. The flood mainly occurred in July, lasted for a long time, and the water receded slowly. Pingshan Station was located in the upstream Jinsha River tributary inflow area, reaching the flood peak on July 17th, and Yichang Station reached the flood peak on July 18. In July, the mainstream and tributaries of the Yangtze River Basin and Dongting Lake generally have records of rivers rising and overflowing. The flood peak flow of the 1860 AD flood in Yichang station was 92500m3/s, and the water level was 58.32 m. It was the second largest flood in the Qing Dynasty, second only to 1870 AD.

(iii) In 1860 AD, the flood disaster in the Yangtze River

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Basin caused the collapse of many people's dykes along the coast, the damage of farmland, the collapse of buildings, the death of a large number of people, the hardship of the people and the disorder of social order. The affected areas are mainly distributed in the upper and middle reaches of the Yangtze River: the main stream flows through the coastal counties of Sichuan Province from Chongqing Prefecture to Kuizhou Prefecture, most of the counties of Jingyi Prefecture, Anlu Prefecture and Hanyang Prefecture in Hubei Province, Binhu Prefecture around Dongting Lake in Hunan Province, and a small number of counties in Jiujiang Prefecture and Nanchang Prefecture in Jiangxi Province. Among them, Pingshan County of Sichuan Province, Donghu County and Guizhou of Yichang Prefecture of Hubei Province, Yidu, Gong'an, Zhijiang and Shishou County of Jingzhou Prefecture were severely affected. Wujiang River, Xiangjiang River and some counties in the upper reaches of Ganjiang River were moderately affected, and most of the other counties along the Yangtze River were moderately affected, and a few were slightly affected. The flood broke the original breach on the south bank, resulting in the formation of Ouchi River in the south of Jingjiang River. A large number of floods were diverted into Dongting Lake through this, which had a profound impact on the relationship between rivers.

(iv) Climatic background and social response of flood disasters in the Yangtze River Basin in 1860 AD. In the early 1860 AD, there was a climate anomaly of heavy rain and snow in spring and heavy precipitation in summer. The middle and lower reaches of the Yangtze River entered Meiyu early, the East Asian monsoon was strong, and the southwest airflow was strong. Therefore, the precipitation in this year was more concentrated in the upper reaches of the Yangtze River, and the water level of the upper reaches was higher. Although the people, local governments and the central government all participated in disaster relief, local governments and people's relief were the main body. At the end of the Qing Dynasty, the government's financial deficit, internal and external troubles, inability to rescue, various disaster relief measures rely more on public donations for relief. Although there are folk relief, porridge relief and advocacy of donations of money and food, but the effect is limited and the burden on the people is increased. Post-disaster reconstruction also relies heavily on fund-raising, and progress is slow.

Data Availability

The datasets generated and analysed during the current study, including historical flood records and hydrological inscriptions, are available from the corresponding author upon reasonable request.

Author Contributions

All authors contributed to the conception and design of the study. Material preparation, data collection, and historical literature analysis were undertaken by Yu Ye, Jinfeng Jiang, and Yihua Song. Yu Ye prepared the initial draft of the manuscript. All authors reviewed and commented on earlier versions, read the final manuscript, and approved its submission for publication.

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Competing Interests

The authors declare that they have no competing financial or non-financial interests relevant to this study.

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References

1. Zhou BT, Qian J. Changes of weather and climate extremes in the IPCC AR6 [in Chinese]. Adv Clim Change Res.
2. Hu MS. Great historical floods in China [in Chinese]. Beijing: Zhonghua Book Company; 1989.
3. Li YF, Zhou L, Yu SY, Zhang DH, Wang PP. Temporal and spatial variations of flood events of the Yangtze River over the past 2000 years [in Chinese]. Earth Environ.
4. Changjiang Water Resources Commission of the Ministry of Water Resources. Hydrological inscription cultural relics in Three Gorges Reservoir Area [in Chinese]. Beijing: Science Press; 1996.
5. Disse M, Engel H. Flood events in the Rhine Basin: genesis, influences and mitigation. Nat Hazards.
6. Piadeh F, Behzadian K, Alani AM. A critical review of real-time modelling of flood forecasting in urban drainage systems. J Hydrol.

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7. Tripathi G, Pandey AC, Parida BR. Flood hazard and risk zonation in North Bihar using satellite-derived historical flood events and socio-economic data. Sustainability.
8. Stamataki I, Kjeldsen TR. Reconstructing the peak flow of historical flood events using a hydraulic model: the city of Bath, United Kingdom. J Flood Risk Manag.
9. Haque C. Risk assessment, emergency preparedness and response to hazards: the case of the 1997 Red River Valley flood, Canada. Nat Hazards.
10. Bathrellos GD, Skilodimou HD, Soukis K, Koskeridou E. Temporal and spatial analysis of flood occurrences in the drainage basin of Pinios River (Thessaly, Central Greece). Land.
11. Chinese Academy of Meteorological Sciences. Yearly charts of dryness/wetness in China for the last 500-year period [in Chinese]. Beijing: SinoMaps Press; 1981.
12. Wen KG, Dong AX, Zhai YA, Zeng QH, Pang TH, Shen JG, et al., eds. Compendium of Chinese meteorological disasters [in Chinese]. Beijing: Meteorological Press; 2005.
13. Zhang DE, Jiang GM. Chinese three thousand years meteorological records collection [in Chinese]. Nanjing: Phoenix Publishing House and Jiangsu Education Publishing House; 2004.
14. Luo CZ. China's great floods: A summary of disastrous flood s [in Chinese]. Beijing: China Bookstore; 1996.
15. Li WH. Modern China famine annals [in Chinese]. Changsha: Hunan Education Publishing House; 1990.
16. Institute of Water Resources and Hydropower Research. Historical materials of floods archives in southwest international rivers in the Yangtze River Basin in the Qing Dynasty [in Chinese]. Beijing: Zhonghua Book Company; 1991.
17. Ye DZ. Research on the laws and causes of droughts and floods in the Yangtze and Yellow River Basins [in Chinese]. Jinan: Shandong Science and Technology Press; 1996.
18. Ma YL. The process reconstruction and comparative analysis of the Haihe River Basin flood disasters in 1917 and 1939 [master's thesis] [in Chinese]. Beijing: Beijing Normal University; 2016.
19. Ye Y, Xu YF, Liang K, Fang XQ. Response to the flood of Yong-ding River in 1801 [in Chinese]. J Chin Hist Geogr.
20. Hao ZX, Xiong DY, Zheng JY. Flood disasters and social resilience during the decline of the Qing Dynasty: case studies of 1823 and 1849. Hydrol Process.
21. Zhang JC. A preliminary investigation of the floods in 1823 and their socioeconomic impacts in China [in Chinese]. J Appl Meteorol Sci.
22. Fang XQ, Ma YL, Li YK, Wan JH, Ye Y. Social response process of the flood disaster in Haihe River Basin in 1917 [in Chinese]. J Catastrophology.
23. Zhao HX, Zheng JY, Ge QS. The reconstruction of 1755 and 1849 severe flood events in Jiangsu and Anhui Provinces [in Chinese]. Sci Meteorol Sin.
24. Zheng JY, Hao ZX, Ge QS. Seasonal precipitation reconstruction and analysis in Shandong Province derived from the archives in the Qing Dynasty since 1736 [in Chinese]. Clim Environ Res.
25. Zhang DE, Liu YW, Liang YY, Li J. Reconstruction of annual and seasonal precipitation series of Nanjing, Suzhou and Hangzhou in the 18th century [in Chinese]. Quaternary Sci.
26. Ge QS, Guo XF, Zheng JY, Hao ZX. Changes of Meiyu in the middle and lower reaches of the Yangtze River since 1736 [in Chinese]. Chin Sci Bull.
27. Zhang M. Reconstruction of drought and flood sequence in 1470-1979 years and its social impact and countermeasures in Fuhe River Basin [master's thesis] [in Chinese]. Nanchang: Jiangxi Normal University; 2018.
28. Chen HL. A study on the regularity of drought and flood in the Changjiang River Basin during last 10 centuries [in Chinese]. Sci Geogr Sin. 1987;(3):197–206.
29. Shi YF, Jiang T, Su BD, Chen JQ, Qin NX. Preliminary study on the relation between the evolution of heavy floods in the Yangtze River catchment and the climate changes since 1840 [in Chinese]. J Lake Sci.
30. Yang YD. Preliminary demonstration of maximum discharge and total flood volume at Yichang in 1870 [in Chinese]. Yangtze River. 1958;(8):50–52.
31. Su LB. Preliminary discussion on the 1870 flood of the Yangtze River [in Chinese]. Yangtze River. 1958;(3):14–22.
32. Xiao SH, Yang YR. Analysis of the historical flood of the Yangtze River in 1870 [in Chinese]. J China Hydrol. 1982;(2):45–50.
33. Zhao YR, Zhang YZ, Zhou LF. Analysis of the extraordinary rainstorm in the upper reaches of the Yangtze River in July 1870 [in Chinese]. J China Hydrol. 1983;(1):51–56.
34. Jin XP, Cheng HY, Wang GY. Characteristics and development process of floods in the Yangtze River Basin in 1998 [in Chinese]. China Three Gorges Constr. 1998;(12):9–12.
35. Liu ZY, Zheng W. Preliminary analysis of the 1998 Yangtze River flood [in Chinese]. J China Hydrol. 1998;(S1):104–106.
36. Yang YW, Wei ZA, Ai X. Comparison and reflection on the Yangtze River floods in 1998 and 1954 [in Chinese]. Meteorol Sci Technol.
37. Wang YF. Discussion on the 842 floods of the Jinsha River in Yibin [in Chinese]. Sichuan Water Resour. 1997;(3):47–48.

 © 2026 Ye Y

38. Wang YF. Overview of historical flood characteristics of the Jinsha River [in Chinese]. Sichuan Water Resour. 1999;(3):46–48.

39. Wang YF. Persistent drought and persistent flood in the Sichuan Basin in 1937 [in Chinese]. Sichuan Water Resour.

40. Wang YF. The persistent flood of rainstorm of the Yangtze Valley in the summer of 1788 and the abnormal climatic phenomena before the flood of rainstorm [in Chinese]. Geogr Res.

41. Wang YF. The very unexpected flood of the Yangtze River in 1860 and the abnormal climatic phenomena before rainstorm [in Chinese]. Sci Geogr Sin.

42. Zhang T, Hu T, Hu QF, Xu YS, Zhao GL, Wang FL. Research on historical typical floods in Changjiang River Basin [in Chinese]. Yangtze River.

43. Wang SW. Diagnostic study on the occurrence regularity of drought and flood disasters in the Yangtze and Yellow Rivers and their economic impacts [in Chinese]. Beijing: Meteorological Press; 1993.

44. Huang RH, Xu YH, Wang PF, Zhou LT. The features of the catastrophic flood over the Changjiang River Basin during the summer of 1998 and cause exploration [in Chinese]. Clim Environ Res.

45. Renmin University of China and Beijing Normal University. The information integration database of natural disasters in Qing Dynasty [dataset] [in Chinese]. 2017.

46. Luo CZ. The compilation of China's historical flood survey data [in Chinese]. Beijing: Cathay Bookshop; 2006.

47. Fang XQ, Zhao WY, Song R, Chen SY, Ye Y. Construction of the integrated database of natural disaster information in the Qing Dynasty [in Chinese]. J Soc Hist.

48. Changjiang Water Resources Commission of the Ministry of Water Resources, Chongqing Municipal Bureau of Culture, and Chongqing Museum. The compilation of historical materials of flood disasters in Sichuan for two thousand years [in Chinese]. Beijing: Cultural Relics Press; 1993.

49. Zheng JY, Ge QS, Hao ZX, Liu HL, Man ZJ, Hou YJ, et al. Paleoclimatology proxy recorded in historical documents and method for reconstruction on climate change [in Chinese]. Quaternary Sci.

50. Li CX. Study on the evolution and social influence of multiple disaster species in the Ming and Qing Dynasties in Gansu and Qinghai regions [master's thesis] [in Chinese]. Xining: Qinghai Normal University; 2023.

51. Chen YX. A preliminary survey on waterlogs of Northern Anhui province during Qing Dynasty -- concerning the problem of dividing historical waterlog degrees [in Chinese]. J Chin Hist Geogr.

52. Gong DY, Wang SW. Impact of ENSO on global land and precipitation in China over the past century [in Chinese]. Chin Sci Bull.

53. Zhang Q, Jiang T, Wu YJ. Impact of ENSO events on flood/drought disasters of upper Yangtze River during 1470-2003 [in Chinese]. J Glacial Geocryol.

54. Gergis JL, Fowler AM. A history of ENSO events since A.D. 1525: implications for future climate change. Clim Change.

55. Huang RH, Chen JL, Zhou LT, Zhang QY. Studies on the relationship between severe climatic disasters in China and the East Asian climate system [in Chinese]. Chin J Atmos Sci.

56. Hao ZX, Li MQ, Zheng JY, Ge QS. Relationship between Meiyu and droughts/floods in the middle and lower reaches of the Yangtze River [in Chinese]. Prog Nat Sci.

57. Hao ZX, Zhang L, Liu Y, Ge QS. A comparative study on the characteristics of start dates of rainy season in southwest and eastern China over the past 300 years [in Chinese]. Quaternary Sci.

58. Ye Y, et al. Study on hydrological inscriptions and the reconstruction of flood disaster in the Yangtze River Basin in 1788 AD. American Research Journal of History and Culture. 2026;12(1):22–36.

59. Chen JQ, Shi YF, Zhang Q, Zhang ZX. Climate background for historical flood of 1860, 1870 during past 500 years in the upper Yangtze River basin [in Chinese]. J Lake Sci.

60. Chen F, Cai GB. General history of China's finance, Vol. 7: Fiscal history of the Qing Dynasty (Part II) [in Chinese]. Ye ZP, editor. Changsha: Hunan People's Publishing House; 2015.

61. Su C, Mo DW, Wang H. Evolution of Lake Dongting and its flood disasters [in Chinese]. Res Soil Water Conserve.

62. Lin CK. Evolution and management of Dongting Lake (II): evolution of Dongting Lake and its management scenarios [in Chinese]. Geogr Geo-Inf Sci.

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