# 中国水旱灾害防御公报

# China Flood and Drought Disaster Prevention Bulletin

# 2024

中华人民共和国水利部

Ministry of Water Resources of the People's Republic of China

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## 《中国水旱灾害防御公报》编委会

Editorial Board of *China Flood and Drought Disaster Prevention Bulletin*



## 《中国水旱灾害防御公报》编辑部

Editorial Office of *China Flood and Drought Disaster Prevention Bulletin*

# CONTENTS 目录

2024 年，受厄尔尼诺事件影响，全球极端天气趋频趋重趋广，我国部分地区汛情刷新纪录、局地发生季节性干旱，水旱灾害防御形势异常复杂严峻。党中央、国务院高度重视防汛抗旱工作。习近平总书记在防汛抗旱关键时期多次作出重要指示批示，主持中央政治局常委会会议专题研究部署防汛抗洪救灾工作。李强总理召开国务院常务会议作出专门部署，深入江西、湖南防汛一线检查指导。张国清、刘国中等国务院领导同志多次提出明确要求。水利部坚决贯彻习近平总书记重要指示批示精神，按照党中央、国务院决策部署和国家防汛抗旱总指挥部（简称“国家防总”）要求，坚持人民至上、生命至上，树牢底线思维、极限思维，会同有关部门和地方采取有力措施，实现了全国水库无一垮坝、大江大河重要堤防无一决口、旱区居民供水和农田灌溉有效保障，最大限度减轻了灾害损失。

注

（1）本公报未包括香港特别行政区、澳门特别行政区和台湾省统计数据，新疆生产建设兵团统计数据计入新疆维吾尔自治区统计数据。
（2）本公报所采用的计量单位部分沿用水利统计惯用单位，未进行换算。
（3）本公报数据来源于水利部、应急管理部，部分水文数据未经整编，未注明来源的数据均来源于水利部，指标解释分别参阅《水旱灾害防御统计调查制度（试行）（2021）》《自然灾害情况统计调查制度（2024）》。
（4）依据《水利部关于明确汛期阶段划分有关事项的通知》（水防〔2024〕89 号），防汛关键期为 7 月 16 日至 8 月 15 日。
（5）GDP 数值及多年均值均为当年价格。

In 2024, under the El Niño influence, extreme weather events became more frequent, severe, and widespread globally. Some regions in China saw record-breaking floods, while some localities experienced seasonal droughts, making the task of flood and drought disaster prevention highly complex and heavy. The central government of China prioritized flood prevention and drought relief. President Xi Jinping issued key directives during critical periods, presided over meetings of the Politburo Standing Committee to deploy work. Premier Li Qiang held meetings of the State Council to make further arrangements and inspected work in the flood-hit Jiangxi and Hunan. Besides, Zhang Guoqing, Liu Guozhong and other officials also gave explicit instructions. The Ministry of Water Resources (hereinafter MWR) thoroughly and forcefully executed the key instructions of President Xi Jinping and the decisions and deployment of the CPC Central Committee, the State Council, and the State Flood Control and Drought Relief Headquarters (hereinafter SFDH), and put the safety of people's lives in the first place. MWR coordinated with all parties to tighten up the nerves against flood and drought disasters and take forceful coping measures. As a result, there were no dam failures nor breaches in important river embankments, and water supplies for drinking and irrigation were secured in drought-stricken areas, thereby preventing losses to the greatest extent.

Notes

(1) The data in this Bulletin does not include statistics of the Hong Kong Special Administrative Region (SAR), the Macao Special Administrative Region (SAR) and Taiwan, and the statistics of the Xinjiang Production and Construction Corps is included in the statistics of the Xinjiang Uygur Autonomous Region.

(2) The units of measurement used in this Bulletin conform to what are customarily used in water conservancy and are not converted.

(3) The data in this Bulletin are from the Ministry of Water Resources (MWR) and the Ministry of Emergency Management (MEM); some hydrological data has not been compiled; data with unspecified sources are all from the MWR; and interpretations on the indicators can be found in *Statistical Investigation System for Flood and Drought Disaster Prevention (Trial) (2021)* and *Statistical Investigation System for Natural Disasters (2020)*, respectively.

(4) According to the Notice on Clarifying the Division of Flood Season Stages by Ministry of Water Resources (Shuifang [2024] No. 89), the critical flood prevention period is from July 16 to August 15.

(5) GDP values and multi-year averages are based on prices of the given year.

# 1 雨水情

RAINFALL AND WATER REGIME

## 1.1 雨情

2024 年，全国面平均降水量 680 毫米，较常年（625 毫米）偏多 9%。其中，海河、淮河、松辽、太湖、珠江流域降水量偏多 2 ~ 3 成，长江、黄河流域略偏多。5—9 月，全国平均降水量 488 毫米，较常年同期（453 毫米）偏多 8%，其中海河、淮河、松辽、太湖、珠江流域偏多 1 ~ 4 成，黄河流域略偏多，长江流域略偏少。全国雨情有 3 个主要特点。

（1）强降水过程多，降水总量大。全年共发生强降水过程 38 次，较常年多 2 次，其中特强降水过程 4 次，较常年多 1 次；全国降水总量达 64445 亿立方米，列 1961 年以来第 4 多。

（2）降雨阶段性强，时空分布集中。4—5 月，雨区高度集中在珠江流域，流域累计面降雨量为 1961 年以来同期最多；6 月中下旬，雨区移动至长江中下游和太湖流域，流域累计面降雨量分别列 1961 年以来同期第 1 位、第 2 位；7 月 23 日至 8 月 30 日，雨带北抬至华北东北地区，辽河、海河流域累计面降雨量均为 1961 年以来同期最多。

（3）台风登陆强度大，雨强罕见。有 6 个台风登陆我国大陆，其中“摩羯”和“贝碧嘉”分别以超强台风、强台风强度登陆海南文昌和上海浦东，为 1949 年以来登陆海南和上海的第 2 强和最强台风；受台风“格美”和“云雀”的环流、水汽影响，湖南资兴、辽宁葫芦岛出现历史罕见大暴雨，资兴最大 24 小时点降雨量达 735.5 毫米，为湖南省原最大实测记录（558.1 毫米）1.32 倍，葫芦岛最大 24 小时点降雨量 638.8 毫米，为辽宁有实测记录以来首次出现 24 小时 500 毫米的极端暴雨。

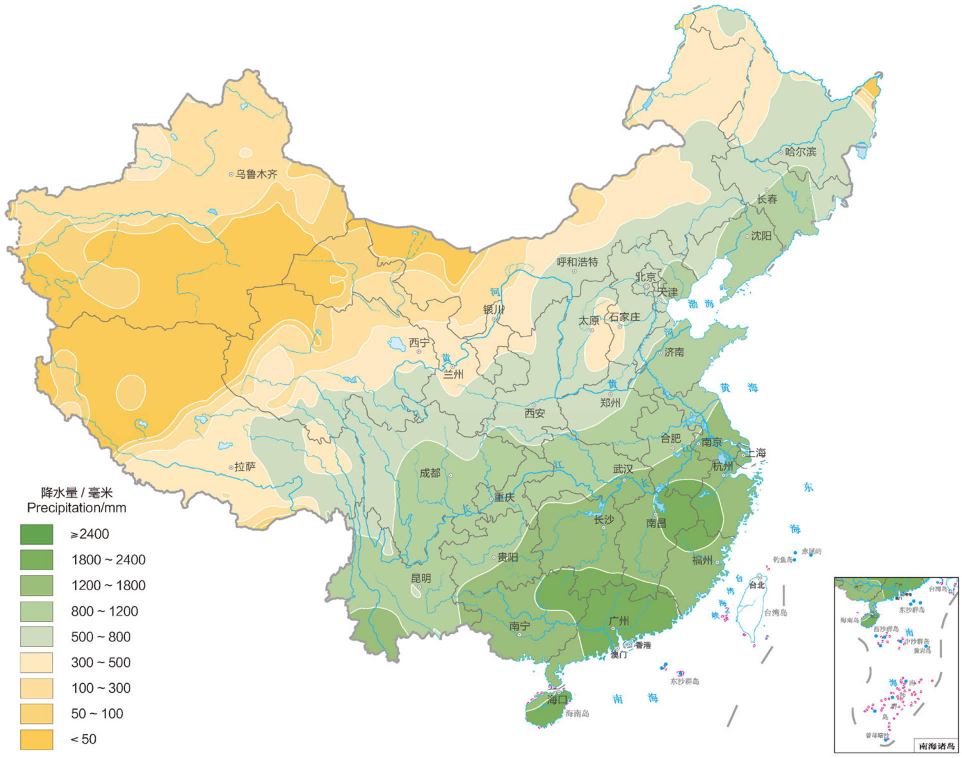
## 1.1 Rainfall

In 2024, the average annual precipitation in China was 680 mm, 9% higher than normal (625 mm). The Haihe, Huaihe, Songhua-Liaohe, Taihu Lake and Pearl River basins received 20%-30% more precipitation than normal, while the Yangtze and Yellow river basins received slightly more. From May to September, the national average precipitation was 488 mm, 8% more than normal over the same period (453 mm); the Haihe, Huaihe, Songhua-Liaohe, Taihu Lake and Pearl River basins received 10%-40% more; the Yellow River basin received slightly more; and the Yangtze River Basin received slightly less. In general, rainfall in 2024 took on the following three characteristics:

(1) Frequent heavy rainfall processes with high total precipitation. A total of 38 heavy rainfall processes occurred nationwide (2 more than normal), including 4 extreme events (1 more than normal). The total precipitation nationwide reached 6,444.5 billion $m^3$, ranking 4th highest since 1961.

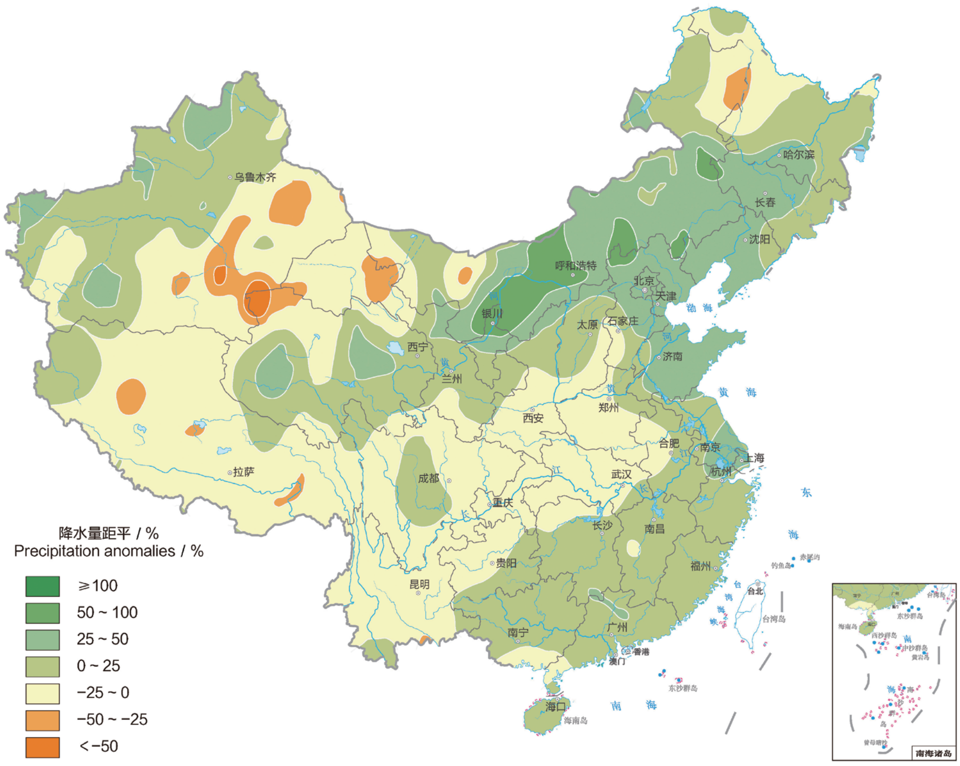
(2) Concentrated spatio-temporal distribution. From April to May, the rain belt hovered around the Pearl River Basin, which recorded its highest cumulative rainfall since 1961 for this period. During mid-to-late June, the rain belt shifted to the middle-lower Yangtze and Taihu Lake basins, which recorded its 1st and 2nd highest cumulative basin-wide rainfall since 1961 for this period, respectively. From July 23 to August 30, the rain belt moved north to North and Northeast China, with the Liaohe and Haihe River basins both recording their highest cumulative basin-wide rainfall since 1961 for this period.

(3) Intense rainfall induced by strong typhoons landfalls. Six typhoons made landfall in China in 2024. Super Typhoon "Yagi" and Severe Typhoon "Bebinca" struck Wenchang in Hainan Province and Pudong in Shanghai Municipality as the 2nd strongest and strongest typhoon to hit these regions since 1949, respectively. Due to the currents and water vapor brought by typhoons "Gaemi" and "Jongdari", Zixing in Hunan Province and Huludao in Liaoning Province experienced historically rare downpours. Zixing recorded 735.5 mm of point rainfall in 24 hours, 1.32 times the previous record of 558.1 mm in Hunan. Huludao recorded 638.8 mm of point rainfall in 24 hours, for the first time surpassing 500mm/24-h in Liaoning’s recorded measurements.




注 香港特别行政区、澳门特别行政区、台湾省资料暂缺。
Note The data of HongKong SAR, Macao SAR and Taiwan are currently unavailable.

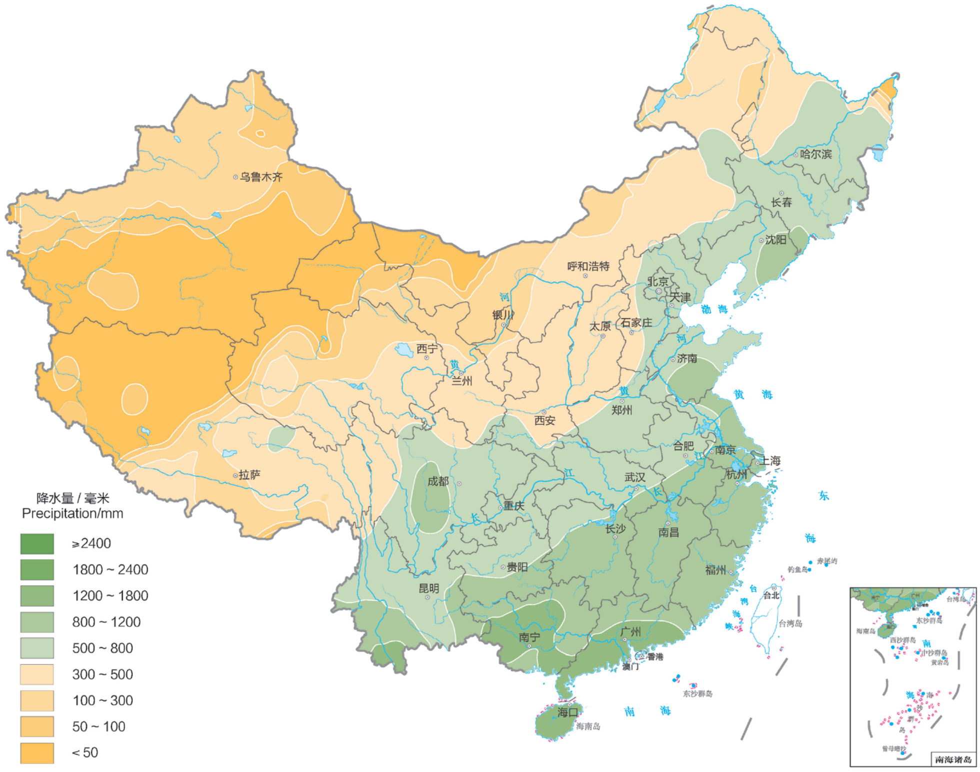
图 1-1 2024 年全国降水量等值线图
Figure 1-1 Isogram of national precipitation in 2024




注 香港特别行政区、澳门特别行政区、台湾省资料暂缺。
Note The data of HongKong SAR, Macao SAR and Taiwan are currently unavailable.

图 1-2 2024 年全国降水量距平图
Figure 1-2 National precipitation anomalies in 2024

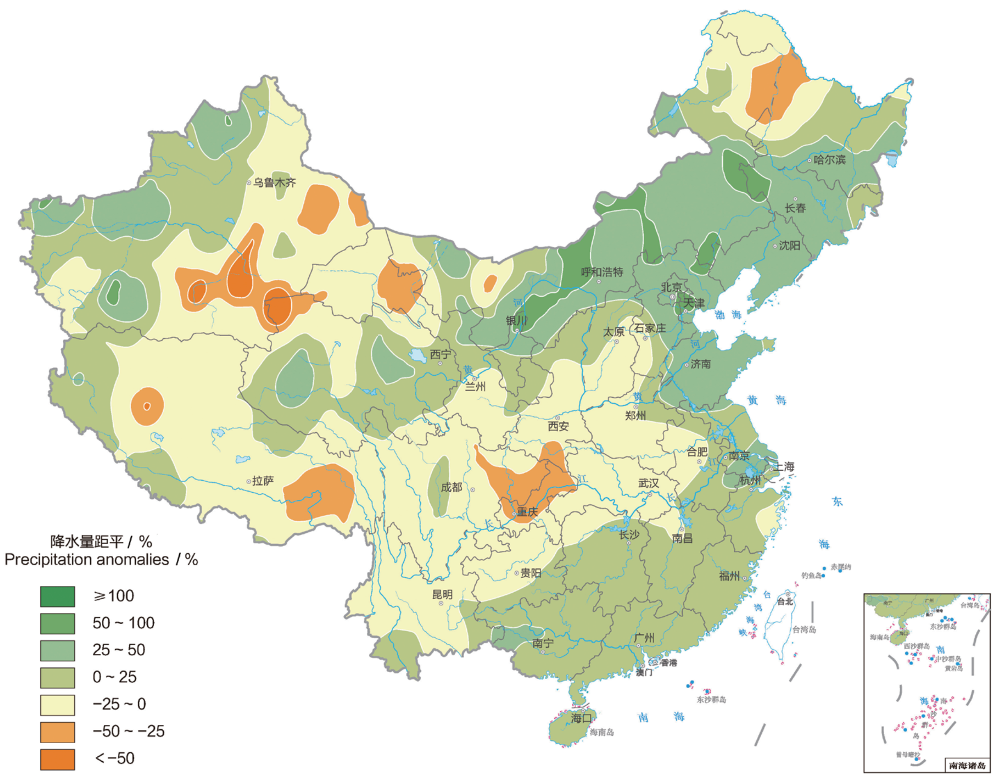
| | |
|---|---|
| 乌鲁木齐 | Urumqi |
| 拉萨 | Lhasa |
| 西宁 | Xining |
| 银川 | Yinchuan |
| 兰州 | Lanzhou |
| 呼和浩特 | Hohhot |
| 哈尔滨 | Harbin |
| 长春 | Changchun |
| 沈阳 | Shenyang |
| 北京 | Beijing |
| 天津 | Tianjin |
| 石家庄 | Shijiazhuang |
| 太原 | Taiyuan |
| 济南 | Ji'nan |
| 郑州 | Zhengzhou |
| 西安 | Xi'an |
| 武汉 | Wuhan |
| 南京 | Nanjing |
| 上海 | Shanghai |
| 杭州 | Hangzhou |
| 合肥 | Hefei |
| 南昌 | Nanchang |
| 福州 | Fuzhou |
| 长沙 | Changsha |
| 重庆 | Chongqing |
| 成都 | Chengdu |
| 贵阳 | Guiyang |
| 广州 | Guangzhou |
| 昆明 | Kunming |
| 南宁 | Nanning |
| 海口 | Haikou |
| 澳门 | Macao |
| 香港 | Hong Kong |
| 台北 | Taibei |
| 海南岛 | Hainan Dao |
| 台湾岛 | Taiwan Dao |
| 钓鱼岛 | Diaoyu Dao |
| 赤尾屿 | Chiwei Yu |
| 渤海 | Bo Hai |
| 黄海 | Yellow Sea |
| 东海 | East China Sea |
| 南海 | South China Sea |
| 台湾海峡 | Taiwan Haixia |
| 南海诸岛 | Nanhai Zhudao |
| 东沙群岛 | Dongsha Qundao |
| 南沙群岛 | Nansha Qundao |
| 中沙群岛 | Zhongsha Qundao |
| 西沙群岛 | Xisha Qundao |
| 黄岩岛 | Huangyan Dao |
| 曾母暗沙 | Zengmu Ansha |




注 香港特别行政区、澳门特别行政区、台湾省资料暂缺。
Note The data of HongKong SAR, Macao SAR and Taiwan are currently unavailable.

图 1–3 2024 年 5—9 月全国降水量等值线图

Figure 1–3 Isogram of precipitation from May to September 2024




注 香港特别行政区、澳门特别行政区、台湾省资料暂缺。
Note The data of HongKong SAR, Macao SAR and Taiwan are currently unavailable.

图 1–4 2024 年 5—9 月全国降水量距平图

Figure 1–4 Precipitation anomalies from May to September 2024

## 1.2 水情

### 1.2.1 江河径流量

2024 年，全国主要江河径流量与常年总体基本持平略偏多。长江大通站 9084.0 亿立方米，基本持平。黄河花园口站 345.3 亿立方米，基本持平（略偏少）。淮河鲁台子站 225.2 亿立方米，偏多近 2 成。海河流域永定河三家店站 2.4 亿立方米，偏多 5.7 倍；拒马河张坊站 4.5 亿立方米，偏多 2.5 倍；子牙河北中山站 2.9 亿立方米，偏多 2 倍。珠江流域西江梧州站 2294.2 亿立方米，偏多 1 成；北江石角站 579.9 亿立方米，偏多近 4 成；东江博罗站 359.5 亿立方米，偏多 6 成。松花江佳木斯站 926.9 亿立方米，偏多 8 成。辽河铁岭站 69.6 亿立方米，偏多 1.3 倍。

汛前，主要江河径流量及与常年同期相比，长江大通站 2326.3 亿立方米，偏多 2 成。黄河花园口站 119.9 亿立方米，偏多近 2 成。淮河鲁台子站 69.2 亿立方米，偏多 1.2 倍。海河流域永定河三家店站 1.0 亿立方米，偏多 7.7 倍；拒马河张坊站 0.8 亿立方米，偏多 3 倍；子牙河北中山站 1.7 亿立方米，偏多 25 倍。珠江流域西江梧州站 382.5 亿立方米，偏多 3 成；北江石角站 229.8 亿立方米，偏多 1.1 倍；东江博罗站 83.4 亿立方米，偏多 5 成。松花江佳木斯站 152.0 亿立方米，偏多近 4 成。辽河铁岭站 7.9 亿立方米，偏多 7 成。

注 松花江、辽河、海河、黄河流域径流量统计时段划分：汛前（1—5 月）、汛期（6—9 月）、汛后（10—12 月）；淮河、长江、珠江流域径流量统计时段划分：汛前（1—4 月）、汛期（5—9 月）、汛后（10—12 月）；太湖暂不做径流量统计。

## 1.2 Water Regime

### 1.2.1 River discharge

In 2024, the discharge of major rivers in China was only slightly above normal. The Datong Station on the Yangtze River recorded 908.40 billion $m^3$, basically the same as normal. The Huayuankou Station on the Yellow River recorded 34.53 billion $m^3$, only slightly below normal. The Lutaizi Station on the Huaihe River recorded 22.52 billion $m^3$, about 20% more. In the Haihe River Basin: The Sanjiadian Station on the Yongding River recorded 240 million $m^3$, 5.7 times normal. The Zhangfang Station on the Juma River recorded 450 million $m^3$, 2.5 times normal. The Beizhongshan Station on the Ziya River recorded 290 million $m^3$, twice the normal. In the Pearl River Basin: The Wuzhou Station on the Xijiang River recorded 229.42 billion $m^3$, 10% more. The Shijiao Station on the Beijiang River recorded 57.99 billion $m^3$, nearly 40% more. The Boluo Station on the Dongjiang River recorded 35.95 billion $m^3$, 60% more. The Jiamusi Station on the Songhua River recorded 92.69 billion $m^3$, 80% more. The Tieling Station on the Liaohe River recorded 6.96 billion $m^3$, 1.3 times normal.

In terms of the discharge of major rivers and comparison with their respective normals prior to the flood season, Datong Station on the Yangtze recorded 232.63 billion $m^3$, 20% more. Huayuankou Station on the Yellow River recorded 11.99 billion $m^3$, nearly 20% more. Lutaizi Station on the Huaihe recorded 6.92 billion $m^3$, 1.2 times normal. In the Haihe River Basin: Sanjiadian Station on the Yongding River recorded 100 million $m^3$, 7.7 times normal; Zhangfang Station on the Juma River recorded 80 million $m^3$, tripling the normal; and Beizhongshan Station on the Ziya River recorded 170 million $m^3$, 25 times normal. In the Pearl River Basin: Wuzhou Station on the Xijiang recorded 38.25 billion $m^3$, 30% more; Shijiao Station on the Beijiang 22.98 $m^3$, 1.1 times normal; Boluo Station on the Dongjiang 8.34 billion $m^3$, 50% more. Jiamusi Station on the Songhua River recorded 15.20 billion $m^3$, nearly 40% more. Tieling Station on the Liaohe recorded 790 million $m^3$, 70% more.

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Note For statistics of river discharges in the Songhua River, the Liaohe River, the Haihe River, and the Yellow River basins: pre-flood period (January-May), flood period (June-September), post-flood period (October-December); for statistics of river discharges in the Huaihe, the Yangtze and the Pearl River basins: pre-flood period (January-April), flood period (May-September), post-flood period (October-December); No statistics of discharges in the Taihu Lake are prepared.

汛期，主要江河径流量及与常年同期相比，长江大通站 5772.0 亿立方米，偏多近 1 成。黄河花园口站 174.3 亿立方米，偏多近 1 成。淮河鲁台子站 144.7 亿立方米，偏多 1 成。海河流域永定河三家店站 0.8 亿立方米，偏多 5.7 倍；拒马河张坊站 2.6 亿立方米，偏多 2.2 倍；子牙河北中山站 1.1 亿立方米，偏多 5 成。珠江流域西江梧州站 1692.7 亿立方米，偏多 1 成；北江石角站 319.7 亿立方米，偏多 2 成；东江博罗站 241.9 亿立方米，偏多 7 成。松花江佳木斯站 657.3 亿立方米，偏多 1.2 倍。辽河铁岭站 53.6 亿立方米，偏多 1.4 倍。

汛后，主要江河径流量及与常年同期相比，长江大通站 985.7 亿立方米，偏少 4 成。黄河花园口站 51.1 亿立方米，偏少 4 成。淮河鲁台子站 11.3 亿立方米，偏少 6 成。海河流域永定河三家店站 0.6 亿立方米，偏多 3.8 倍；拒马河张坊站 1.1 亿立方米，偏多 2.9 倍；子牙河北中山站 0.1 亿立方米，偏少近 6 成。珠江流域西江梧州站 219.0 亿立方米，偏少 2 成；北江石角站 30.4 亿立方米，偏少近 4 成；东江博罗站 34.2 亿立方米，基本持平略偏少。松花江佳木斯站 117.6 亿立方米，偏多 2 成。辽河铁岭站 8.1 亿立方米，偏多 1.4 倍。

In terms of the discharge of major rivers and comparison with their respective normals during the flood season, Datong Station on the Yangtze recorded 577.20 billion $m^3$, nearly 10% more. Huayuankou Station on the Yellow River recorded 17.43 billion $m^3$, nearly 10% more. Lutaizi Station on the Huaihe recorded 14.47 billion $m^3$, 10% more. In the Haihe River Basin: Sanjiadian Station on the Yongding River recorded 80 million $m^3$, 5.7 times normal; Zhangfang Station on the Juma River recorded 260 million $m^3$, 2.2 times normal; and Beizhongshan Station on the Ziya River recorded 110 million $m^3$, 50% more. In the Pearl River Basin: Wuzhou Station on the Xijiang recorded 169.27 billion $m^3$, 10% more; Shijiao Station on the Beijiang 31.97 $m^3$, 20% more; Boluo Station on the Dongjiang 24.19 billion $m^3$, 70% more. Jiamusi Station on the Songhua River recorded 65.73 billion $m^3$, 1.2 times normal. Tieling Station on the Liaohe recorded 5.36 billion $m^3$, 1.4 times normal.

In terms of the discharge of major rivers and comparison with their respective normals after the flood season, Datong Station on the Yangtze recorded 98.57 billion $m^3$, 40% less. Huayuankou Station on the Yellow River recorded 5.11 billion $m^3$, 40% less. Lutaizi Station on the Huaihe recorded 1.13 billion $m^3$, 60% less. In the Haihe River Basin: Sanjiadian Station on the Yongding River recorded 60 million $m^3$, 3.8 times normal; Zhangfang Station on the Juma River recorded 110 million $m^3$, 2.9 times normal; and Beizhongshan Station on the Ziya River recorded 10 million $m^3$, nearly 60% less. In the Pearl River Basin: Wuzhou Station on the Xijiang recorded 21.90 billion $m^3$, 20% less; Shijiao Station on the Beijiang recorded 3.04 billion $m^3$, nearly 40% less; Boluo Station on the Dongjiang recorded 3.42 billion $m^3$, slightly less than normal. Jiamusi Station on the Songhua River recorded 11.76 billion $m^3$, 20% more. Tieling Station on the Liaohe recorded 810 million $m^3$, 1.4 times normal.

### 1.2.2 水库蓄水

6 月 1 日，纳入水利部日常统计范围的 9520 座水库（以下简称“统计水库”）蓄水量 4539.5 亿立方米，较常年同期偏多 15%。其中，762 座大型水库蓄水量 4057.9 亿立方米，较常年同期偏多 16%；3405 座中型水库蓄水量 427.6 亿立方米，较常年同期偏多 8%；5353 座小型水库蓄水量 54.0 亿立方米，较常年同期偏多 4%。

10 月 1 日，统计水库蓄水量 5475.2 亿立方米，较 6 月 1 日增加 21%，较常年同期偏多 5%。其中，762 座大型水库蓄水量 4975.5 亿立方米，较 6 月 1 日增加 23%，较常年同期偏多 6%；3405 座中型水库蓄水量 451.6 亿立方米，较 6 月 1 日增加 6%，较常年同期偏多 3%；5353 座小型水库蓄水量 48.1 亿立方米，较 6 月 1 日减少 11%，与常年同期持平。

年末（2025 年 1 月 1 日数据），统计水库蓄水量 5381.5 亿立方米，较 1 月 1 日增加 1%，较常年同期偏多 9%。其中，762 座大型水库蓄水量 4910.1 亿立方米，较 1 月 1 日增加 1%，较常年同期偏多 9%；3405 座中型水库蓄水量 426.5 亿立方米，较 1 月 1 日减少 1%，较常年同期偏多 4%；5353 座小型水库蓄水量 44.87 亿立方米，较 1 月 1 日基本持平，较常年同期偏多 7%。

表 1-1 2024 年统计水库蓄水量情况
Table 1-1 Water storage of the daily-reporting reservoirs in 2024

| 时间<br>Date | 9520 座水库蓄水量 / 亿立方米<br>Storage in 9,520 reservoirs / 100 million m³ | | | |
|---|---|---|---|---|
| | 762 座大型水库<br>762 large reservoirs | 3405 座中型水库<br>3,405 medium-sized reservoirs | 5353 座小型水库<br>5,353 small reservoirs | 合计<br>Total |
| 1 月 1 日<br>January 1 | 4876.7 | 429.8 | 45.0 | 5351.5 |
| 6 月 1 日<br>June 1 | 4057.9 | 427.6 | 54.0 | 4539.5 |
| 10 月 1 日<br>October 1 | 4975.5 | 451.6 | 48.1 | 5475.2 |
| 年末<br>Year-end | 4910.1 | 426.5 | 44.87 | 5381.5 |

注 年末数据指 2025 年 1 月 1 日 8 时统计数据。
Note Year-end data as of 8:00 am on January 1, 2025.

### 1.2.2 Reservoir storage

On June 1, the 9,520 reservoirs that report daily statistics to MWR (hereinafter “daily-reporting reservoirs”) held 453.95 billion $m^3$ of water, 15% more than normal over the same period. Among them, the 762 large reservoirs stored 405.79 billion $m^3$,16% more than normal; the 3,405 medium-sized reservoirs stored 42.76 billion $m^3$, 8% more than normal; and the 5,353 small reservoirs stored 5.40 billion $m^3$ , 4% more than normal.

On October 1, the total storage of daily-reporting reservoirs was 547.52 billion $m^3$, a 21% increase from June 1 and 5% more than normal. Among them, the 762 large reservoirs stored 497.55 billion $m^3$, a 23% increase from June 1 and 6% more than normal; the 3,405 medium-sized reservoirs stored 45.16 billion $m^3$, a 6% increase from June 1 and 3% more than normal; and the 5,353 small reservoirs stored 4.81 billion $m^3$, an 11% decrease from June 1 and the same as normal.

At year-end (January 1, 2025 ), the storage of daily-reporting reservoirs was 538.15 billion $m^3$, a 1% increase from last January 1 and 9% more than normal. Among them, the 762 large reservoirs stored 491.01 billion $m^3$, a 1% increase from last January 1 and 9% more than normal; the 3,405 medium-sized reservoirs stored 42.65 billion $m^3$, a 1% decrease from last January 1 and 4% more than normal; and the 5,353 small reservoirs stored 4.487 billion $m^3$, basically unchanged from last January 1 and 7% more than normal.

# 2 洪涝灾害防御

FLOOD DISASTER PREVENTION

## 2.1 汛情

2024 年 4 月 1 日，我国进入汛期，与多年平均入汛日期一致。全国主要江河共发生 26 次编号洪水，共有 1321 条河流发生超警戒洪水，较多年平均（684 条）偏多 93%，其中 298 条河流发生超保证洪水、67 条河流发生超历史实测记录洪水。长江流域（片）有 433 条河流发生超警戒洪水，其中湖南洞庭湖水系湘江下游干流、江西鄱阳湖水系修水干流等 115 条河流发生超保证洪水，鄱阳湖水系修水、汉江支流金钱河清河、洞庭湖水系涞水侧水汨罗江涓水溆水耒水等 25 条河流发生超历史实测记录洪水，长江干流共发生 3 次编号洪水；黄河流域（片）有 80 条河流发生超警戒洪水，其中新疆塔里木河、陕西北洛河、宁夏苏峪口沟等 21 条河流发生超保证洪水，新疆额尔齐斯河、陕西渭河支流千河、宁夏渭河支流泾河等 7 条河流发生超历史实测记录洪水，黄河干流发生 1 次编号洪水；淮河流域（片）有 66 条河流发生超警戒洪水，其中河南洪河、安徽涡河等 10 条河流发生超保证洪水，安徽涡河等 7 条河流发生超历史实测记录洪水，淮河、沂河、沭河共发生 5 次编号洪水；海河流域（片）有 14 条河流发生超警戒洪水，其中河北沿海汤河发生超保证、超历史实测记录洪水；珠江流域（片）有 328 条河流发生超警戒洪水，其中广西桂江、海南万泉河、福建汀江、广东绥江等 42 条河流发生超保证洪水，广东梅江、广西桂江等 14 条河流发生超历史实测记录洪水，西江、北江、东江、韩江共发生 13 次编号洪水；松辽流域（片）有 264 条河流发生超警戒洪水，其中黑龙江乌苏里江、吉林饮马河、辽宁大辽河等 75 条河流发生超保证洪水，乌苏里江、大辽河、鸭绿江等 11 条河流发生超历史实测记录洪水，松花江吉林段发生 2 次编号洪水；太湖流域（片）有 136 条河流发生超警戒洪水，其中福建建溪富屯溪、浙江新安江等 34 条河流发生超保证洪水，江苏洮滆运河、漕桥河等 2 条河流发生超历史实测记录洪水，太湖发生 2 次编号洪水。黄河、黑龙江等北方河流凌情平稳。

## 2.1 Floods

The 2024 flood season began on April 1, consistent with the multi-year average start date. There were 26 numbered floods in major rivers nationwide. A total of 1,321 rivers swelled above the warning level/discharge, a 93% increase over the average annual (684 rivers). Among them, 298 rivers had floods beyond the guaranteed level/discharge and 67 rivers had record-breaking floods.

In the Yangtze River Basin/Region, 433 rivers experienced floods beyond the warning level/discharge. Among them, 115 rivers experienced floods beyond the guaranteed level/discharge, including the lower mainstream of Xiangjiang draining to Dongting Lake system in Hunan Province and the Xiushui mainstream draining to Poyang Lake system in Jiangxi Province; and 25 rivers experienced record-breaking floods, including the Xiushui in the Poyang Lake system, the Qinghe (a tributary of Jinqian River that joins the Hanjiang), and rivers in the Dongting Lake system such as the Mishui, Ceshui, Miluojiang, Juanshui, Xushui and Leishui. The Yangtze mainstream experienced 3 numbered floods.

In the Yellow River Basin/Region, 80 rivers had floods beyond the warning level/discharge. Among them, 21 rivers had flood beyond the guaranteed level/discharge, including Tarim River in Xinjiang, Beiluo River in Shaanxi, and Suyukou Gully in Ningxia; and 7 rivers had record-breaking floods, including Irtysh River in Xinjiang, the Qianhe (a tributary of the Weihe) in Shaanxi, and the Jinghe (a tributary of the Weihe) in Ningxia. The Yellow River mainstream had 1 numbered flood.

In the Huaihe River Basin/Region, 66 rivers had floods beyond the warning level/discharge. Among them, 10 rivers had floods beyond the guaranteed level/discharge, including the Honghe in Henan and the Guohe in Anhui; 7 rivers had record-breaking floods, including the Guohe in Anhui; and the Huaihe, Yihe, and Shuhe collectively experienced 5 numbered floods.

In the Haihe River Basin/Region, 14 rivers had floods beyond the warning level/discharge. Among them, floods in the coastal Tanghe in Hebei went beyond the guaranteed level /discharge and broke historical records.

In the Pearl River Basin/Region, 328 rivers had floods beyond the warning level/discharge. Among them, 42 rivers had floods beyond the guaranteed level/discharge, including the Guijiang in Guangxi, the Wanquan River in Hainan, the Tingjiang in Fujian, and the Suijiang in Guangdong; 14 rivers had record-breaking floods, including the Meijiang in Guangdong and the Guijiang in Guangxi. The Xijiang, Beijiang, Dongjiang and Hanjiang rivers collectively experienced 13 numbered floods.

In the Songhua-Liaohe River Basin/Region, 264 rivers had floods beyond the warning level/discharge. Among them, 75 rivers had floods beyond the guaranteed level/discharge, including the Ussuri River in Heilongjiang, the Yinma River in Jilin, and the Daliao River in Liaoning; 11 rivers had record-breaking floods, including the Ussuri River, Daliao River and Yalu River. The Jilin section of the Songhua River experienced 2 numbered floods.

In the Taihu Lake Basin/Region, 136 rivers had floods beyond the warning level/discharge. Among them, 34 rivers had floods beyond the guaranteed level/discharge, including the Jianxi and Futunxi rivers in Fujian and the Xin'anjiang in Zhejiang; the Tao-Ge Canal and Caoqiao River in Jiangsu had record-breaking floods. Taihu Lake experienced 2 numbered floods.

China’s northern rivers, including the Yellow River and the Heilong River, safely passed the ice flood period.

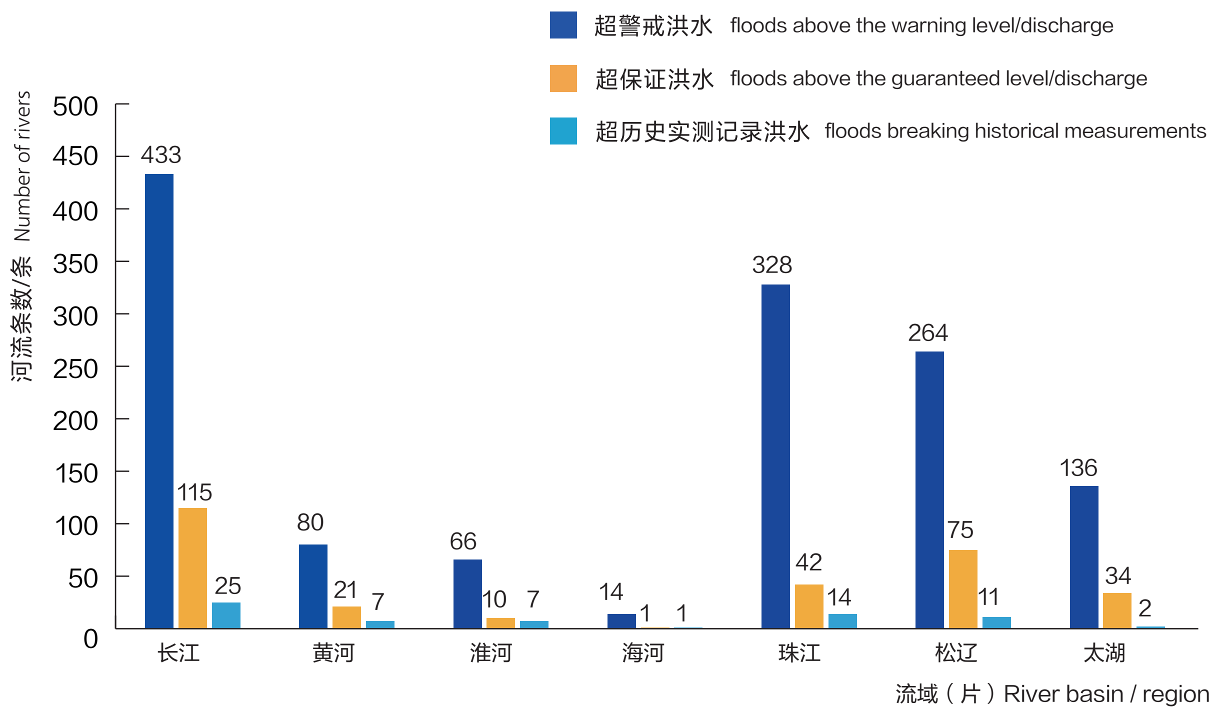



图 2-1　2024 年各流域（片）发生超警戒、超保证、超历史实测记录洪水河流条数

Figure 2-1　Number of rivers experiencing floods above the warning water level/discharge, above the guaranteed water level/discharge, and breaking historical measurements in the major river basins / regions in 2024

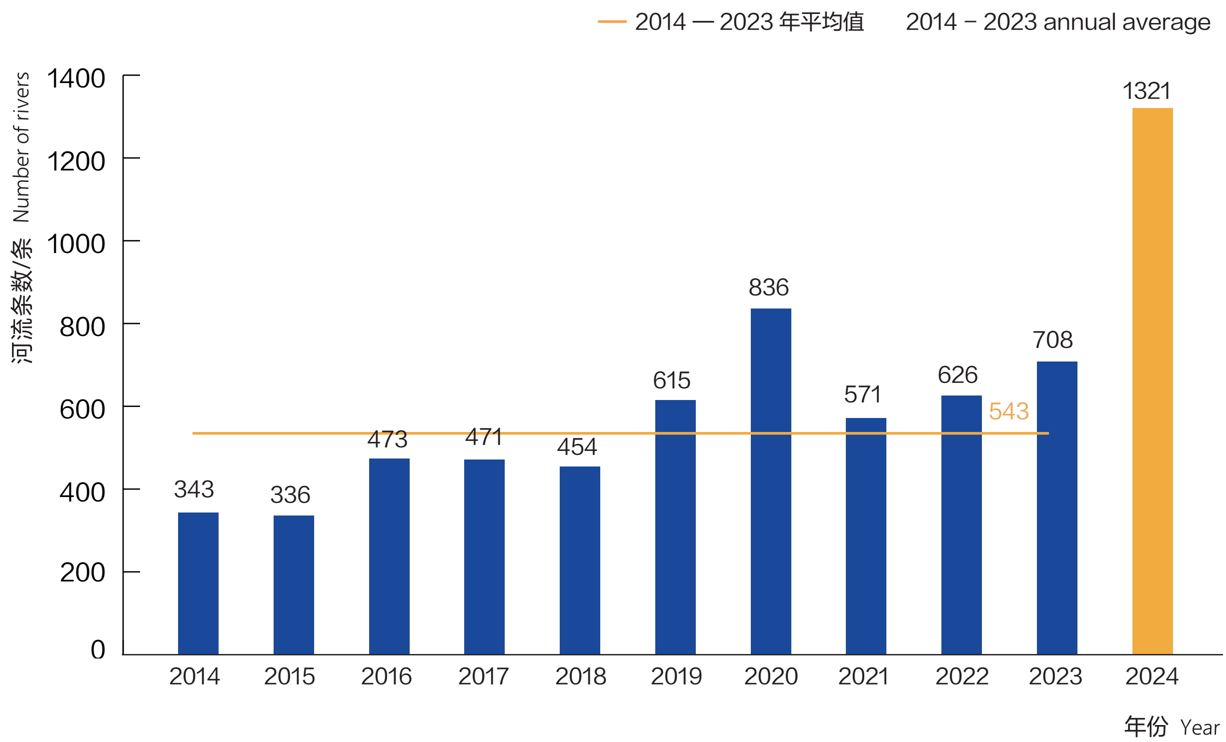



图 2-2　2014—2024 年全国发生超警戒洪水河流条数

Figure 2-2　Number of rivers experiencing floods above the warning level/discharge in China, 2014-2024

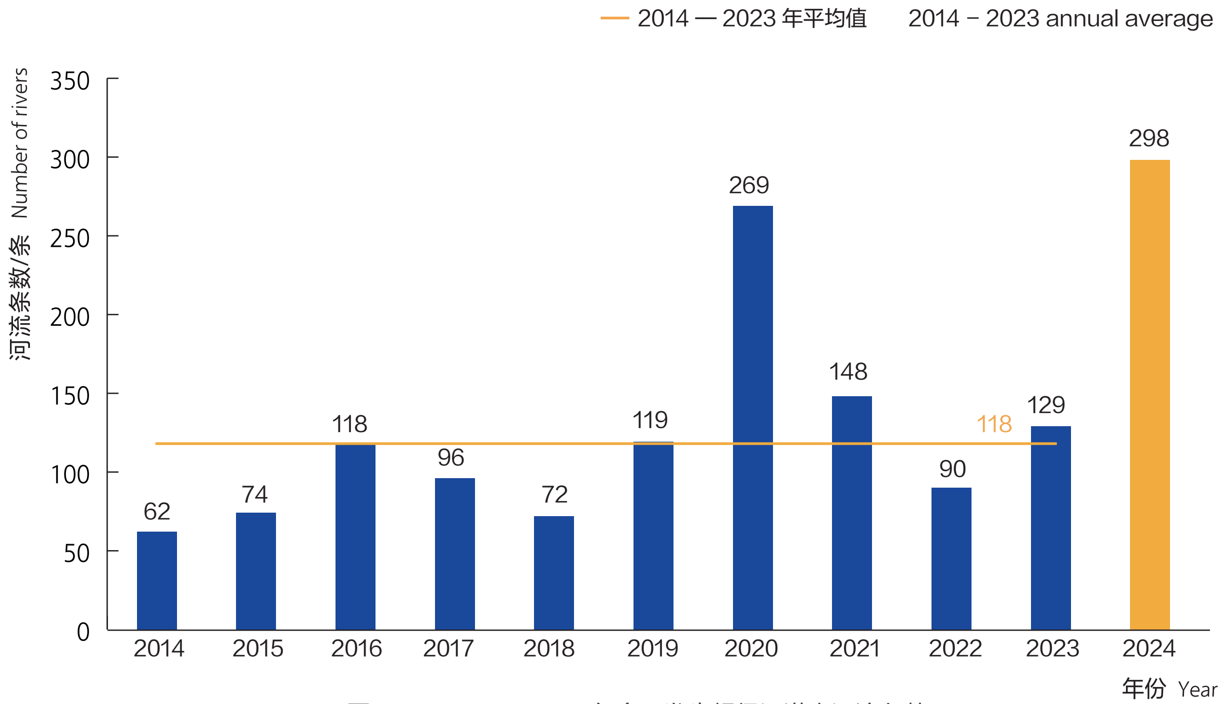



图 2-3 2014—2024 年全国发生超保证洪水河流条数

Figure 2-3 Number of rivers experiencing floods above the guaranteed level/discharge in China, 2014-2024

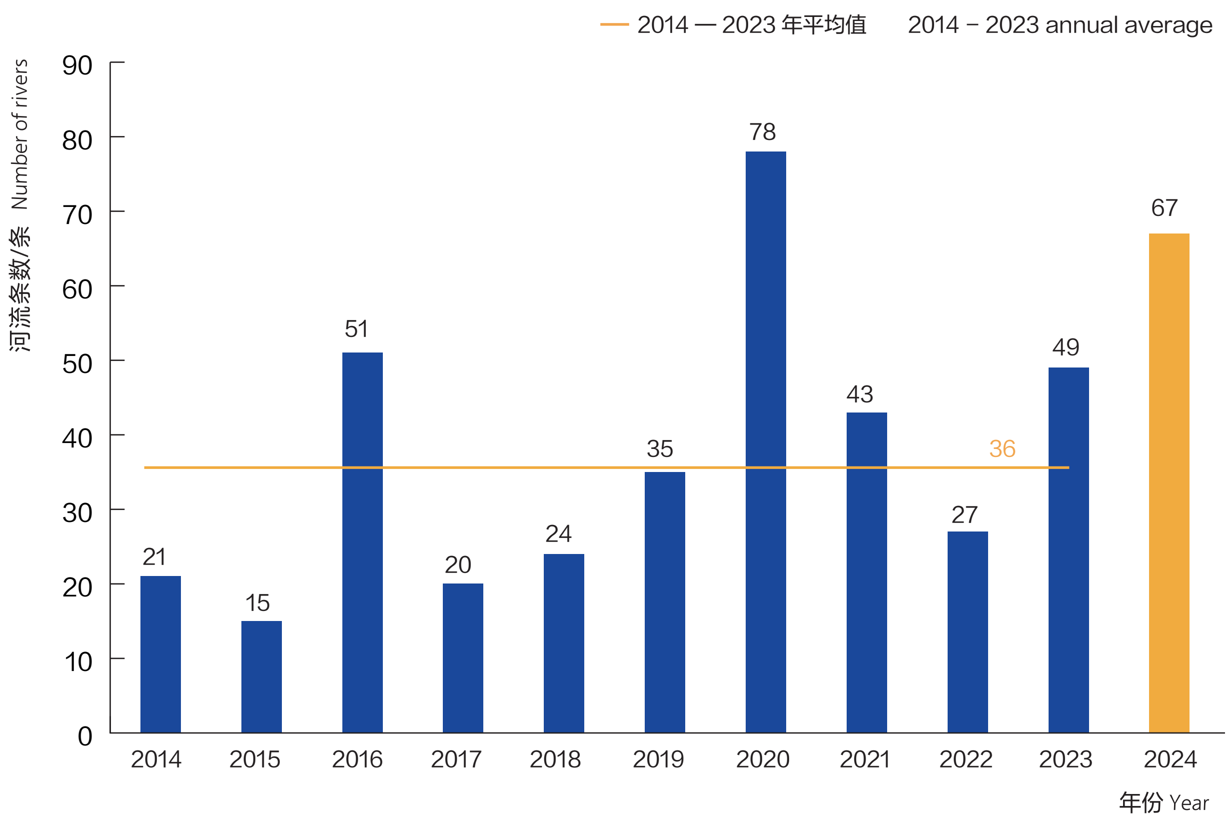



图 2-4 2014—2024 年全国发生超历史实测记录洪水河流条数

Figure 2-4 Number of rivers experiencing floods breaking historical measurements in China, 2014-2024

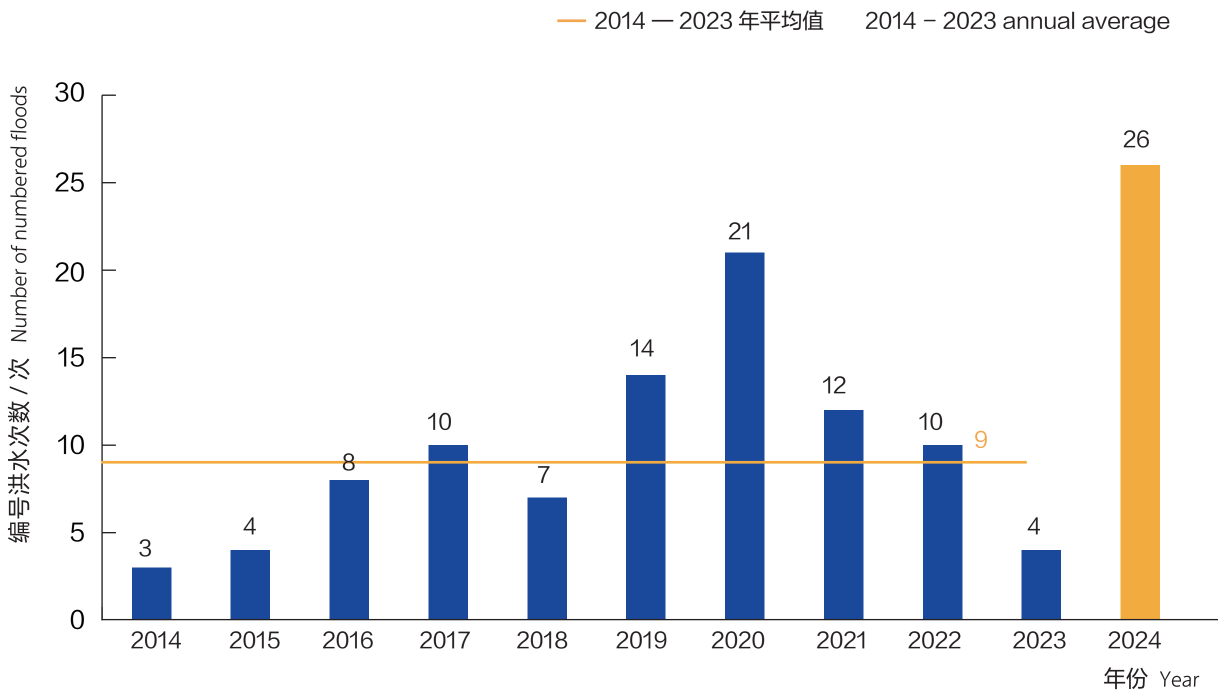



图 2-5　2014—2024 年全国主要江河发生编号洪水次数

Figure 2-5　Statistics of numbered floods in major rivers in China, 2014–2024

全国汛情有 3 个主要特点。

（1）洪水发生时间早，汛期持续时间长。4 月，珠江流域主要江河发生 6 次编号洪水，其中北江第 1 号洪水（4 月 7 日）为全国主要江河 1998 年有资料统计以来最早的编号洪水，较常年偏早 2 个月。全国自 4 月 1 日入汛后洪水持续活跃直至 10 月底，汛情活跃时间长达 7 个月。

（2）编号洪水创新高，多发并发时间集中。全国大江大河共发生 26 次编号洪水，列 1998 年有资料统计以来第 1 位（第 2 位 2020 年 21 次、第 3 位 1998 年 20 次），其中长江 3 次、黄河 1 次、淮河 5 次、珠江 13 次、松花江 2 次、太湖 2 次。珠江流域编号洪水数量列历史第 1 位，流域内四大江河继 2006 年之后再次全部出现编号洪水，其中北江发生特大洪水。6 月 27 日至 7 月 14 日 18 天内全国主要江河接连发生 12 次编号洪水。

（3）超警河流数量多范围广，洪水涨势猛量级大。广西、吉林、广东、黑龙江、四川、江苏、云南等 30 个省（自治区、直辖市）1321 条河流发生超警戒以上洪水，其中 298 条超保证、67 条超历史实测记录。防汛关键期超警河流数量一度达到常年同期 2.4 倍。福建汀江棉花滩水库 12 小时内入库流量由 673 立方米每秒涨至 9860 立方米每秒，广东梅江支流差干河差干站 11 小时水位涨幅高达 10.31 米。乌苏里江上游干流虎头江段 2 个月内连发 2 次有实测记录以来最大洪水，鸭绿江十三道湾到临江段发生有实测记录以来最大洪水。

Floods in 2024 generally took on the following three characteristics.

(1) Early flood occurrence with prolonged flood season duration. In April, major rivers in the Pearl River Basin experienced 6 numbered floods. In particular, No. 1 Flood in the Beijiang formed on April 7—the earliest numbered flood in China's major rivers since records began in 1998, occurring 2 months earlier than normal. Nationwide flood processes remained persistent from the April 1 flood season onset until late October, lasting 7 months.

(2) Record-high numbered floods with concentrated occurrences. Major rivers nationwide experienced 26 numbered floods—the highest since records began in 1998 (followed by 21 in 2020 and 20 in 1998). Among them, 3 occurred in the Yangtze River, 1 in the Yellow River, 5 in the Huaihe River, 13 in the Pearl River, 2 in the Songhua River, and 2 in Taihu Lake. The Pearl River Basin set a new record for numbered floods, with all four major rivers experiencing numbered floods for the first time since 2006 and an extreme flood in the Beijiang River. During the 18 days between June 27 and July 14, 12 numbered floods hit major rivers nationwide.

(3) Widespread rivers swelling beyond the warning level/discharge with rapid, severe flooding. A total of 1,321 rivers in 30 provinces/autonomous regions/municipalities, including Guangxi, Jilin, Guangdong, Heilongjiang, Sichuan, Jiangsu and Yunnan, swelled beyond the warning level/discharge, with 298 going beyond the guaranteed level/discharge and 67 experiencing record-breaking floods. At the critical period for flood control, the number of rivers rising beyond the warning level/discharge reached 2.4 times the normal over the same period. The Mianhuatan Reservoir on the Tingjiang in Fujian saw inflow surge from 673 $m^3/s$ to 9,860 $m^3/s$ within 12 hours, while Chagan Station on the Chagan River (a Meijiang tributary) in Guangdong recorded a 10.31 m water level rise in just 11 hours. The Hutou river section of upper Ussuri experienced two record-breaking floods within two months, and the Yalu River from Shisandaowan to Linjiang river section experienced a record-breaking flood.

## 2.2 主要江河洪水过程

### 2.2.1 长江流域 3 次编号洪水

6 月 11 日至 7 月 2 日，长江流域连续发生 6 次强降雨过程，雨区主要集中在长江干流及洞庭湖、鄱阳湖流域。长江流域累计面降雨量 245 毫米，较常年同期（155 毫米）偏多 58%，列 1961 年以来同期第 2 位（第 1 位为 1998 年 261 毫米），其中洞庭湖 366 毫米、中游干流 358 毫米、鄱阳湖 413 毫米，较常年同期分别偏多 137%、125%、89%，分别列 1961 年以来同期第 1 位、第 3 位、第 2 位。中游干流九江水文站（江西九江市）6 月 28 日 14 时水位涨至警戒水位（20.00 米），形成长江 1 号洪水，7 月 4 日 18 时 20 分洪峰水位 21.86 米，超过警戒水位 1.86 米，相应流量 59500 立方米每秒，21 日 22 时水位降至警戒水位以下，超警历时 25 天。

7 月 3—13 日，长江上游连续出现 3 次强降雨过程，流域累计面降雨量嘉陵江 142 毫米、上游干流 130 毫米，累计最大点降雨量重庆奉节岩湾平石 692 毫米、四川南充周河 565 毫米。三峡水库 7 月 11 日 18 时入库流量涨至 50000 立方米每秒，形成长江 2 号洪水，12 日 20 时出现 2024 年最大入库流量 55000 立方米每秒，14 日 12 时出现此次过程最高库水位 166.55 米。

长江湖北武汉市汉口站水位上涨（7 月 3 日）
Water level rises at Hankou Station (Wuhan, Hubei) on the Yangtze River (July 3)

# 2.2 Major Flood Processes

## 2.2.1 Three numbered floods in the Yangtze River Basin

From June 11 to July 2, the Yangtze River Basin experienced six consecutive heavy rainfall processes, primarily affecting the Yangtze mainstream and the Dongting and Poyang Lake basins. The basin's cumulative rainfall reached 245 mm — 58% higher than normal (155 mm) and ranking second highest since 1961 (after 261 mm in 1998). In particular, the Dongting Lake received 366 mm (137% above normal, ranking first in post-1961 records), the middle Yangtze mainstream 358 mm (125% above normal, ranking third highest in post-1961 records), and Poyang Lake 413 mm (89% above normal, ranking second highest in post-1961 records). At the Jiujiang Hydrological Station (Jiujiang, Jiangxi) on the middle Yangtze mainstream, the water level rose to the warning level (20.00 m) at 14:00 on June 28, forming the No. 1 Flood in the Yangtze. The water level peaked at 21.86 m (1.86 m above the warning level) with a corresponding flow of 59,500 m³/s at 18:20 on July 4. The water level remained above the warning level for 25 days, before falling back to normal at 22:00 on July 21.

From July 3 to 13, three consecutive heavy rainfall processes occurred in the upper Yangtze, with cumulative rainfall of 142 mm in the Jialing River basin and 130 mm in the upper mainstream. Maximum point rainfall reached 692 mm at Pingshi station in Yanwan, Fengjie, Chongqing and 565 mm at Zhouhe in Nanchong, Sichuan. At 18:00 on July 11, the inflow to Three Gorges Reservoir reached 50,000 m³/s, forming the No. 2 Flood in the Yangtze. The inflow topped the yearly record at 55,000 m³/s at 20:00 on July 12 and the reservoir level peaked at 166.55 m at 12:00 on July 14.

7 月 25—31 日，受台风“格美”登陆和冷空气共同影响，华南、江南、西南东部等地出现了一次大范围强降雨过程，湖南省累计面降雨量 108 毫米，其中湘潭 207 毫米、郴州 203 毫米、衡阳 189 毫米，累计最大点降雨量湖南郴州坪石 718 毫米。莲花塘水位站（湖南岳阳市）7 月 29 日 18 时 50 分水位涨至警戒水位（32.50 米），形成长江 3 号洪水，31 日 10 时洪峰水位 32.91 米，超过警戒水位 0.41 米，8 月 2 日 12 时水位降至警戒水位以下，超警历时 5 天。

From July 25 to 31, influenced by Typhoon "Gaemi" and cold air, extensive downpours lashed South China, Jiangnan (areas south of the middle-lower Yangzte) and eastern Southwest China. Hunan Province received cumulative rainfall of 108 mm, while its Xiangtan received 207 mm, Chenzhou 203 mm and Hengyang 189 mm. The maximum point rainfall of 718 mm was recorded at Pingshi Station in Chenzhou, Hunan. The Lianhuatang Water Level Station (Yueyang, Hunan) recorded water level reaching the warning level (32.50 m) at 18:50 on July 29, forming the No. 3 Flood in the Yangtze. The water level peaked at 32.91 m (0.41 m above the warning level) at 10:00 on July 31 and remained above the warning level for 5 days before falling back to normal at 12:00 on August 2.

长江洪水过境重庆巫山县（7 月 15 日）
Floodwater in the Yangtze River rush past Wushan County, Chongqing (July 15)

### 2.2.2 黄河流域 1 次编号洪水

7 月中下旬，受持续性降雨影响，黄河上游唐乃亥以上累计面降雨量 89 毫米，较常年同期（63 毫米）偏多 4.2 成，累计最大点降雨量四川阿坝求吉玛 236 毫米。黄河上游干流控制站唐乃亥水文站（青海海南州）7 月 29 日 9 时 36 分涨至 2510 立方米每秒，形成黄河 1 号洪水，30 日 6 时 24 分洪峰流量 2790 立方米每秒。

### 2.2.2 One numbered flood in the Yellow River Basin

In mid-to-late July, persistent rainfall in the upper Yellow River resulted in 89 mm of cumulative rainfall in the river section upstream of Tangnaihai 42% higher than normal (63 mm). The maximum point rainfall of 236 mm occurred at Qiujima in Aba, Sichuan. The flow at Tangnaihai Hydrological Station (Hainan Prefecture, Qinghai) on the upper Yellow River mainstream rose to 2,510 $m^3/s$ at 09:36 on July 29, forming the No. 1 Flood in the Yellow River. The peak flow reached 2,790 $m^3/s$ at 06:24 on July 30.

### 2.2.3 淮河流域 5 次编号洪水

7 月 7—17 日，淮河流域连续出现 3 次强降雨过程，流域累计面降雨量 162 毫米，其中淮河水系 180 毫米、沂沭泗水系 204 毫米，累计最大点降雨量河南商丘包公庙 648 毫米、江苏连云港赣榆 513 毫米。

淮河上游干流控制站王家坝水文站（安徽阜阳市）7 月 13 日 16 时 12 分水位涨至警戒水位（27.50 米），形成淮河 1 号洪水，15 日 21 时 12 分洪峰水位 27.93 米，超过警戒水位 0.43 米，17 日 12 时 6 分水位降至警戒水位，超警历时 5 天；中游干流控制站正阳关水位站（安徽淮南市）7 月 15 日 9 时 42 分水位涨至警戒水位（24.00 米），20 日 13 时 42 分洪峰水位 25.17 米，超过警戒水位 1.17 米，24 日 18 时 24 分降至警戒水位，超警历时 10 天。

沂河干流控制站临沂水文站（山东临沂市）7 月 7 日 18 时 46 分涨至 5010 立方米每秒，形成沂河 1 号洪水，7 日 21 时 44 分最大流量 6240 立方米每秒，9 日 1 时退至 2650 立方米每秒后复涨，9 日 12 时复涨至 4180 立方米每秒，形成沂河 2 号洪水，9 日 13 时最大流量 5100 立方米每秒。

沭河干流控制站重沟水文站（山东临沂市）7 月 6 日 18 时 35 分流量涨至 2040 立方米每秒，形成沭河 1 号洪水，7 日 22 时 54 分最大流量 2250 立方米每秒，9 日 0 时退至 1330 立方米每秒后复涨，9 日 10 时 11 分时复涨至 2010 立方米每秒，形成沭河 2 号洪水，9 日 13 时 14 分洪峰流量 2230 立方米每秒。

江苏淮安市金湖县淮河入江水道水位上涨（7 月 11 日）
Water level rises in the Huaihe-Yangtze floodway in Jinhu County, Huai'an, Jiangsu (July 11)

### 2.2.3 Five numbered floods in the Huaihe River Basin

From July 7 to 17, the Huaihe River Basin experienced three consecutive heavy rainfall processes, with cumulative rainfall of 162 mm in the basin. The Huaihe river system received 180 mm and the Yihe-Shuhe-Sihe river system 204 mm. The maximum point rainfall of 648 mm was recorded at Baogongmiao in Shangqiu, Henan and 513 mm at Ganyu in Lianyungang, Jiangsu.

At Wangjiaba Hydrological Station (Fuyang, Anhui) on the upper Huaihe mainstream, the water level rose to the warning level (27.50 m) at 16:12 on July 13, forming the No. 1 Flood in the Huaihe. The water level peaked at 27.93 m (0.43 m above warning level) at 21:12 on July 15 and remained above the warning level for 5 days before falling back to normal at 12:06 on July 17. At Zhengyangguan Controlling Water Level Station (Huainan, Anhui) on the middle Huaihe mainstream, the water level rose to the warning level (24.00 m) at 09:42 on July 15, peaked at 25.17 m (1.17 m above the warning level) at 13:42 on July 20, and remained above the warning level for 10 days before falling back to normal at 18:24 on July 24.

At Linyi Controlling Hydrological Station (Linyi, Shandong) on the Yihe mainstream, the flow rose to 5,010 $m^3/s$ at 18:46 on July 7, forming the No. 1 Flood in the Yihe. The flow peaked at 6,240 $m^3/s$ at 21:44 on July 7, receded to 2,650 $m^3/s$ at 01:00 on July 9, and rose again to 4,180 $m^3/s$ at 12:00, forming the No. 2 Flood in the Yihe, with the flow peaking at 5,100 $m^3/s$ at 13:00 on July 9.

At Chonggou Controlling Hydrological Station (Linyi, Shandong) on the Shuhe mainstream, the flow rose to 2,040 $m^3/s$ at 18:35 on July 6, forming the No. 1 Flood in the Shuhe. The flow peaked at 2,250 $m^3/s$ at 22:54 on July 7, receded to 1,330 $m^3/s$ at 00:00 on July 9, and rose again to 2,010 $m^3/s$ at 10:11, forming the No. 2 Flood in the Shuhe, with the flow peaking at 2,230 $m^3/s$ at 13:14 on July 9.

### 2.2.4 珠江流域 13 次编号洪水

西江、北江、东江、韩江共发生 13 次编号洪水，其中韩江 6 次，均为 1998 年有编号洪水统计以来最多，继 2006 年后流域主要江河再次全部发生编号洪水，其中北江 2 号洪水为特大洪水。

### 2.2.4 Thirteen numbered floods in the Pearl River Basin

The Xijiang, Beijiang, Dongjiang, and Hanjiang rivers experienced a total of 13 numbered floods, among which 6 happened in the Hanjiang. Both numbers broke the statistical records of numbered floods since 1998. It was also the first time since 2006 that all major rivers in the basin experienced numbered floods. Among these, the No. 2 Flood in the Beijiang was classified as an extreme event.

东江 1 号洪水过境广东东莞市（4 月 30 日）
Dongjiang No. 1 Flood passes by Dongguan, Guangdong (April 30)

表 2-1　珠江流域编号洪水情况
Table 2-1　Numbered floods in the Pearl River Basin

| 编号洪水名称<br>Numbered flood | 依据站名<br>Reporting station | 编号洪水起始时间<br>Start time | 依据要素<br>The basis element | 洪峰水位 / 米<br>Peak water level/m | 洪峰流量 / 立方米每秒<br>Peak flow /($m^3$/s) |
|---|---|---|---|---|---|
| 北江 1 号洪水<br>The No. 1 Flood in the Beijiang | 石角<br>Shijiao | 2024-04-07 06:35 | 流量<br>Flow | 8.61 | 12800 |
| 韩江 1 号洪水<br>The No. 1 Flood in the Hanjiang | 三河坝<br>Sanheba | 2024-04-07 16:40 | 水位<br>Water level | 42.97 | — |
| 北江 2 号洪水<br>The No. 2 Flood in the Beijiang | 石角<br>Shijiao | 2024-04-20 20:45 | 流量<br>Flow | 11.26 | 18100 |
| 韩江 2 号洪水<br>The No. 2 Flood in the Hanjiang | 三河坝<br>Sanheba | 2024-04-25 19:15 | 水位<br>Water level | 42.97 | — |
| 韩江 3 号洪水<br>The No. 3 Flood in the Hanjiang | 三河坝<br>Sanheba | 2024-04-28 12:50 | 水位<br>Water level | 42.34 | — |
| 东江 1 号洪水<br>The No. 1 Flood in the Dongjiang | 博罗<br>Boluo | 2024-04-28 20:55 | 水位<br>Water level | 7.71 | 7380 |
| 西江 1 号洪水<br>The No. 1 Flood in the Xijiang | 梧州<br>Wuzhou | 2024-06-15 15:20 | 水位<br>Water level | 20.84 | 32300 |
| 韩江 4 号洪水<br>The No. 4 Flood in the Hanjiang | 三河坝<br>Sanheba | 2024-06-16 23:40 | 水位<br>Water level | 48.24 | — |
| 西江 2 号洪水<br>The No. 2 Flood in the Xijiang | 武宣<br>Wuxuan | 2024-06-18 21:25 | 流量<br>Flow | 60.16 | 31200 |
| 西江 3 号洪水<br>The No. 3 Flood in the Xijiang | 武宣<br>Wuxuan | 2024-06-27 15:10 | 流量<br>Flow | 57.79 | 25400 |
| 西江 4 号洪水<br>The No. 4 Flood in the Xijiang | 梧州<br>Wuzhou | 2024-07-03 01:30 | 水位<br>Water level | 19.60 | 31200 |
| 韩江 5 号洪水<br>The No. 5 Flood in the Hanjiang | 三河坝<br>Sanheba | 2024-07-26 22:50 | 水位<br>Water level | 42.62 | — |
| 韩江 6 号洪水<br>The No. 6 Flood in the Hanjiang | 三河坝<br>Sanheba | 2024-08-20 16:35 | 水位<br>Water level | 42.73 | — |

4 月 18—30 日，珠江流域连续出现 3 次强降雨过程，雨区主要集中在流域东部北部，流域累计面降雨量 170 毫米，其中东江 415 毫米、北江 411 毫米、韩江 339 毫米，累计最大点降雨量广东清远佛冈 820 毫米。北江下游干流控制站石角水文站（广东清远市）4 月 20 日 20 时 45 分流量涨至 12000 立方米每秒，形成北江 2 号洪水，21 日 21 时水位涨至 11.01 米，超过警戒水位（11.00 米）0.01 米，22 日 8 时洪峰流量 18100 立方米每秒，相应水位 11.26 米，超过警戒水位 0.26 米，还原洪峰流量 19400 立方米每秒，洪水重现期超过 100 年（相应流量为 19000 立方米每秒），为特大洪水，23 日 12 时水位退至警戒水位以下，超警历时 3 天。东江下游干流控制站博罗水文站（广东惠州市）4 月 28 日 20 时 55 分涨至 7000 立方米每秒，形成东江 1 号洪水，继 2013 年后首次发生编号洪水，29 日 6 时洪峰水位 7.71 米，相应流量 7380 立方米每秒。

6 月 3—18 日，珠江流域接连出现 4 次强降雨过程，雨区主要集中在流域西北部和东部，流域累计面降雨量 219 毫米，其中桂江 378 毫米、北江 261 毫米、西江干流 232 毫米、韩江 198 毫米，累计最大点降雨量广西桂林塔边 928 毫米。西江中游干流控制站梧州水文站（广西梧州市）6 月 15 日 15 时 20 分水位涨至警戒水位（18.50 米），形成西江 1 号洪水，17 日 5 时 35 分洪峰水位 20.84 米；中游干流武宣水文站（广西来宾市）18 日 21 时 25 分流量涨至 25000 立方米每秒，形成西江 2 号洪水，20 日 4 时洪峰水位 60.16 米，相应流量 31200 立方米每秒；梧州水文站 21 日 12 时 20 分洪峰水位 24.10 米，相应流量 41300 立方米每秒，为 2008 年以来最大，24 日 3 时降至警戒水位，超警历时 10 天。韩江上游干流控制站三河坝水位站（广东梅州市）6 月 16 日 23 时 40 分水位涨至警戒水位（42.00 米），形成韩江 4 号洪水，17 日 12 时 55 分洪峰水位 48.24 米，18 日 14 时降至警戒水位以下 0.23 米，超警历时 3 天，上游支流梅江发生 2002 年有实测资料以来最大洪水，上游支流汀江棉花滩水库入库洪水重现期超 100 年。


西江 4 号洪水过境广西梧州市（7 月 3 日）
Xijiang No. 4 Flood passed by Wuzhou, Guangxi (July 3)

From April 18 to 30, the Pearl River Basin withstood three consecutive heavy rainfall processes, with rain belt mainly in the eastern and northern parts of the basin. The cumulative rainfall in the basin reached 170 mm, with the Dongjiang recording 415 mm, the Beijiang 411 mm, and the Hanjiang 339 mm. The maximum point rainfall was 820 mm at Fogang, Qingyuan, Guangdong Province. At Shijiao Controlling Hydrological Station (Qingyuan, Guangdong) on the lower Beijiang, the flow surged to 12,000 $m^3$/s at 20:45 on April 20, forming the No. 2 Flood in the Beijiang. By 21:00 on April 21, the water level rose to 11.01 m, exceeding the warning level (11.00 m) by 0.01 m. At 08:00 on April 22, the flow peaked at 18,100 $m^3$/s, with a corresponding water level of 11.26 m (0.26 m above the warning level). The reconstructed peak flow was 19,400 $m^3$/s, mounting to an extreme flood with a return period exceeding 100 years (benchmark: 19,000 $m^3$/s) . The water level remained above the warning level for three days before falling back to normal at 12:00 on April 23. At Boluo Hydrological Station (Huizhou, Guangdong) on the lower Dongjiang mainstream, the flow rose to 7,000 $m^3$/s at 20:55 on April 28, forming the No. 1 Flood in the Dongjiang–the river's first numbered since 2013. The water level peaked at 7.71 m at 06:00 on April 29, with a corresponding flow of 7,380 $m^3$/s.

From June 3 to 18, the Pearl River Basin experienced four consecutive heavy rainfall processes, with rain belt mainly in the northwestern and eastern parts of the basin. The cumulative rainfall in the basin was 219 mm, with the Guijiang recording 378 mm, the Beijiang 261 mm, the Xijiang mainstream 232 mm, and the Hanjiang 198 mm. The maximum point rainfall was 928 mm at Tabian, Guilin, Guangxi. At Wuzhou Hydrological Station (Wuzhou, Guangxi) on the middle Xijiang, the water level rose to the warning level (18.50 m) at 15:20 on June 15, forming the No. 1 Flood in the Xijiang. The water level peaked at 20.84 m at 05:35 on June 17. At 21:25 on June 18, the flow at the Wuxuan Hydrological Station (Laibin, Guangxi) surged to 25,000 $m^3$/s, forming the No. 2 Flood in the Xijiang. The water level peaked at 60.16 m at 04:00 on June 20, with a corresponding flow of 31,200 $m^3$/s. At 12:20 on June 21, the Wuzhou Hydrological Station recorded a peak water level of 24.10 m with a corresponding flow of 41,300 $m^3$/s—the highest since 2008. The water level remained above the warning level for 10 days before falling back to normal at 03:00 on June 24. At Sanheba Controlling Water Level Station (Meizhou, Guangdong) on the upper Hanjiang, the water level rose to the warning level (42.00 m) at 23:40 on June 16, forming the No.4 Flood in the Hanjiang. The water level peaked at 48.24 m at 12:55 on June 17 and remained above the warning level for 3 days before receding to 0.23 m below the warning level by 14:00 on June 18. The Meijiang River, a tributary of the upper Hanjiang, experienced its largest flood since records began in 2002, while the Tingjiang River, another tributary, saw floods with a return period exceeding 100 years at the Mianhuatan Reservoir.

### 2.2.5 松花江吉林段 2 次编号洪水

7 月下旬，松花江流域连续出现 3 次强降雨过程，主要集中在松花江吉林段。松花江流域累计面降雨量 72 毫米，其中松花江吉林段 213 毫米，累计最大点降雨量吉林通化季家 466 毫米。松花江吉林段上游干流代表站丰满水库（吉林吉林市）7 月 27 日 8 时入库流量涨至 9010 立方米每秒，形成松花江吉林段 1 号洪水，29 日 2 时最大入库流量 11300 立方米每秒，8 月 3 日 14 时达到最高库水位 263.52 米，超过汛限水位（260.50 米）3.02 米；上游干流白山水库（吉林吉林市）7 月 28 日 20 时入库流量涨至 5410 立方米每秒，形成松花江吉林段 2 号洪水，29 日 5 时最大入库流量 9220 立方每秒，31 日 20 时达到最高库水位 415.70 米，超过汛限水位（413.00 米）2.70 米；下游干流控制站扶余水文站（吉林松原市）7 月 31 日 19 时水位涨至 133.57 米，超过警戒水位 0.01 米，8 月 5 日 8 时洪峰水位 134.52 米，超过警戒水位 0.96 米，相应流量 5190 立方米每秒，12 日 5 时水位降至警戒水位，超警历时 13 天。

丰满水库利用导流洞泄洪（8 月 1 日）
Fengman Reservoir releases floodwater through diversion tunnels (August 1)

### 2.2.5 Two numbered floods in the Jilin Section of the Songhua River

In late July, the Songhua River Basin experienced three consecutive heavy rainfall processes, primarily in the Jilin section. The cumulative rainfall in the Songhua River Basin was 72 mm, with the Jilin section recording 213 mm. The maximum point rainfall was 466 mm at Jijia, Tonghua, Jilin. At 08:00 on July 27, the inflow to the Fengman Reservoir(Jilin City, Jilin), a representative station on the upper Songhua River (Jilin section), surged to 9,010 $m^3/s$, forming the No. 1 Flood in the Songhua River (Jilin section). The maximum inflow reached 11,300 $m^3/s$ at 02:00 on July 29. By 14:00 on August 3, the reservoir’s water level peaked at 263.52 m, exceeding the flood limit level (260.50 m) by 3.02 m. At 20:00 on July 28, the inflow to the Baishan Reservoir (Jilin City, Jilin) on the upper mainstream rose to 5,410 $m^3/s$, forming the No. 2 Flood in the Songhua River (Jilin section). The maximum inflow reached 9,220 $m^3/s$ at 05:00 on July 29. By 20:00 on July 31, the reservoir’s water level peaked at 415.70 m, exceeding the flood limit level (413.00 m) by 2.70 m. At 19:00 on July 31, the water level at Fuyu Controlling Hydrological Station (Songyuan, Jilin) on the lower mainstream of Songhua River rose to 133.57 m, exceeding the warning level by 0.01 m. By 08:00 on August 5, the water level peaked at 134.52 m (0.96 m above the warning level) with a corresponding flow of 5,190 $m^3/s$. The water level remained above the warning level for 13 days before falling back to normal at 05:00 on August 12.

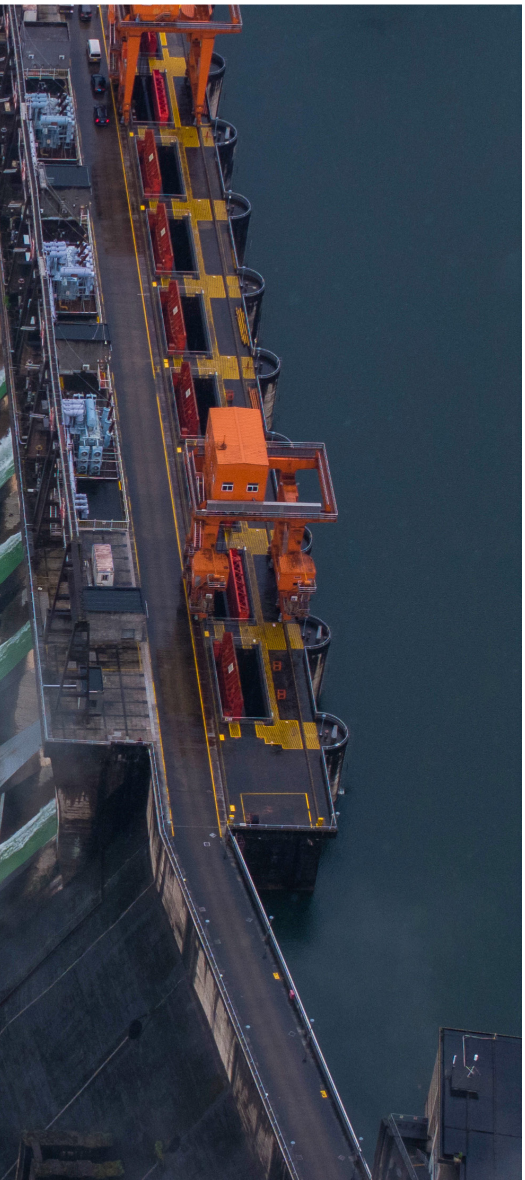
### 2.2.6 太湖流域 2 次编号洪水

6 月 19 日至 7 月 2 日，太湖流域连续发生 4 次强降雨过程，流域累计面降雨量 312 毫米，累计最大点降雨量浙江杭州徐家头 537 毫米。太湖平均水位 6 月 30 日 7 时 25 分涨至警戒水位（3.80 米），形成太湖 1 号洪水，7 月 3 日 9 时 5 分出现最高水位 4.04 米，8 日 23 时降至警戒水位，超警历时 9 天；12 日 6 时复涨，9 时 30 分再次涨至警戒水位，13 日 12 时 20 分水位涨至 3.90 米，超过警戒水位 0.10 米，回涨幅度达到 0.20 米，形成太湖 2 号洪水，14 日 16 时 20 分洪峰水位 3.95 米，20 日 4 时水位降至警戒水位，超警历时 9 天。南溪水系漕桥河、洮滆运河分别发生 1956 年、1972 年有实测资料以来最大洪水。新安江干流新安江水库（浙江杭州市）6 月 20 日 17 时最大入库流量 21000 立方米每秒，列 1960 年有实测资料以来第 3 位（历史最大入库流量 23400 立方米每秒，1969 年 7 月）。

新安江水库 7 孔泄洪（6 月 25 日）
Xin'anjiang Reservoir opens up all 7 sluice holes to discharge floodwater (June 25)

### 2.2.6 Two numbered floods in the Taihu Lake Basin

From June 19 to July 2, the Taihu Lake Basin experienced four consecutive heavy rainfall processes. The cumulative rainfall in the basin was 312 mm, with the maximum point rainfall reaching 537 mm at Xujiatou, Hangzhou, Zhejiang. At 07:25 on June 30, the average water level in Taihu rose to the warning level (3.80 m), forming the No. 1 Flood in the Taihu. The highest water level of 4.04 m was recorded at 09:05 on July 3. The lake saw its water level above the warning level by 9 days before falling back to normal by 23:00 on July 8. At 06:00 on July 12, the water level began to rise again. It reached the warning level at 09:30 and finally rose by 0.2 m, stopping at 3.90 m at 12:20 on July 13. It was 0.10 m above the warning level, forming the No. 2 Flood in the Taihu. The peak water level of 3.95 m was recorded at 16:20 on July 14. The water level remained above the warning level for another 9 days before falling back to normal at 04:00 on July 20. The Caoqiao River and the Tao-Ge Canal in the Nanxi River system experienced their largest floods since records began in 1956 and 1972, respectively. The maximum inflow to the Xin'anjiang Reservoir (Hangzhou, Zhejiang) on the Xin'anjiang mainstream reached 21,000 $m^3/s$ at 17:00 on June 20, ranking as the third-highest since records began in 1960 (the highest was 23,400 $m^3/s$ in July 1969).



## 2.3 典型山洪灾害

### 2.3.1 广东梅州“6 · 16”暴雨洪涝地质灾害

6 月 16 日，广东省梅州市平远县、蕉岭县及梅县区等三县（区）出现短时强降雨，主要集中在 16 日 10—22 时的 12 个小时内，分布在石窟河上游平远县泗水镇等 5 个乡镇，最大 1 小时降雨 79.6 毫米（平远县泗水镇泗水站），多个站点降雨频率均超 100 年一遇。通过现场调查和复盘分析，研判平远县泗水镇泗水村洪峰流量为 517 立方米每秒，洪水频率超 100 年一遇。强降雨导致三县（区）洪涝地质灾害群发齐发，造成 55 人死亡失踪。此次灾害是由极端暴雨引发三县（区）山区沟道和中小河流普遍发生洪水，叠加枯枝枯树堵塞桥梁阻水改道和滑坡堰塞体溃决所致。

## 2.3 Major Flash Flood Disasters

### 2.3.1 "6·16" Rainstorm-induced flood and geological disaster in Meizhou, Guangdong

On June 16, a rainstorm struck Pingyuan, Jiaoling, and Meixian in Meizhou City, Guangdong Province. The rainfall was concentrated within a 12-hour period from 10:00 to 22:00, primarily affecting five townships in the upper reaches of the Shiku River. The maximum hourly rainfall reached 79.6 mm (recorded at Sishui Station in Sishui Town, Pingyuan County), with multiple stations experiencing rainfall intensities exceeding the 100-year return period. Field investigations and retrospective analysis estimated the peak flood discharge at Sishui Village, Sishui Town to be 517 $m^3/s$, with an over-100-year return period. The extreme rainfall triggered extensive flash floods and geological disasters across the three counties, resulting in 55 deaths and missing persons. The disaster was caused by extreme rainfall-induced flooding in mountainous gullies, stream and creeks, compounded by debris-blockage at bridges and breaches of landslide-dammed lakes.

平远县泗水镇灾害现场
The wrecked site in
Sishui Town, Pingyuan County

### 2.3.2 四川汉源“7 · 20”山洪泥石流灾害

7 月 19 日 8 时至 20 日 8 时，四川省雅安市汉源县马烈沟突降暴雨至大暴雨，主要分布在马烈沟小流域上游，最大 3 小时降雨量约 86.5 毫米（20 日 0—3 时），暴雨强度约 30 年一遇。强降雨诱发山洪泥石流灾害，造成 41 人死亡失踪。通过洪痕测量、复盘分析，研判洪峰流量约 263 立方米每秒，洪水重现期约 30 年。此次山洪泥石流灾害系马烈沟小流域上游强降雨诱发山洪泥石流，叠加桥涵堵塞壅高导致改道进入村庄所致。

### 2.3.2 “7·20” Flash flood and debris flow disaster in Hanyuan, Sichuan

From 08:00 on July 19 to 08:00 on July 20, heavy to torrential rainstorms struck the Malie Gully watershed in Hanyuan County, Ya’an City, Sichuan Province. The rain was concentrated in the upper reaches of the gully, with the maximum 3-hour rainfall reaching 86.5 mm (00:00-03:00, July 20) with an approximate 30 years. The intense rainfall triggered flash floods and debris flows, causing 41 deaths and missing persons. Based on flood mark measurements and retrospective analysis, the peak flood discharge was estimated at 263 m³/s, with a return period of about 30 years. The disaster was caused by heavy rainfall-induced flash floods and debris flows in the upper Malie Gully, exacerbated by blockage at culverts and bridges that forced floodwaters into residential areas.

汉源县马烈乡山洪泥石流灾害现场
The Debris flow disaster site in Malie Township, Hanyuan County

### 2.3.3 湖南资兴“7 · 27”洪涝地质灾害

7 月 26—28 日，受台风“格美”外围云系影响，湖南郴州资兴出现历史罕见大暴雨，局部特大暴雨，最大 12 小时降雨量 619 毫米，最大 24 小时降雨量 735.5 毫米，均突破湖南省历史极值。强降雨引发大面积洪涝滑坡地质灾害，造成 65 人死亡失踪（老人儿童占 90.1%），分布在 5 个乡镇 28 个村 46 个点位，时间集中在 27 日凌晨 4—6 时。此次灾害是由极端暴雨引发的洪涝地质复合型灾害，具有群发、齐发、突发、以滑坡灾害为主的特点。

### 2.3.3 “7·27” Flood and geological disaster in Zixing, Hunan

From July 26 to 28, under the influence of the peripheral cloud system of Typhoon “Gaemi”, Zixing City in Chenzhou, Hunan Province, experienced historically rare heavy to extreme rainstorms. The maximum 12-hour rainfall reached 619 mm and the maximum 24-hour rainfall was 735.5 mm, both surpassing historical records in Hunan. The intense rainfall triggered widespread flooding and landslides, resulting in 65 deaths and missing persons (90.1% of whom were elderly or children) across 46 sites in 28 villages of five townships. The fatalities mostly occurred during 04:00-06:00 on July 27. This disaster was a landslide-dominated compound disaster that was caused by extreme rainfall and characterized by multiple, simultaneous, and sudden occurrences.

湖南资兴市洪涝地质灾害现场
The flood and geological disaster site in Zixing City, Hunan

### 2.3.4 辽宁葫芦岛“8 · 20”洪涝地质灾害

8 月 18—22 日，辽宁省葫芦岛市突降暴雨到大暴雨，部分乡镇特大暴雨，最大过程面降雨量 648.3 毫米，超过辽宁省历史极值，主要集中在 19 日 20 时至 20 日 19 时，大屯村站连续 11 小时（19 日 23 时至 20 日 10 时）雨强超过 20 毫米每小时，其中连续 4 小时（20 日 5—9 时）雨强超过 50 毫米每小时，强降雨引发洪涝地质灾害，造成建昌县、绥中县 25 人死亡失踪。经调查分析，此次洪涝地质灾害由极端特强暴雨引发，具有散发、夜发特征，人员死亡失踪时间多在后半夜。

### 2.3.4 "8·20" Flood and geological disaster in Huludao, Liaoning

From August 18 to 22, major to heavy downpours and localized extreme rainstorms struck Huludao City, Liaoning Province. The maximum rainfall of a single process reached 648.3 mm, surpassing historical records in Liaoning. The heaviest rainfall occurred from 20:00 on August 19 to 19:00 on August 20, with the Datuncun Station recording 11 consecutive hours (23:00 on August 19 to 10:00 on August 20) of rainfall intensity exceeding 20 mm/h and 4 consecutive hours (05:00–09:00 on August 20) exceeding 50 mm/h. The intense rainfall triggered flooding and geological disasters, causing 25 deaths and missing persons in Jianchang and Suizhong counties. Investigations revealed that the disaster was caused by extreme rainfall and struck in scattered places and mainly at night, with most fatalities occurring in the wee hours.

建昌县杨树湾子乡石洞子村灾害点情况

Disaster site in Shidongzi Village, Yangshuwanzi Township, Jianchang County

## 2.4 洪涝灾情

### 2.4.1 总体灾情

2024 年，洪涝导致全国 5331.43 万人次受灾，较近 10 年平均值偏少 15.9%；436 人死亡失踪，较近 10 年平均值偏少 2.0%；5.70 万间房屋倒塌，较近 10 年平均值偏少 63.7%；农作物受灾 6035.81 千公顷，较近 10 年平均值偏多 0.9%，其中绝收 850.38 千公顷；直接经济损失 2598.10 亿元，较近 10 年平均值偏多 21.3%；直接经济损失占当年国内生产总值的 0.19%，较近 10 年平均值偏少 20.8%。湖南、辽宁、河南、陕西 4 省直接经济损失均超过 200 亿元，占全国总损失的 49.2%。

## 2.4 Disasters and Losses

### 2.4.1 Summary

In 2024, floods affected 53.3143 million person-times nationwide, down by 15.9% from the preceding decadal average; 436 persons died or went missing, down by 2.0% from the preceding decadal average; 57,000 dwellings collapsed, down by 63.7% from the preceding decadal average; 6,035,810 ha of cropland were affected, 0.9% above the preceding decadal average; 850,380 ha of cropland suffered total crop failure. The direct economic losses amounted to 259.810 billion RMB (21.3% above the preceding decadal average) and accounted for 0.19% of the yearly GDP (20.8% below the preceding decadal average). Four provinces — Hunan, Liaoning, Henan, and Shaanxi—each recorded direct losses exceeding 20 billion RMB and collectively accounted for 49.2% of the national total.

表 2-2 2024 年全国因洪涝受灾人口、死亡失踪人口及直接经济损失情况

Table 2-2 Population affected, deaths and missing persons, direct economic losses by floods in 2024

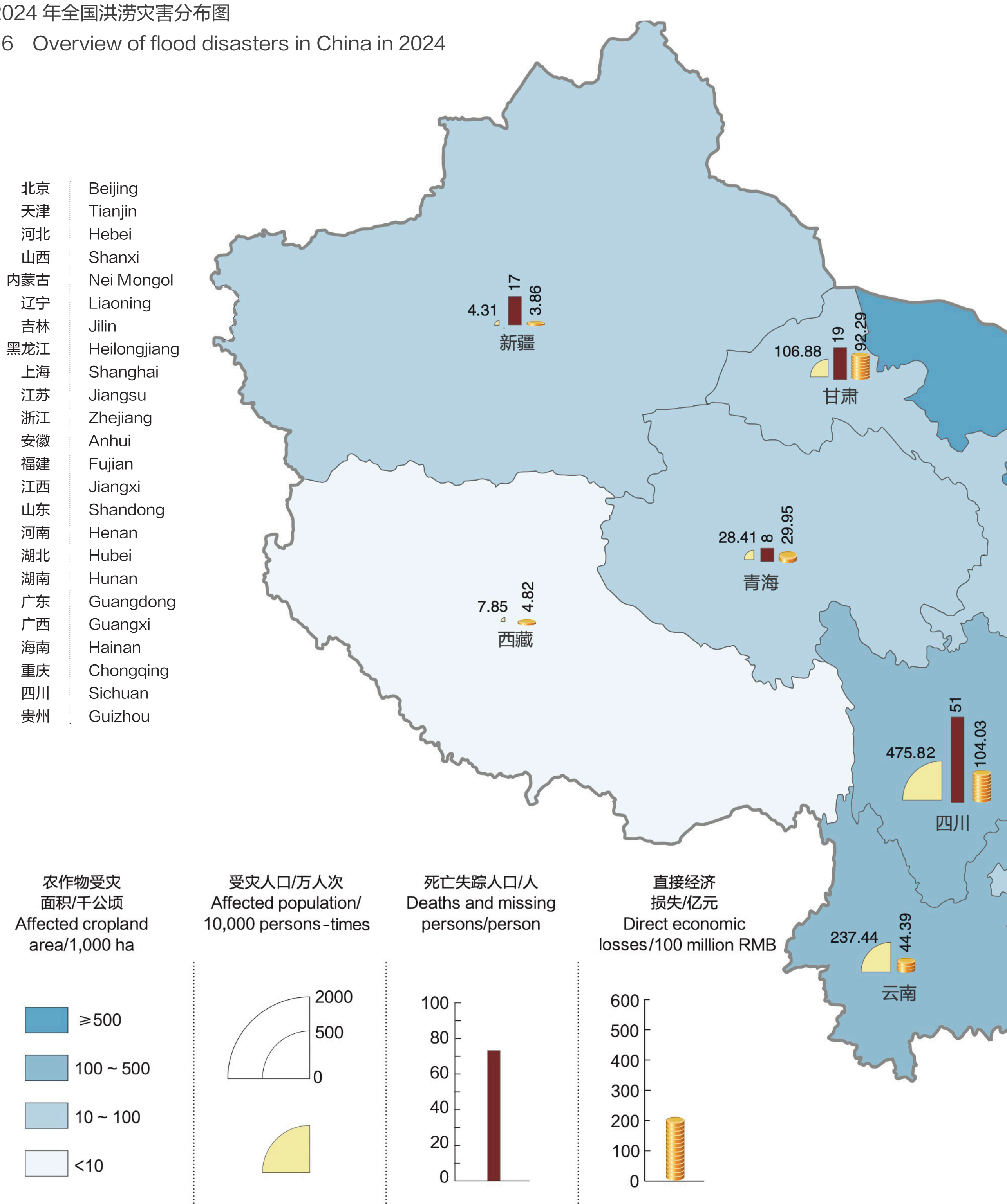
| 地区<br>Region | 受灾人口 / 万人次<br>Affected population/<br>10,000 person-times | 死亡失踪人口 / 人<br>Deaths and missing persons/person | 直接经济损失 / 亿元<br>Direct economic losses / 100 million RMB |
|---|---|---|---|
| 全国 Nationwide | 5331.43 | 436 | 2598.10 |
| 北京 Beijing | 0.07 | | 0.35 |
| 天津 Tianjin | 1.68 | | 4.06 |
| 河北 Hebei | 57.59 | 6 | 12.67 |
| 山西 Shanxi | 8.17 | | 1.54 |
| 内蒙古 Nei Mongol | 136.77 | 13 | 89.95 |
| 辽宁 Liaoning | 258.87 | 27 | 289.60 |
| 吉林 Jilin | 82.09 | 2 | 152.17 |
| 黑龙江 Heilongjiang | 20.72 | | 17.16 |
| 上海 Shanghai | | | |
| 江苏 Jiangsu | 1.87 | | 0.61 |
| 浙江 Zhejiang | 17.02 | | 35.57 |
| 安徽 Anhui | 174.13 | 12 | 87.38 |
| 福建 Fujian | 108.64 | | 137.41 |
| 江西 Jiangxi | 330.27 | 1 | 67.04 |
| 山东 Shandong | 41.90 | | 6.74 |
| 河南 Henan | 1411.12 | 4 | 239.34 |
| 湖北 Hubei | 264.76 | | 39.75 |
| 湖南 Hunan | 690.82 | 53 | 526.94 |
| 广东 Guangdong | 117.51 | 100 | 175.65 |
| 广西 Guangxi | 305.44 | 6 | 105.30 |
| 海南 Hainan | 1.28 | 8 | 0.41 |
| 重庆 Chongqing | 108.65 | 5 | 41.25 |
| 四川 Sichuan | 475.82 | 51 | 104.03 |
| 贵州 Guizhou | 178.33 | | 61.08 |
| 云南 Yunnan | 237.44 | | 44.39 |
| 西藏 Xizang | 7.85 | | 4.82 |
| 陕西 Shaanxi | 147.34 | 96 | 221.51 |
| 甘肃 Gansu | 106.88 | 19 | 92.29 |
| 青海 Qinghai | 28.41 | 8 | 29.95 |
| 宁夏 Ningxia | 5.68 | 8 | 5.28 |
| 新疆 Xinjiang | 4.31 | 17 | 3.86 |

注 数据来源于应急管理部，不包括台风引发暴雨洪涝导致的直接经济损失。空白表示无灾情。

Note The data come from the Ministry of Emergency Management and exclude direct economic losses caused by typhoon-induced floods. Blanks indicate no such disaster impacts.

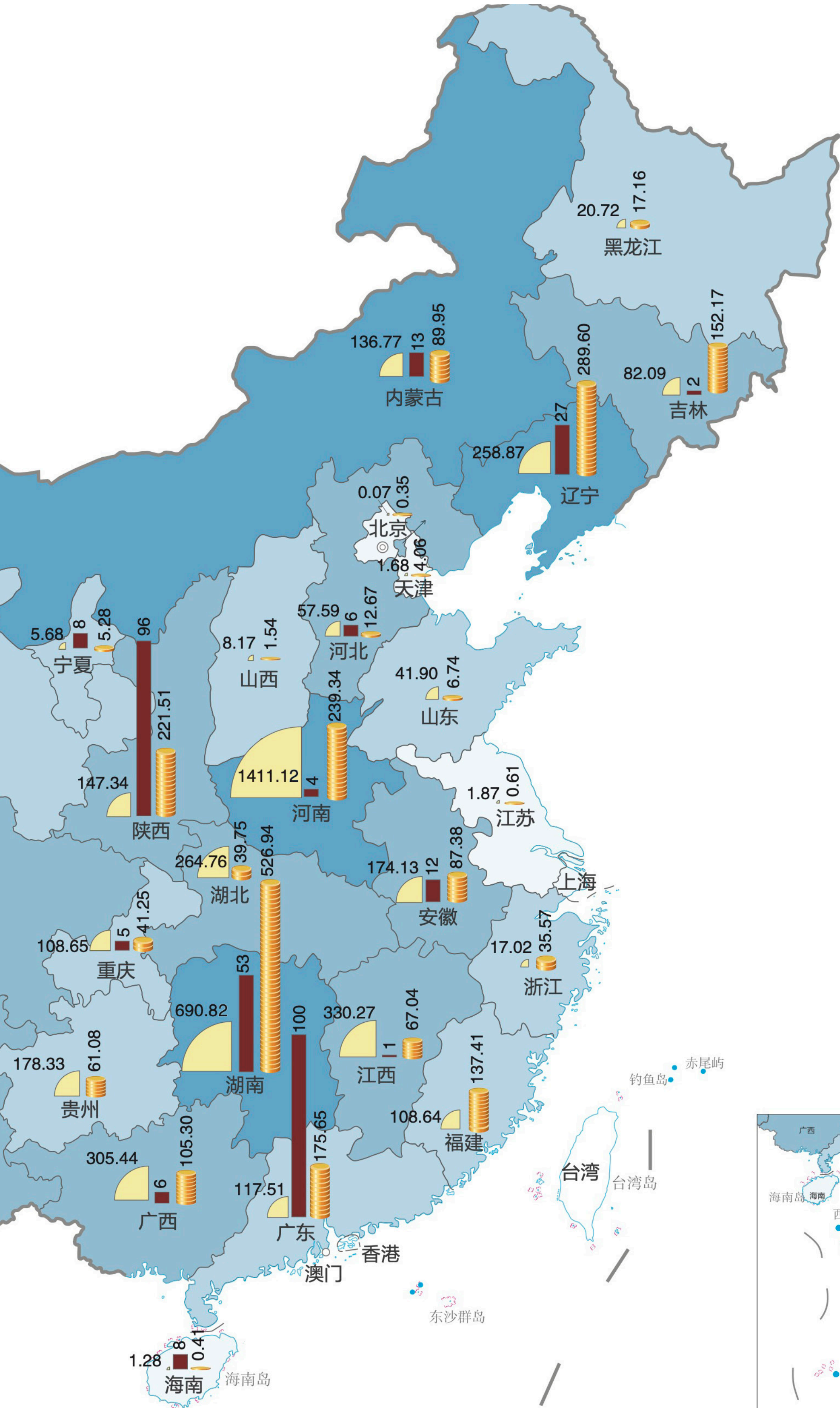
图 2-6　2024 年全国洪涝灾害分布图

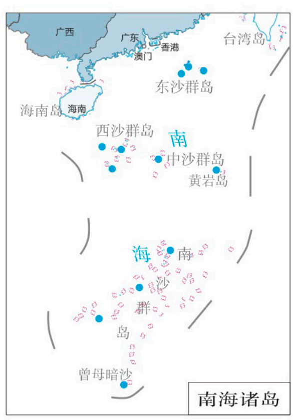
Figure 2-6　Overview of flood disasters in China in 2024




注　数据来源于应急管理部，香港特别行政区、澳门特别行政区、台湾省资料暂缺。

Note　The data come from the Ministry of Emergency Management, data of Hong Kong SAR, Macao SAR and Taiwan are currently unavailable.



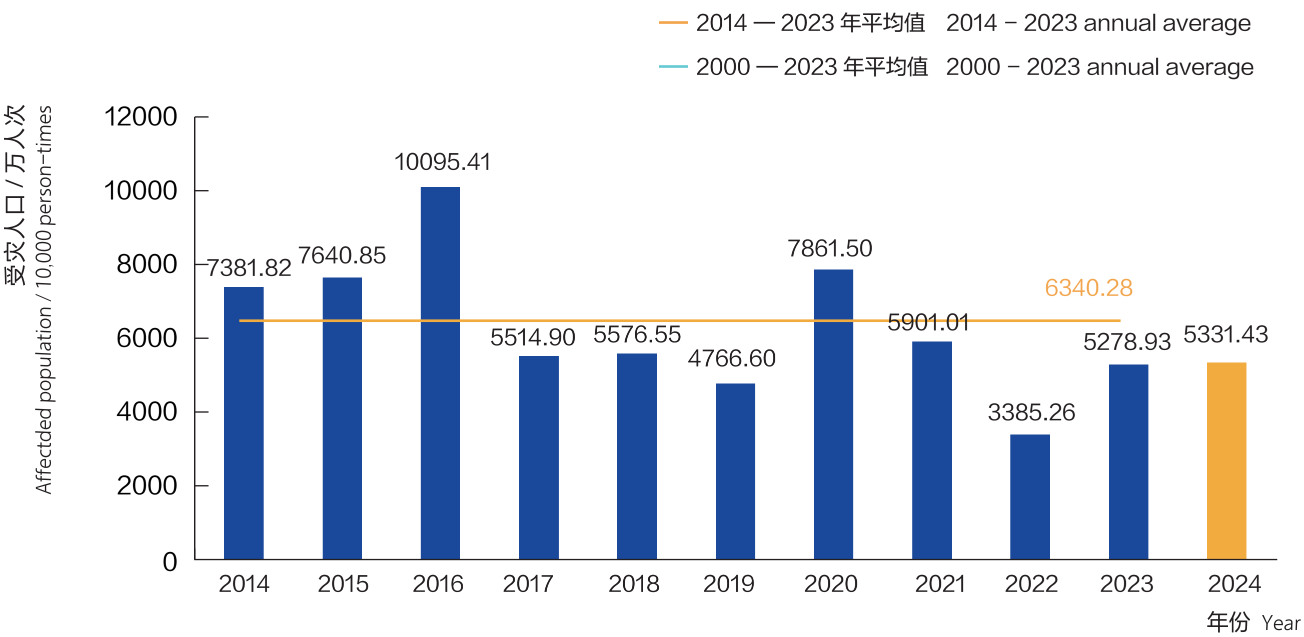




| | |
|---|---|
| 云南 | Yunnan |
| 西藏 | Xizang |
| 陕西 | Shaanxi |
| 甘肃 | Gansu |
| 青海 | Qinghai |
| 宁夏 | Ningxia |
| 新疆 | Xinjiang |
| 澳门 | Macao |
| 香港 | Hong Kong |
| 台湾 | Taiwan |
| 海南岛 | Hainan Dao |
| 台湾岛 | Taiwan Dao |
| 钓鱼岛 | Diaoyu Dao |
| 赤尾屿 | Chiwei Yu |
| 台湾海峡 | Taiwan Haixia |
| 南海诸岛 | Nanhai Zhudao |
| 东沙群岛 | Dongsha Qundao |
| 南沙群岛 | Nansha Qundao |
| 中沙群岛 | Zhongsha Qundao |
| 西沙群岛 | Xisha Qundao |
| 黄岩岛 | Huangyan Dao |
| 曾母暗沙 | Zengmu Ansha |

表 2-3　2024 年全国因洪涝农作物受灾面积、农作物绝收面积、倒塌房屋情况
Table 2-3　Cropland affected and failed, collapsed dwellings by floods in China in 2024

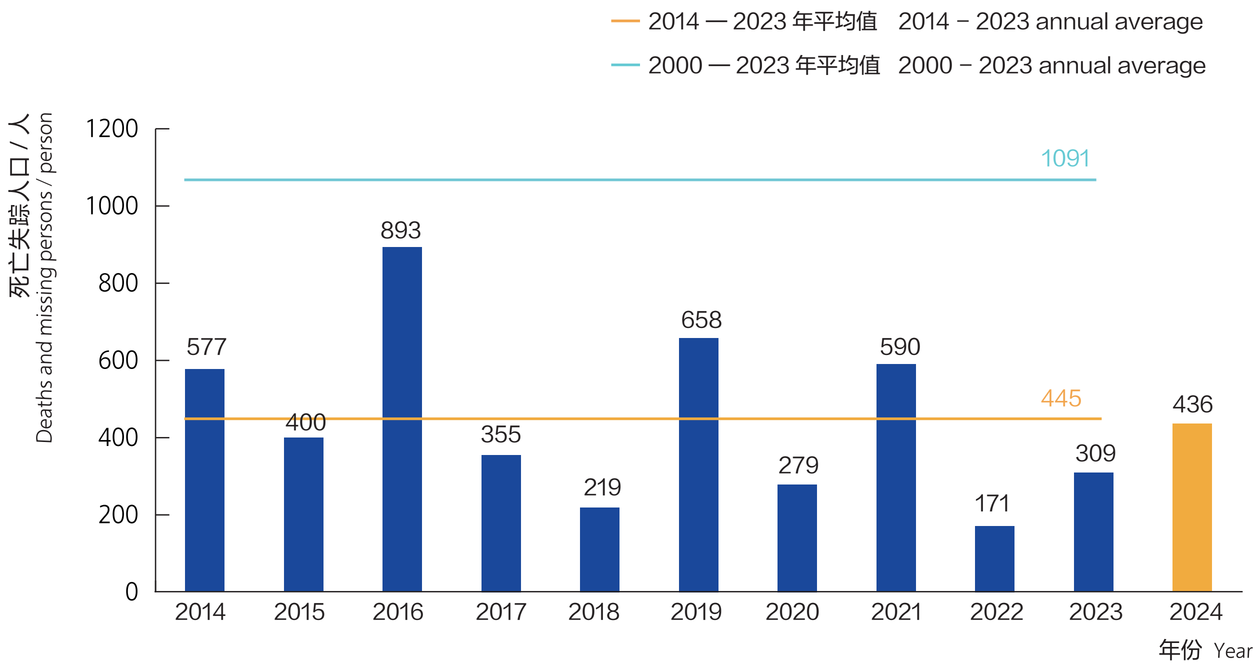
| 地区 Region | 农作物受灾面积 / 千公顷 Affected cropland area / 1,000 ha | 农作物绝收面积 / 千公顷 Failed cropland area / 1,000 ha | 倒塌房屋 / 万间 Collapsed dwellings / 10,000 rooms |
|---|---|---|---|
| 全国 Nationwide | 6035.81 | 850.38 | 5.70 |
| 北京 Beijing | 0.03 | | |
| 天津 Tianjin | 1.48 | 0.19 | 0.01 |
| 河北 Hebei | 117.29 | 12.99 | 0.02 |
| 山西 Shanxi | 16.23 | 1.02 | 0.01 |
| 内蒙古 Nei Mongol | 1040.49 | 114.78 | 0.06 |
| 辽宁 Liaoning | 648.57 | 138.81 | 0.16 |
| 吉林 Jilin | 141.99 | 22.58 | 0.07 |
| 黑龙江 Heilongjiang | 84.44 | 16.49 | 0.04 |
| 上海 Shanghai | | | |
| 江苏 Jiangsu | 2.85 | 0.72 | |
| 浙江 Zhejiang | 22.05 | 3.50 | 0.06 |
| 安徽 Anhui | 168.92 | 19.06 | 0.06 |
| 福建 Fujian | 66.25 | 8.72 | 0.34 |
| 江西 Jiangxi | 354.66 | 33.17 | 0.04 |
| 山东 Shandong | 44.11 | 3.27 | 0.06 |
| 河南 Henan | 1275.05 | 259.04 | 0.27 |
| 湖北 Hubei | 307.63 | 18.66 | 0.01 |
| 湖南 Hunan | 936.14 | 99.48 | 1.80 |
| 广东 Guangdong | 95.83 | 14.70 | 1.49 |
| 广西 Guangxi | 122.90 | 6.30 | 0.12 |
| 海南 Hainan | 0.04 | 0.02 | |
| 重庆 Chongqing | 65.50 | 12.69 | 0.14 |
| 四川 Sichuan | 103.13 | 11.08 | 0.25 |
| 贵州 Guizhou | 77.47 | 7.06 | 0.03 |
| 云南 Yunnan | 133.03 | 18.06 | 0.01 |
| 西藏 Xizang | 2.15 | 0.44 | 0.03 |
| 陕西 Shaanxi | 104.74 | 21.04 | 0.43 |
| 甘肃 Gansu | 53.25 | 2.26 | 0.12 |
| 青海 Qinghai | 24.29 | 1.19 | 0.06 |
| 宁夏 Ningxia | 13.50 | 1.45 | 0.01 |
| 新疆 Xinjiang | 11.80 | 1.61 | |

注　数据来源于应急管理部，不包括台风引发暴雨洪涝导致的受灾情况。空白表示无灾情。
Note　The data come from the Ministry of Emergency Management and exclude direct economic losses caused by typhoon-induced floods. Blanks indicate no such disaster impacts.



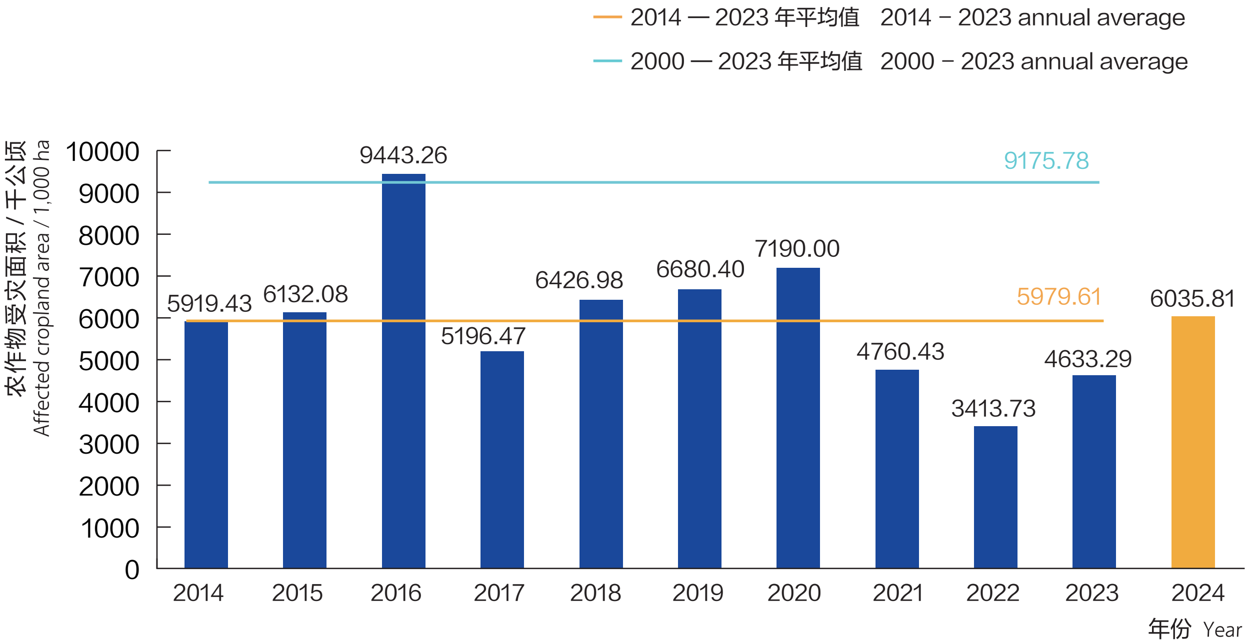

注 数据来源于应急管理部。
Note The data come from the Ministry of Emergency Management.

图 2-7 2014—2024 年全国因洪涝受灾人口
Figure 2-7 Population affected by floods in China during 2014-2024




注 数据来源于应急管理部。
Note The data come from the Ministry of Emergency Management.

图 2-8 2014—2024 年全国因洪涝死亡失踪人口
Figure 2-8 Deaths and missing persons attributed to floods in China during 2014-2024

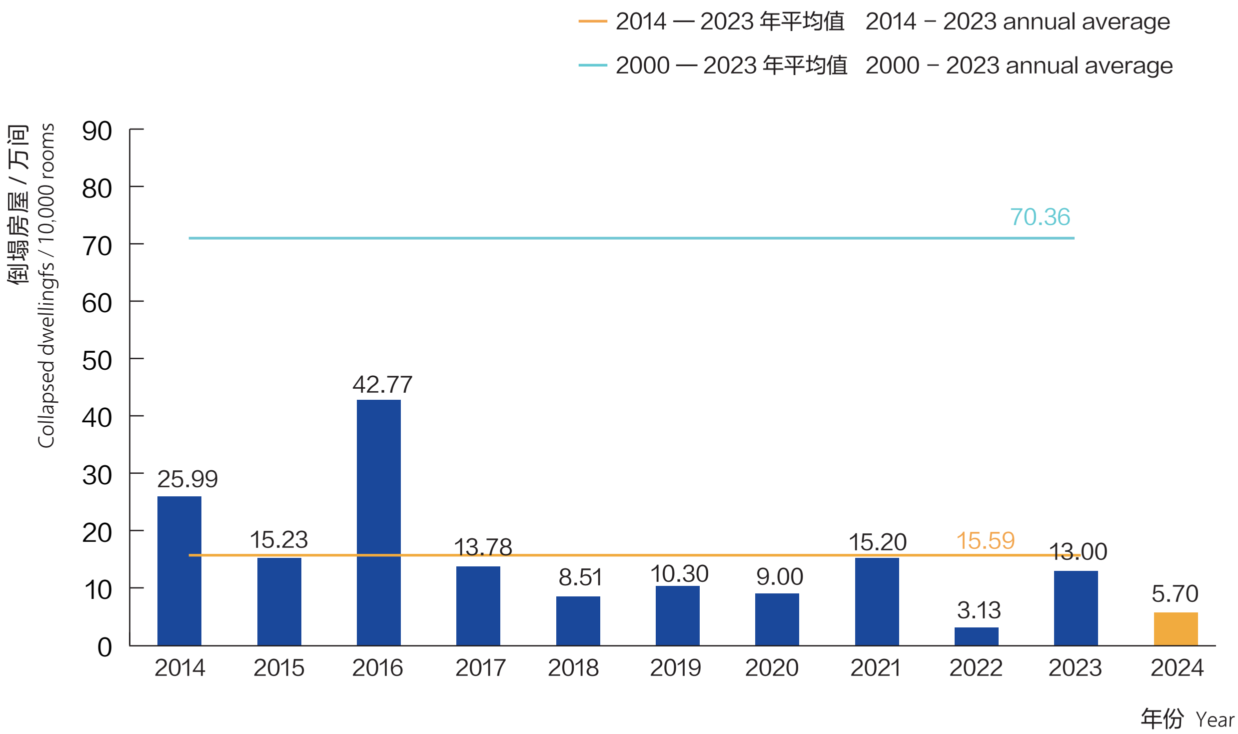



注 数据来源于应急管理部。

Note The data come from the Ministry of Emergency Management.

图 2-9 2014—2024 年全国因洪涝农作物受灾面积

Figure 2-9 Cropland area affected by floods in China during 2014—2024

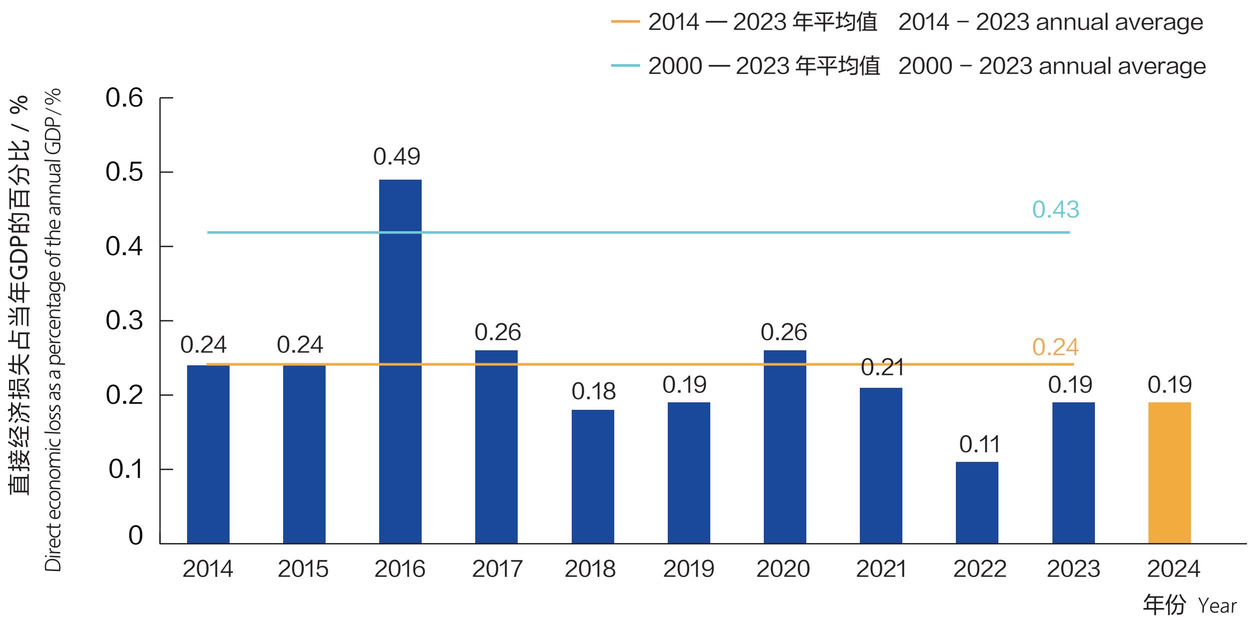



注 数据来源于应急管理部。

Note The data come from the Ministry of Emergency Management.

图 2-10 2014—2024 年全国因洪涝倒塌房屋

Figure 2-10 Collapsed dwellings attributed to floods in China during 2014—2024

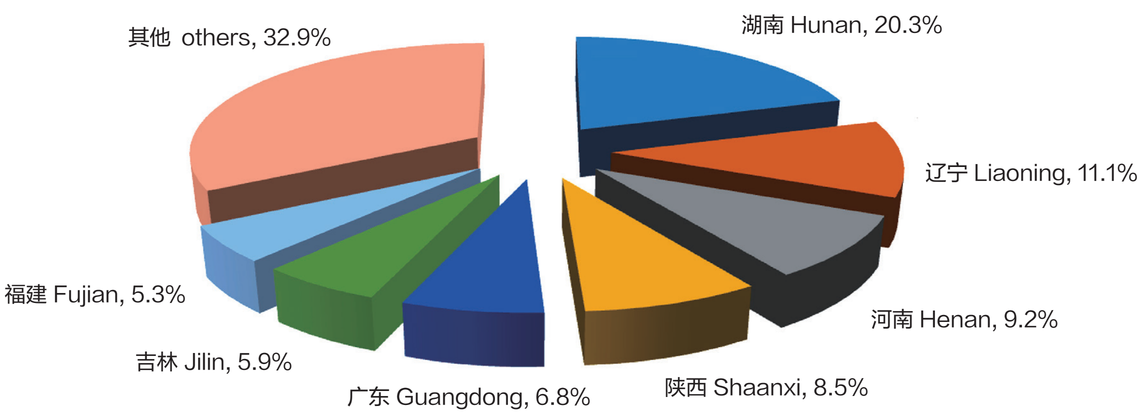



注 数据来源于应急管理部。

Note The data come from the Ministry of Emergency Management.

图 2-11 2014—2024 年全国因洪涝直接经济损失占当年 GDP 的百分比

Figure 2-11 National direct economic losses attributed to floods as a percentage of the annual GDP in China during 2014-2024




注 数据来源于应急管理部。

Note The data come from the Ministry of Emergency Management.

图 2-12 2024 年全国因洪涝直接经济损失分布

Figure 2-12 A regional break-down of direct economic losses attributed to floods in 2024

### 2.4.2　水利工程设施灾损情况

2024 年，洪涝共造成全国 2483 座水库（其中 26 座大型、229 座中型、2228 座小型）、36986 处 8093.77 千米堤防、63510 处护岸、6836 座水闸、40670 座塘坝、3507 个水文测站、6350 眼机电井、5688 座机电泵站、1137 座水电站（其中 17 座大中型、1120 座小型水电站）不同程度受损。

水利工程设施直接经济损失 725.88 亿元，较近 10 年均值偏多 69.1%，其中湖南 147.88 亿元、辽宁 64.49 亿元、广东 53.17 亿元、陕西 50.71 亿元，4 省损失占全国损失的 43.6%。

### 2.4.2　Losses and damages to water projects and facilities

In 2024, floods damaged to varying degrees 2,483 reservoirs (including 26 large, 229 medium-sized, and 2,228 small), 36,986 sections of embankments with a total length of 8,093.77 km, 63,510 bank revetments, 6,836 sluices, 40,670 small pond reservoirs, 3,507 hydrologic stations, 6,350 electromechanical wells, 5,688 electromechanical pumping stations, and 1,137 hydropower stations (17 large/medium and 1,120 small).

Direct economic losses to water projects and facilities totaled 72.588 billion RMB, 69.1% above the preceding decadal average. Four provinces—Hunan (14.788 billion RMB), Liaoning (6.449 billion RMB), Guangdong (5.317 billion RMB), and Shaanxi (5.071 billion RMB)—accounted for 43.6% of the national total.

表 2–4　2024 年全国水利工程设施灾损情况

Table 2–4　Losses and damages to water projects and facilities in 2024

| 地区 Region | 损坏水库 / 座 Damaged reservoirs/number | | 损坏堤防 Damaged dikes | | 损坏护岸 / 处 Damaged revetments/ number | 损坏水闸 / 座 Damaged sluices/ number | 损坏塘坝 / 座 Damaged small pond reservoirs/ number | 损坏水文测站 / 个 Damaged hydrologic stations/ number | 损坏水电站 / 座 Damaged hydropower stations/ number | 水利工程设施直接经济损失 / 亿元 Direct economic loss by water projects and facilities/100 million RMB |
|---|---|---|---|---|---|---|---|---|---|---|
| | 大中型 Large and medium-size | 小型 Small | 数量 / 处 Number of sites | 长度 / 千米 Length/km | | | | | | |
| 全国 Nationwide | 255 | 2228 | 36986 | 8093.77 | 63510 | 6836 | 40670 | 3507 | 1137 | 725.88 |
| 北京 Beijing | 1 | | 14 | 1.76 | 173 | | | 13 | | 1.32 |
| 天津 Tianjin | 1 | 4 | 2 | 0.06 | 37 | 9 | 8 | | | 0.29 |
| 河北 Hebei | 7 | 88 | 1726 | 167.99 | 1811 | 32 | 5 | 3 | | 6.39 |
| 山西 Shanxi | 1 | 1 | 7 | 0.39 | 18 | | 3 | | | 0.12 |
| 内蒙古 Nei Mongol | 5 | 44 | 4609 | 359.86 | 450 | 20 | 29 | 6 | | 6.56 |
| 辽宁 Liaoning | 8 | 68 | 2361 | 578.41 | 4136 | 121 | 83 | 205 | | 64.49 |
| 吉林 Jilin | 22 | 88 | 1390 | 841.26 | 1572 | 128 | 233 | 157 | 67 | 46.20 |

续表 Continued

| 地区 Region | 损坏水库 / 座 Damaged reservoirs/number | | 损坏堤防 Damaged dikes | | 损坏护岸 / 处 Damaged revetments/number | 损坏水闸 / 座 Damaged sluices/number | 损坏塘坝 / 座 Damaged small pond reservoirs/number | 损坏水文测站 / 个 Damaged hydrologic stations/number | 损坏水电站 / 座 Damaged hydropower stations/number | 水利工程设施直接经济损失 / 亿元 Direct economic loss by water projects and facilities/100 million RMB |
|---|---|---|---|---|---|---|---|---|---|---|
| | 大中型 Large and medium-size | 小型 Small | 数量 / 处 Number of sites | 长度 / 千米 Length/km | | | | | | |
| 黑龙江 Heilongjiang | 8 | 43 | 344 | 240.51 | 344 | 50 | 123 | 1 | | 6.97 |
| 上海 Shanghai | | | | | | | | | | |
| 江苏 Jiangsu | 2 | 2 | 108 | 56.16 | 69 | 58 | | 13 | | 3.70 |
| 浙江 Zhejiang | | 2 | 2156 | 129.33 | 2600 | 22 | 455 | 38 | | 10.98 |
| 安徽 Anhui | 1 | 55 | 1514 | 233.13 | 5233 | 494 | 3053 | 225 | 16 | 30.30 |
| 福建 Fujian | | | 825 | 102.00 | 4761 | 118 | 273 | 156 | 123 | 33.10 |
| 江西 Jiangxi | 11 | 207 | 1654 | 125.52 | 6303 | 722 | 2577 | 211 | 16 | 23.84 |
| 山东 Shandong | 11 | 59 | 411 | 21.92 | 1161 | 65 | 114 | 375 | | 3.81 |
| 河南 Henan | 23 | 76 | 994 | 558.62 | 2509 | 604 | 615 | 1 | 5 | 45.82 |
| 湖北 Hubei | 24 | 90 | 818 | 282.70 | 3168 | 684 | 1666 | 158 | 31 | 24.99 |
| 湖南 Hunan | 10 | 395 | 3105 | 950.40 | 18329 | 2652 | 24436 | 473 | 406 | 147.88 |
| 广东 Guangdong | 37 | 125 | 733 | 119.23 | 2405 | 199 | 284 | 9 | 337 | 53.17 |
| 广西 Guangxi | 7 | 40 | 2211 | 205.83 | 3202 | 308 | 323 | 283 | 24 | 24.12 |
| 海南 Hainan | 39 | 294 | 167 | 22.39 | 92 | 78 | 80 | 169 | 4 | 15.71 |
| 重庆 Chongqing | 3 | 134 | 776 | 59.30 | 903 | 86 | 1730 | 283 | 35 | 7.88 |
| 四川 Sichuan | 6 | 272 | 1817 | 479.91 | 1570 | 139 | 3987 | 227 | 14 | 48.47 |
| 贵州 Guizhou | 1 | 11 | 616 | 151.81 | 224 | 7 | 116 | 116 | 24 | 8.72 |
| 云南 Yunnan | 4 | 33 | 1090 | 164.33 | 641 | 32 | 66 | 1 | 26 | 10.25 |
| 西藏 Xizang | | 1 | 314 | 109.74 | 6 | | 1 | 1 | | 2.42 |
| 陕西 Shaanxi | 10 | 41 | 4555 | 1272.25 | 478 | 12 | 258 | 163 | 6 | 50.71 |
| 甘肃 Gansu | | 12 | 1628 | 643.23 | 270 | 3 | 43 | 52 | | 25.75 |
| 青海 Qinghai | | 1 | 781 | 147.46 | 153 | | 2 | 2 | | 7.88 |
| 宁夏 Ningxia | 12 | 38 | 35 | 1.15 | 168 | 5 | 104 | 24 | | 3.14 |
| 新疆 Xinjiang | 1 | 4 | 206 | 63.50 | 115 | 182 | 3 | 33 | 3 | 9.06 |
| 水利部直属 Directly managed by MWR | | | 19 | 3.62 | 609 | 6 | | 109 | | 1.84 |

注 水利工程设施灾损包括地震引发的损失，空白表示无损失。
Note Earthquake-induced losses and damages to water projects and facilities are included. Blanks indicate no such loss.

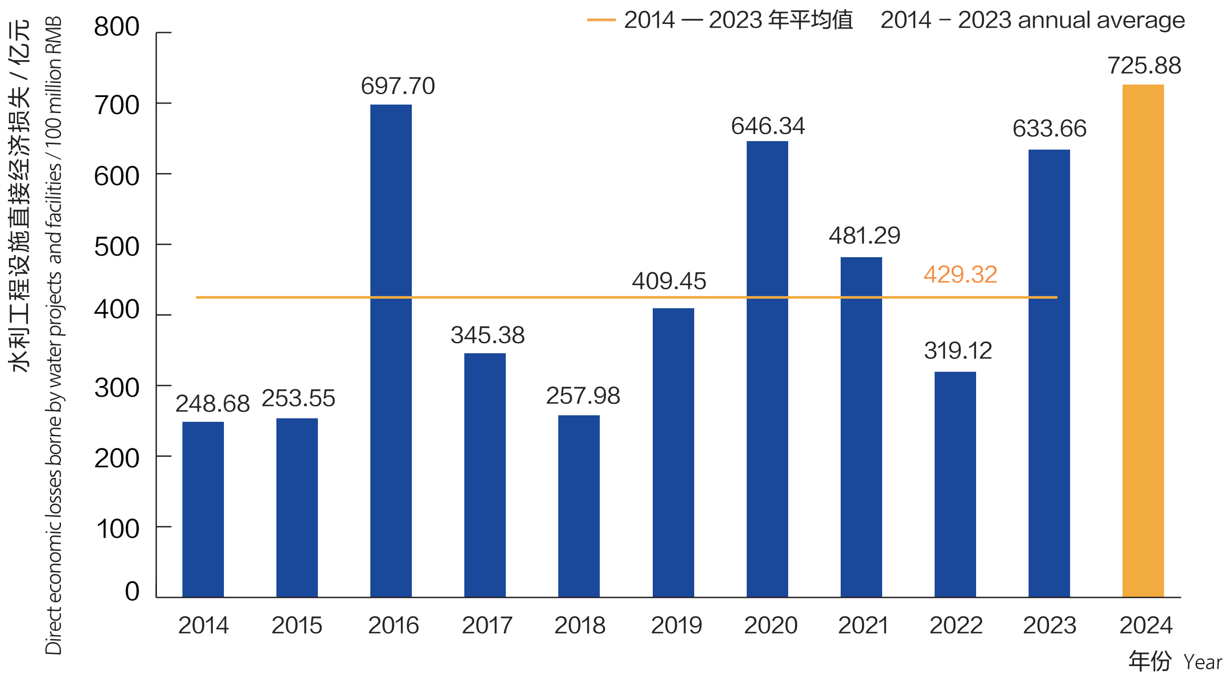



图 2–13 2014—2024 年全国水利工程设施直接经济损失

Figure 2–13 Direct economic losses borne by water projects and facilities in China during 2014–2024

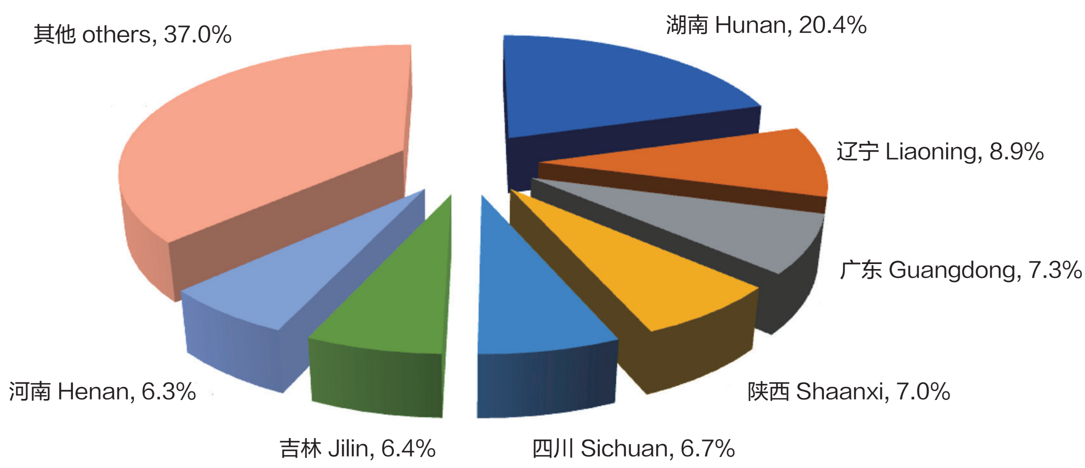



图 2–14 2024 年全国水利工程设施直接经济损失分布

Figure 2–14 A provincial break–down of direct economic losses borne by water projects and facilities in China in 2024

## 2.5 防御工作

各级水利部门坚决贯彻落实习近平总书记关于防汛抗旱工作的重要讲话指示批示精神，积极践行“两个坚持、三个转变”防灾减灾救灾理念，按照党中央、国务院决策部署，锚定“人员不伤亡、水库不垮坝、重要堤防不决口、重要基础设施不受冲击”防御目标，贯通雨情、汛情、险情、灾情“四情”防御，强化预报、预警、预演、预案“四预”措施，构建气象卫星和测雨雷达、雨量站、水文站组成的雨水情监测预报“三道防线”，落实落细水旱灾害防御工作体系和重大水旱灾害事件调度指挥机制，有力有效组织开展洪涝灾害防御工作。

## 2.5 Prevention and Control

Water resources authorities at all levels implemented forcefully President Xi Jinping’s instructions on flood prevention and drought relief. They upheld the people-centered approach and scientific prevention and control, and shifted the focus from disaster relief to comprehensive disaster prevention, from post-disaster response to pre-disaster preparedness, and from risk mitigation to hazard management. In compliance with the decisions and plans of the CPC Central Committee and the State Council, they focused on achieving its goals of “zero casualties, no dam breaches, no key embankment failures, and no disruption to vital infrastructure”. This commitment led to an integrated approach to managing rainfall, water regimes, hazards, and disasters. Central to this strategy were the four preemptive pillars of disaster prevention: forecasting, early warning, exercising, and contingency planning. A robust defense system was established with three lines of defense for rainfall monitoring and forecasting, comprising meteorological satellites, rain gauge radars, rainfall stations, and hydrological stations, to effectively organize flood disaster prevention efforts through implementing and refining the flood and drought disaster prevention framework, along with the command-and-coordination mechanisms for major flood and drought events.

### 2.5.1 工作部署

汛前，水利部先后召开全国水利工作会议和水旱灾害防御、水库安全度汛、山洪灾害防御、蓄滞洪区建设管理等工作会议，逐流域召开防汛抗旱总指挥部工作会议，提早部署防范水旱灾害重大风险；印发《关于做好山洪灾害防御准备工作的通知》，提早部署开展山洪风险隐患排查整治、预警阈值动态调整应用、山洪灾害防御预案修订完善、临灾预警“叫应”机制建立等重点工作；印发《关于做好 2024 年蓄滞洪区运用准备工作的通知》，安排部署蓄滞洪区运用预案修订、工程隐患排查、水毁修复及维修养护、预警转移措施实化细化、各环节责任落实等运用准备工作；受中组部委托举办水旱灾害风险管理专题研究班，针对性调训全国 3200 多名分管水利（水务）市县级党委、政府负责人，提高防汛抗旱调度指挥能力；向社会公布 744 座大型水库大坝安全责任人名单。

### 2.5.1 Work deployment

Prior to the flood season, the MWR convened national conferences on water conservancy and held conferences on flood and drought disaster prevention, reservoir safety for flood control, flash flood disaster prevention, and development and governance of flood detention areas. Working meetings of Flood Control and Drought Relief Headquarters (hereinafter FDH) were held for each river basin to proactively address major flood and drought risks. Directives such as *the Notice on Preparing for Flash Flood Disaster Prevention* facilitated early deployment of key tasks including hazard identification and rectification, dynamic adjustment and application of early-warning thresholds, revision of disaster prevention plans, and establishment of the “call and response” mechanism for any imminent-risk warning. *The Notice on Preparing for the Utilization of Flood Detention Areas in 2024* facilitated preparatory measures such as the revision of the contingency plan for the use of flood detention areas, identifying potential risks, flood-damage repair and maintenance, operational refinement of early warning and evacuation measures, ensuring accountability across implementation phases. A special seminar on flood and drought disaster risk management, authorized by the Organization Department of the CPC Central Committee, was conducted to enhance the flood control and drought relief command capabilities of over 3,200 municipal-/county-level party committee and government leaders responsible for water affairs nationwide. Furthermore, a list of responsible personnel for the safety of 744 major reservoirs was made public.

### 2.5.2 隐患排查

2024 年 4—5 月，水利部提高检查效率，为基层减负，统筹开展水旱灾害防御监督检查，以水旱灾害防御工作体系及“四预”措施落实、大中型水库调度运用、山洪灾害防御、防洪工程设施隐患排查及水毁修复等工作为重点，派出 9 个检查组对全国 31 个省（自治区、直辖市）、新疆生产建设兵团及南水北调工程开展检查，共发现 680 个问题，以“一省一单”形式反馈各省级水利部门和工程管理单位，督促建立问题台账，限时整改到位，为做好 2024 年水旱灾害防御工作奠定了基础。与此同时，组织技术人员深入一线实地查找水旱灾害防御风险隐患。各地采取市县级全面自查、省级现场重点抽查和线上检查等方式，全面深入排查整治雨水情自动监测站网、监测预报预警平台、群测群防体系等各类山洪风险隐患 10595 处。

### 2.5.2 Risks identification

From April to May, the MWR enhanced inspection efficiency and lessened grassroots burdens by conducting coordinated supervision and inspection work. Inspections prioritized the disaster prevention systems, implementation of the four preemptive pillars (forecasting, early warning, exercising, and contingency planning), the operation and scheduling of large and medium-sized reservoirs, flash flood disaster prevention, risks identification of flood-control projects and post-flood rehabilitation. Nine inspection teams were dispatched to 31 provinces/autonomous regions/municipalities, the Xinjiang Production and Construction Corps, and the South-North Water Diversion Project, identifying 680 deficiencies in total. Identified issues were communicated to provincial water resources departments and facility management units through a province-specific approach, mandating the creation of deficiency inventories with binding rectification timelines. At the same time, technical personnel were mobilized to go to the frontline for hazard identification. Various inspection methods, including comprehensive self-inspections at the city/county level, targeted on-site inspections at the provincial level, and online inspections, were adopted. Altogether 10,595 flash flood hazards were found and rectified from automatic monitoring station networks, monitoring and early warning platforms, and crowd-sourced disaster prevention efforts.

### 2.5.3 汛前演练

水利部门选取流域典型洪水，运用数字孪生水利建设成果，以提升防洪“四预”和水工程联合调度能力为重点，开展模拟复杂环境下的防洪调度演练。长江水利委员会（以下简称“长江委”）组织湖南、湖北等省水利部门开展长江“1935 · 7”中游型特大洪水模拟调度推演，应用数字孪生江垭皂市工程、数字孪生汉江流域等试点建设成果，设置水文气象预报、调度预演、风险分析、方案制定、会商讨论、指挥决策、应急响应等环节，检验现状工程体系下的洪水防御能力。黄河水利委员会（以下简称“黄委”）组织河南、山东等省水利部门移植 2021 年河南郑州“7 · 20”特大暴雨，模拟黄河花园口水文站天然情况下发生 30000 立方米每秒量级大洪水，以中游干支流水库群联合调度运用和东平湖蓄滞洪区分洪运用为重点，开展防洪调度演练。淮河水利委员会（以下简称“淮委”）组织河南、安徽等省水利部门以 2020 年淮河流域性较大洪水为例，叠加淮河北部支流沙颍河、洪汝河同时发生较大洪水的不利形势，利用淮河防洪“四预”系统，开展淮河洪水调度演练。海河水利委员会（以下简称“海委”）组织北京、天津、河北等省（直辖市）水利部门以大清河南支发生“1963 · 8”洪水、北支发生“2023 · 7”洪水为例，基于防洪“四预”平台，对水工程联合调度和洪水演进情况进行模拟预演，增强防洪指挥决策的科学性和精准性。珠江水利委员会（以下简称“珠江委”）组织广西、广东等省（自治区）水利部门以西江、北江同时发生 100 年一遇、东江发生 200 年一遇特大洪水为例，检验防洪调度能力，首次联合流域 8 省（自治区）开展水文应急监测演练，提升联动配合和实战能力。松辽水利委员会（以下简称“松辽委”）组织黑龙江、吉林等省水利部门以 1998 年和 2010 年典型洪水为例，分别模拟松花江吉林段和松花江流域性特大洪水应对场景，开展防洪调度演练。太湖流域管理局（以下简称“太湖局”）组织江苏、上海等省（直辖市）水利部门以太湖流域当前工况下遭遇 1.5 倍的“烟花”台风强降雨为例，重点模拟长三角一体化示范区防御超标准洪水的极端情况，针对性开展防洪调度演练。

### 2.5.3 Pre-flood exercising

The water resources authorities chose typical floods by basin to conduct flood control dispatch drills under simulated complex scenarios, leveraging digital twins to enhance the four preemptive pillars and the joint project dispatch capabilities. The Changjiang Water Resources Commission (Changjiang Commission hereinafter) organized a simulation drill on an extreme flood scenario happening on the middle reaches, modeled after the July 1935 extreme flood event, in collaboration with the water resources authorities from Hunan and Hubei provinces. Leveraging the pilot initiatives including the digital twin of Jiangya-Zaoshi water projects and the digital twin of the Hanjiang River Basin, the drill incorporated operational modules such as hydro-meteorological forecasting, dispatch simulation, risk analysis, contingency planning, stakeholder consultation, commanding & decision-making, and emergency response. This comprehensive exercise validated the flood prevention capacity of the existing water project system. The Yellow River Conservancy Commission (Yellow River Commission hereinafter) organized the water resources departments of Henan, and Shandong provinces to reconstruct the "July 20" extreme rainstorm disaster in 2021 in Zhengzhou, Henan. This involved simulating a major natural flood scenario with a discharge magnitude of 30,000 $m^3/s$ at Huayuankou Station on the Yellow River. The flood control dispatch drill emphasized the joint operation of reservoir groups in the middle reaches of the Yellow River and its tributaries and the flood diversion operations utilizing the Dongping Lake Flood Detention Area. The Huaihe River Commission (Huaihe Commission hereinafter) organized the water resources departments of Henan and Anhui provinces to conduct flood control drills by modelling after the 2020 basin-wide medium flood in the Huaihe River Basin. The flood dispatch drill incorporated an unfavorable situation where medium flooding occurred simultaneously in the northern tributaries—Shaying and Hongru. It employed the four preemptive measures designed for the basin. The Haihe River Water Conservancy Commission (Haihe Commission hereinafter) organized the water resources departments of Beijing and Tianjin municipalities and Hebei Province to conduct a simulation drill on the joint operation of water projects and flood evolution processes. The drill, based on the four preemptive measures, reconstructed historical flood events—the "August 1963" flood in the southern branch and the "July 2023" flood in the northern branch of the Daqing River. It was aimed to enhance the scientificness and precision of flood command decision-making. The Pearl River Water Resources Commission (Pearl River Commission hereinafter) organized the water resources departments of Guangxi and Guangdong provinces/autonomous region to conduct a flood control capacity assessment using extreme flood scenarios—a 100-year return period flood in the Xijiang and Beijiang rivers and a 200-year return period flood in the Dongjiang River appearing simultaneously. For the first time, the Pearl River Commission coordinated eight provinces/autonomous regions within the basin for a joint hydrological emergency monitoring drill, aiming to enhance inter-regional cooperation and operational proficiency. The Songliao River Water Resources Commission (Songliao Commission hereinafter) organized the water resources departments of Heilongjiang and Jilin to conduct a flood control dispatch drill by modelling after the historical flood events of 1998 and 2010. The drill simulated the response scenarios for both the Jilin section of the Songhua River and the basin-wide extreme flood in the Songhua River. The Taihu Basin Authority (Taihu Authority hereinafter) organized the water resources departments of Jiangsu and Shanghai to simulate how the Yangtze River Delta Integration Demonstration Zone would cope with an extreme flood scenario that exceeds design standards. A scenario with 150% rainfall intensity of Typhoon In-Fa under current operational conditions in the Taihu Lake was used.

### 2.5.4 “四预”措施

各级水利部门加快构建“天空地水工”一体化监测感知体系，强化预报、预警、预演、预案“四预”措施，汛期滚动发布洪水预报 76.39 万站次、江河洪水预警 4303 次，其中水利部流域管理机构 2024 年汛期发布洪水预报 1384 期、洪水预警 171 次。水利部联合中国气象局发布未来 24 小时山洪灾害气象风险预警 148 期，根据橙色、红色预警级别范围先后 5 次启动（调整）洪水防御应急响应；每日根据 24 小时降雨预报数据，结合前期降雨情况，精准识别细化至乡镇的山洪灾害风险区域及点位，累计发布“一省一单”靶向预警 6085 县次，滚动发布 2 小时临近预报预警 460 期，提醒做好局地短时强降雨防范应对；持续开展山洪灾害监测预警抽查，累计抽查县级山洪灾害监测预警情况 1382 县次。各地利用山洪灾害监测预警平台向相关防汛责任人发送预警短信 3736.5 万条，启动预警广播 195.2 万次，依托“三大运营商”向社会公众发送预警短信 25.2 亿条，提前转移群众 242.9 万人次。在应对湖南团洲垸堤防决口、黑龙江乌苏里江超实测记录洪水、内蒙古老哈河堤防决口等险情中，水利部组织有关技术支撑单位在数字流场中“正向”预演洪水风险，分析洪水威胁区域和工程风险点位，由设定的目标“逆向”推演流域水工程运用次序、运用时机、运用规模，科学制定团洲垸堤防决口险情中第三道防线的构建方案、乌苏里江子堤加高方案以及老哈河堤防决口影响人员转移方案，牢牢把握防御洪涝灾害主动性。

长江委组织推进基于雷达信息的短临强降雨预警、水文水动力学耦合演进模型研发，完善信息共享机制，有序推进长江流域水监控系统全覆盖，支撑流域水库群实时预报调度。黄委加强与流域各省（自治区）信息共享，滚动开展预测预报，及时发布降雨及洪水预警，强化“三条黄河”耦合联动，精细调度以小浪底水库为核心的干支流水工程。淮委密切监视流域天气变化和雨水情发展态势，及时预测降雨分布、降雨总量，滚动预测预报淮河干流水位流量，对不同调度方案充分预演，研判防洪风险隐患，对照洪水防御“四个链条”精准制定措施方案。海委采用精细化智能化网格数值预报降水产品，滚动开展洪水预报，主要站点 24 小时预见期洪水预报精度 85%，有效应对 11 次强降水过程。珠江委按照“洪水预报滚动通报 + 短临降雨点对点预警”，及时发布洪水预警，并加密洪水预报，关键期各场次预报精度达 90% 以上，对场次洪水充分进行预演，及时优化调整防洪预案，有效应对 13 次编号洪水。松辽委通过气象卫星、天气雷达、雨量站三源融合降雨产品估算乌苏里江境外实况降雨，有效提高乌苏里江洪水预报精度，为逐堤段推演研判风险、预置抢险力量提供支撑。太湖局及时启动与华东区域气象中心紧急会商机制，进一步提高水位预报精度，并组织开展湖面倾斜和越浪预测 4 次，累计开展预演近 100 场次，为流域骨干工程调度决策提供有力支撑。

### 2.5.4 The four preemptive pillars

The water resources authorities accelerated the establishment of an integrated "space-air-ground-water-project" monitoring and sensing system. Through enhanced implementation of the four preemptive pillars (forecasting, early warning, exercising, and contingency planning), 763,900 station-times of flood forecast and 4,303 river flood warnings were released in a non-stop manner during the flood season. Specifically, basin authorities under the MWR released 1,384 flood forecasts and 171 times of flood warning during the flood season. In collaboration with the China Meteorological Administration, the MWR released 148 meteorological warnings for flash flood disasters for the coming 24 hours, and activated/adjusted the flood prevention emergency responses for five times in accordance with Orange and Red Alerts; precisely identified township-level zones and locations prone to the flash flood disaster according to the 24-hour rainfall forecast and actual precipitation data, released 6,085 county-times of targeted warnings, and released 460 short-term precipitation forecasts and warnings for the coming two hours in a non-stop manner; and conducted continuous inspections of flash flood disaster monitoring and early warning systems, with a total of 1,382 county-level inspections carried out. The monitoring and early warning platform for flash flood disasters sent 37.365 million text alerts to relevant flood control personnel, made 1.952 million warning broadcasts, and sent 2.52 billion text alerts to the public through the three major telecom operators. Preemptive relocation was executed for 2.429 million person-times. In responses to the Tuanzhou Polder embankment breach (Hunan), record-breaking floods in the Ussuri River (Heilongjiang), and the Laoha River embankment breach (Nei Mongol), the MWR organized technical support units to conduct forward simulations of flood risks in digital flow fields, analyzing inundation-threatened zones and dangerous spots in the projects. They determined the sequence, time and scale in the utilization of the basin-wide water projects through reverse deduction aligned with predefined mitigation objectives, and designed the plans for Tuanzhou embankment breach containment, for heightening the temporary levee for the Ussuri River, and for evacuation of populations impacted by the breach on the Laoha River. Robust maneuvering capacity against the floods were gained as a result.

The Changjiang Commission advanced the development of radar-based short-term imminent heavy rainfall forecasting systems and the integrated hydro-hydrodynamic predictive modeling framework while improving the information sharing mechanism. These initiatives systematically advanced the comprehensive coverage of the Yangtze River Basin Water Monitoring System, thereby enabling real-time forecast dispatch for the reservoir group in the basin. The Yellow River Commission intensified data sharing with basin-level provinces/autonomous regions, released forecasts in a non-stop manner and reported early warnings for rainfall and flood in time, reinforced the physical-digital-modeled Yellow

River governance system, and executed precision project scheduling on the mainstream and tributaries with Xiaolangdi Reservoir at the center. The Huaihe Commission maintained vigilant monitoring of weather dynamics and rainfall evolution across the basin, provided timely forecasts of rainfall distribution and amount, released forecasts of water levels and flows in a non-stop manner. It conducted scenario-based simulations of reservoir scheduling to assess flood risks and formulated precise action plans. These efforts entailed strengthening the process management from rainfall, runoff generation, confluence to evolution, from the basin scale, mainstreams, tributaries to sections,from flood volume, flood peak, flood processes to scheduling, and from technology, materials, teams to organization. The Haihe Commission adopted refined, intelligent grid-based numerical data to forecast precipitation, and conducted flood forecasts in a non-stop manner, achieving a precision rate of 85% in 24-hour lead-time floods at key stations. It effectively responded to 11 times of intense rainfall. The Pearl River Commission released flood warnings under the mechanism of “non-stop flood forecast notifications + point-to-point short-term rainfall warnings”, and it increased the frequency of flood forecasts, so the accuracy of flood forecasts during critical periods reached 90%. It conducted scenario-based simulations for each flood event, and optimized flood control plans through real-time adjustments, and effectively coped with 13 numbered floods. The Songliao Commission combined rainfall data from meteorological satellite, weather radars, and rain gauge stations to estimate the real precipitation in the transboundary sections of the Ussuri River. This approach enhanced the accuracy of flood forecast, enabling section-by-section risk analysis of embankments and strategic deployment of emergency rescuers ahead of flood peaks. The Taihu Authority activated an emergency consultation mechanism with the East China Regional Meteorological Center in time to improve the accuracy of water level forecasts. It organized four forecasts for wind-driven tilting of the lake surface and wave overtopping risks. Nearly 100 drills were conducted, providing strong support for the decision-making in project scheduling across the basin.

山东省水利厅完成大汶河、沂沭河防洪“四预”联合调度决策支持系统试点建设，基于系统平台对沂沭河 218 个、大汶河 72 个预报断面进行未来 3 天滚动洪水预报，共计预报 350 余次，生成洪水预报调度简报 321 份，主要降雨期间预报准确率均在 80% 以上。

广东省水利厅完成省级小流域山洪灾害“四预”系统建设，在北江流域 4 月 20 日特大暴雨期间，利用该系统提前发布 24 小时风险预警公众短信，提前 3 小时发布山洪准备转移和立即转移预警。由于预警转移及时，江尾镇受山洪威胁的 256 人得以快速转移，山洪灾害未导致人员伤亡。

The Water Resources Department of Shandong Province completed a pilot decision-making support system based on the four preemptive pillars for the flood prevention of the Dawen River and Yihe-Shuhe River. This system delivered non-stop 3-day flood forecasts for 218 sections on the Yihe-Shuhe River and 72 sections on the Dawen River, producing over 350 forecasts and 321 flood forecast and command briefs. The forecast accuracy was over 80% during the main rainfall period.

The Water Resources Department of Guangdong Province developed a provincial-level flash flood prevention system based on the four preemptive measures for small river basins. During the April 20 extreme rainstorm in the Beijiang River Basin, the system sent text alerts to the public for the coming 24 hours, and released evacuation warnings and orders to evade flash floods three hours in advance. Timely evacuation saved the 256 at-risk residents in Jiangwei Town and no casualties were caused by flash floods.

表 2-5 2024 年汛期水利部流域管理机构预报预警情况

Table 2-5 Monitoring, forecasts and early warnings by each river basin commission/authority during the 2024 flood season

| 流域管理机构 Commission/authority | 降水预报 / 期 Precipitation forecasts/time | 洪水预报 / 期 Flood forecasts/ time | 洪水预警 / 站次 Flood warnings/ Station-time | 预警短信 / 万条 Alert messages/10,000 pieces |
| --- | --- | --- | --- | --- |
| 长江委 Changjiang | 214 | 267 | 52 | 6.7 |
| 黄委 Yellow River | 192 | 309 | 6 | 1.9 |
| 淮委 Huaihe | 160 | 104 | 13 | 1.6 |
| 海委 Haihe | 92 | 63 | 3 | 2.0 |
| 珠江委 Pearl River | 274 | 342 | 50 | 9.0 |
| 松辽委 Songliao | 19 | 90 | 44 | 2.2 |
| 太湖局 Taihu | 179 | 209 | 3 | 1.3 |
| 合计 Total | 1130 | 1384 | 171 | 24.7 |

### 2.5.5 会商响应

水利部坚持主汛期部长“周会商 + 场次洪水会商”机制，国家防汛抗旱总指挥部副总指挥、水利部部长李国英先后主持会商 22 次，关键时刻赴江西、湖南、广东、广西、贵州等地现场指挥调度防御工作。水利部密切监视雨情水情汛情灾情，逐日跟踪分析，滚动会商研判 211 次，启动洪水防御 Ⅲ 级应急响应 8 次、Ⅳ 级应急响应 32 次。汛期每天以“一省一单”形式将预报降雨量超过预警阈值（50 毫米或 25 毫米）的县（市、区）、水库名单和山洪灾害风险县（市、区）发至相关省级水利部门，提醒做好强降雨防范。

### 2.5.5 Consultation and responses

The MWR maintained regular weekly consultation and consultation on specific flood events. Li Guoying, SFDH Vice Commander-in-Chief and Minister of Water Resources, presided over 22 consultations, and went to flood control frontline in Jiangxi, Hunan, Guangdong, Guangxi, and Guizhou to direct and coordinate emergency operations at critical junctures. The MWR kept a close eye on the trend of rainfall, water levels, floods and droughts, conducting day-to-day tracking and analysis. It held 211 consultations, initiated 8 Level III emergency responses and 32 Level IV emergency responses for flood control. During the flood season, counties/cities/districts and reservoirs anticipated to receive above-warning (50mm or 25mm) precipitation, and places exposed to flash flood risks were listed and made known by relevant provincial water resources departments daily, in order to heighten alerts.

表 2-6　2024 年水利部本级洪水防御应急响应启动情况

Table 2-6  Initiation of flood disaster prevention emergency response by the Ministry of Water Resources in 2024

| 序号<br>No. | 启动日期<br>Start date | 响应级别<br>Response level | 针对区域<br>Targeted area | 终止日期<br>End date |
|---|---|---|---|---|
| 1 | 1 月 23 日<br>January 23 | IV | 新疆（地震）<br>Xinjiang (earthquake) | 2 月 1 日<br>February 1 |
| 2 | 4 月 5 日<br>April 5 | IV | 福建、江西、广东、广西<br>Fujian, Jiangxi, Guangdong, Guangxi | 4 月 9 日<br>April 9 |
| 3 | 4 月 19 日<br>April 19 | IV | 福建、江西、湖南、广东、广西<br>Fujian, Jiangxi, Hunan, Guangdong, Guangxi | 福建、江西、湖南、广西 4 月 23 日，广东 4 月 21 日提升至 Ⅲ 级<br>Fujian, Jiangxi, Hunan, and Guangxi elevated to Level III on April 23, and Guangdong elevated to Level III on April 21 |
| 4 | 4 月 21 日<br>April 21 | III | 广东<br>Guangdong | 4 月 23 日调整至Ⅳ级，4 月 27 日终止<br>Adjusted to Level IV on April 23 and ended on April 27 |
| 5 | 4 月 28 日<br>April 28 | IV | 广东<br>Guangdong | 5 月 6 日<br>May 6 |
| 6 | 5 月 3 日<br>May 3 | IV | 江西、湖南、广西<br>Jiangxi, Hunan, Guangxi | 5 月 6 日<br>May 6 |
| 7 | 5 月 19 日<br>May 19 | IV | 福建、广东、广西<br>Fujian, Guangdong, Guangxi | 5 月 22 日<br>May 22 |
| 8 | 6 月 14 日<br>June 14 | IV | 福建、广西、贵州、云南<br>Fujian, Guangxi, Guizhou, Yunnan | 福建 6 月 20 日，贵州、云南 7 月 8 日，广西 6 月 19 日提升至 Ⅲ 级<br>Fujian, Guizhou and Yunnan, and Guangxi elevated to Level III on June 20, July 8, and June 19, respectively |
| 9 | 6 月 16 日<br>June 16 | IV | 广东<br>Guangdong | 6 月 24 日<br>June 24 |
| 10 | 6 月 17 日<br>June 17 | IV | 浙江、江西、湖南<br>Zhejiang, Jiangxi, Hunan | 浙江 7 月 8 日，江西、湖南 6 月 28 日提升至 Ⅲ 级<br>Zhejiang, and Jiangxi and Hunan elevated to Level III on July 8 and June 28, respectively |
| 11 | 6 月 19 日<br>June 19 | IV | 安徽、湖北<br>Anhui, Hubei | 6 月 28 日提升至 Ⅲ 级<br>Elevated to Level III on June 28 |
| 12 | 6 月 19 日<br>June 19 | III | 广西<br>Guangxi | 6 月 22 日调整至Ⅳ级，6 月 24 日终止<br>Adjusted to Level IV on June 22 and ended on June 24 |
| 13 | 6 月 26 日<br>June 26 | IV | 广西、重庆<br>Guangxi, Chongqing | 广西 7 月 8 日，重庆 7 月 16 日<br>Guangxi on July 8 and  Chongqing on July 16 |
| 14 | 6 月 28 日<br>June 28 | III | 安徽、江西、湖北、湖南<br>Anhui, Jiangxi, Hubei, Hunan | 湖北 7 月 10 日调整至Ⅳ级，7 月 24 日终止；江西 7 月 15 日调整至Ⅳ级，7 月 31 日终止；安徽 7 月 19 日调整至Ⅳ级，7 月 31 日终止；湖南 7 月 24 日调整至Ⅳ级，7 月 27 日提升至 Ⅲ 级<br>Hubei adjusted to Level IV on July 10 and ended on July 24; Jiangxi adjusted to Level IV on July 15 and ended on July 31; Anhui adjusted to Level IV on July 19 and ended on July 31; Hunan adjusted to Level IV on July 24 and elevated to Level III on July 27 |

续表 Continued

| 序号 No. | 启动日期 Start date | 响应级别 Response level | 针对区域 Targeted area | 终止日期 End date |
|---|---|---|---|---|
| 15 | 6月28日 June 28 | IV | 黑龙江 Heilongjiang | 7月15日 July 15 |
| 16 | 7月7日 July 7 | IV | 江苏、山东 Jiangsu, Shandong | 山东7月11日，江苏7月31日 Shandong on July 11, Jiangsu on July 31 |
| 17 | 7月9日 July 9 | IV | 四川 Sichuan | 7月23日提升至Ⅲ级 Elevated to Level III on July 23 |
| 18 | 7月15日 July 15 | IV | 山东、河南 Shandong, Henan | 7月24日 July 24 |
| 19 | 7月16日 July 16 | IV | 陕西、甘肃 Shaanxi, Gansu | 7月31日 July 31 |
| 20 | 7月21日 July 21 | IV | 广东、广西、海南、云南 Guangdong, Guangxi, Hainan, Yunnan | 广西、海南、云南7月24日，广东7月31日 Guangxi, Hainan and Yunnan on July 24; Guangdong on July 31 |
| 21 | 7月23日 July 23 | III | 四川 Sichuan | 7月26日调整至Ⅳ级，8月11日终止 Adjusted to Level IV on July 26 and ended on August 11 |
| 22 | 7月24日 July 24 | IV | 浙江、福建 Zhejiang, Fujian | 7月25日提升至Ⅲ级 Elevated to Level III on July 25 |
| 23 | 7月24日 July 24 | IV | 北京、天津、河北 Beijing, Tianjin, Hebei | 7月31日 July 31 |
| 24 | 7月25日 July 25 | IV | 辽宁、吉林 Liaoning, Jilin | 7月29日提升至Ⅲ级 Elevated to Level III on July 29 |
| 25 | 7月25日 July 25 | III | 浙江、福建 Zhejiang, Fujian | 7月28日 July 28 |
| 26 | 7月27日 July 27 | III | 湖南 Hunan | 8月8日 August 8 |
| 27 | 7月28日 July 28 | IV | 重庆 Chongqing | 8月8日 August 8 |
| 28 | 7月29日 July 29 | III | 辽宁、吉林 Liaoning, Jilin | 8月17日 August 17 |
| 29 | 7月31日 July 31 | IV | 黑龙江 Heilongjiang | 9月6日 September 6 |
| 30 | 8月6日 August 6 | IV | 山西、陕西、宁夏、甘肃 Shanxi, Shaanxi, Ningxia, Gansu | 山西、宁夏、甘肃8月11日，陕西8月17日 Shanxi, Ningxia and Gansu on August 11; Shaanxi on August 17 |
| 31 | 8月9日 August 9 | IV | 内蒙古 Nei Mongol | 8月28日 August 28 |
| 32 | 8月17日 August 17 | IV | 新疆、兵团 Xinjiang, XPCC | 9月17日 September 17 |
| 33 | 8月20日 August 20 | IV | 辽宁 Liaoning | 8月28日 August 28 |
| 34 | 8月25日 August 25 | IV | 山西、陕西、宁夏 Shanxi, Shaanxi, Ningxia | 8月28日 August 28 |

续表 Continued

| 序号 No. | 启动日期 Start date | 响应级别 Response level | 针对区域 Targeted area | 终止日期 End date |
|---|---|---|---|---|
| 35 | 9 月 4 日 September 4 | IV | 广东、广西、海南、云南 Guangdong, Guangxi, Hainan, Yunnan | 云南 9 月 12 日，广西 9 月 17 日，广东、海南 9 月 5 日提升至Ⅲ级 Yunnan, Guangxi, and Guangdong and Hainan elevated to Level III on September 12, September 17 and September 5, respectively |
| 36 | 9 月 5 日 September 5 | III | 广东、海南 Guangdong, Hainan | 9 月 8 日调整至Ⅳ级，9 月 10 日终止 Adjusted to Level IV on September 8 and ended on September 10 |
| 37 | 9 月 14 日 September 14 | IV | 上海、江苏、浙江、安徽 Shanghai, Jiangsu, Zhejiang, Anhui | 上海、江苏、浙江 9 月 17 日，安徽 9 月 21 日 Shanghai, Jiangsu and Zhejiang on September 17; Anhui on September 21 |
| 38 | 9 月 18 日 September 18 | IV | 上海、江苏、浙江、河南、海南 Shanghai, Jiangsu, Zhejiang, Henan, Hainan | 9 月 21 日 September 21 |
| 39 | 10 月 30 日 October 30 | IV | 海南 Hainan | 11 月 1 日 November 1 |
| 40 | 10 月 31 日 October 31 | IV | 上海、江苏、浙江、福建 Shanghai, Jiangsu, Zhejiang, Fujian | 11 月 2 日 November 2 |

表 2-7 2024 年各流域管理机构会商及洪水防御应急响应启动情况
Table 2-7 Consultations held and emergency responses initiated by river basin commissions authorities for flood disaster prevention in 2024

| 流域管理机构 Commissions / authorities | 会商次数 Consultations | 启动次数 Emergency responses | | | | 累计时间 / 天 Accumulation time / day |
|---|---|---|---|---|---|---|
| | | Ⅰ级 Level I | Ⅱ级 Level II | Ⅲ级 Level III | Ⅳ级 Level IV | |
| 长江委 Changjiang | 126 | | | 5 | 18 | 49 |
| 黄委 Yellow River | 69 | | | | 8 | 111 |
| 淮委 Huaihe | 70 | | | 1 | 3 | 34 |
| 海委 Haihe | 53 | | | | 4 | 8 |
| 珠江委 Pearl River | 165 | | 2 | 5 | 16 | 108 |
| 松辽委 Songliao | 73 | | 1 | 5 | 12 | 66 |
| 太湖局 Taihu | 120 | | 1 | 4 | 8 | 50 |
| 合计 Total | 676 | | 4 | 20 | 69 | / |

注 空白表示未启动。
Note Blank means zero initation.

### 2.5.6 工程调度

2024 年 7 月 25 日，习近平总书记组织召开中共中央政治局常务委员会，部署防汛抗洪救灾工作，明确要求要科学调度防洪工程，细化蓄滞洪区运用准备。水利部及地方各级水利部门坚决贯彻党中央决策部署，“系统、科学、安全、精准”调度水工程，全年共发出各类调度指令 3.01 万道，6929 座次大中型水库投入调度运用、拦洪 1471.26 亿立方米，有效减轻下游防洪压力。

长江流域：水利部和流域有关省（直辖市）水利部门及水库管理单位将 127 座（处）水工程纳入联合调度，汛前调度其中 53 座控制性水库腾出库容约 870 亿立方米；汛期调度三峡等干支流水库预泄、削峰、拦蓄，下达三峡、丹江口及金沙江下游梯级、雅砻江梯级、嘉陵江亭子口、大渡河瀑布沟等控制性水库调度令 65 条，成功防御长江 3 次编号洪水、汉江 1 次编号洪水。应对长江 1 号洪水过程中，联合调度控制性水库群累计拦洪 165 亿立方米，分别降低长江中下游干流莲花塘、汉口、九江、大通站洪峰水位 1.70 米、1.00 米、0.60 米、0.40 米，避免长江中下游干流、洞庭湖湖区、鄱阳湖湖区 450 余个洲滩民垸运用；应对长江 2 号洪水过程中，调度三峡水库，控制水库出库流量至 37000 立方米每秒适度拦洪，削峰率 33%，同时联合调度金沙江、雅砻江等 15 座控制性水库累计拦洪 68.5 亿立方米，降低长江中下游干流水位 0.70 ~ 3.10 米；应对长江 3 号洪水过程中，在上游防洪风险可控的前提下，调减三峡水库出库流量至 27000 立方米每秒，通过科学调度长江上中游水库群，实现洞庭湖城陵矶（七里山）站不超警戒水位的调度目标；应对汉江 1 号洪水过程中，以丹江口水库为核心的控制性水库群累计拦洪 29.42 亿立方米，其中丹江口水库拦洪 24.29 亿立方米，削峰率达 81.1%。

### 2.5.6 Water project scheduling

On July 25, 2024, President Xi Jinping convened a meeting of the Standing Committee of the Political Bureau of the CPC Central Committee to map out flood prevention, control, and disaster relief work. It was made clear that scientific scheduling of flood control works and refined utilization of flood detention areas must be pursued. The MWR and water resources authorities at all levels executed on these directives and dispatched water projects' use in a systematic, scientific, safe, and precise manner. In total, 30,100 scheduling dispatches were issued, large/medium-sized reservoirs held back 147.126 billion $m^3$ of floodwater under 6,929 orders, effectively lessening the flood prevention pressure for the lower reaches.

The Yangtze River Basin: The MWR, relevant water resources authorities, and reservoir operators put 127 water projects under joint flood control operations. In total 53 controlling reservoirs emptied 87 billion $m^3$ of storage capacity in the run-up to the flood season. During the flood season, reservoirs on the Yangtze mainstream and tributaries including the Three Gorges Reservoir were utilized for pre-discharge, peak flow reduction, and floodwater retention; 65 operational orders for controlling reservoirs (including the Three Gorges, Danjiangkou, cascade reservoirs on the lower Jinsha River, cascade reservoirs on the Yalong River, Tingzikou on the Jialing River and Pubugou on the Dadu River) were issued. These efforts were successful in preventing three numbered floods in the Yangtze River and one numbered flood in the Hanjiang River. To fight the Yangtze No.1 flood, controlling reservoirs cumulatively retained 16.5 billion $m^3$ of floodwater, reducing peak flood levels at Lianhuatang, Hankou, Jiujiang, and Datong Station (on the middle and lower Yangtze mainstream) by 1.70 m, 1.00 m, 0.60m and 0.40m, respectively. As a result, over 450 polder areas on the middle and lower Yangtze and in the Dongting and Poyang lake areas remained inactivated. To fight the Yangtze No.2 Flood, outflow from the Three Gorges was controlled at 37,000 $m^3/s$ to achieve a flood peak reduction rate of 33%, while 15 controlling reservoirs on the Jinsha River and Yalong River cumulatively retained 6.85 billion $m^3$ of floodwater, lowering the water levels along the middle and lower Yangtze mainstream by 0.70-3.10 m. To fight the Yangtze No.3 Flood, outflow from the Three Gorges was reduced to 27,000 $m^3/s$ under controllable upstream flood risks, and through scientific coordination of the reservoir group on the upper and middle reaches of the Yangtze River, the objective of preventing Chenglingji (Qilishan) Station in the Dongting Lake from exceeding its warning water level was achieved. To fight Hanjiang No.1 Flood, the controlling reservoir group with Danjiangkou at the core cumulatively retained 2.942 billion $m^3$ of floodwater; Danjiangkou alone intercepted 2.429 billion $m^3$ with the peak flow reduced by 81.1%.

**淮河流域：**应对淮河1号洪水过程中，水利部和流域有关省水利部门调度22座大型水库预留防洪库容52.7亿立方米；调度大型水库群充分拦洪削峰，最大拦洪13.29亿立方米，避免杨庄滞洪区启用；畅通河道行洪，蚌埠闸等拦河枢纽提前敞泄，启用茨淮新河分泄洪水1.5亿立方米，有效降低正阳关站洪峰水位约0.28米，避免董峰湖、上六坊堤、下六坊堤3处蓄滞洪区运用；洪泽湖口门全力下泄，结合排涝河道相机分洪，避免洪泽湖超警和入海水道启用。应对沂河、沭河4次连续编号洪水过程中，提前3天调度拦河闸坝塌坝敞泄，预降底水畅通河道，避免洪峰叠加；洪水期间，发出130道指令科学精准调度沂沭泗骨干工程，协调调度许家崖、石梁河等12座大型水库拦洪削峰，最大拦洪6.6亿立方米；精细调度刘家道口枢纽、大官庄枢纽等直管工程全力东调，洪水通过新沂河、新沭河东出入海88亿立方米；充分利用南四湖拦洪12.6亿立方米；科学调度骆马湖嶂山闸下泄洪水60亿立方米。

**珠江流域：**水利部和流域有关省（自治区）水利部门滚动更新水工程调度方案，累计下发132道调度指令，调度大中型水库群拦洪356亿立方米。应对北江第2号洪水过程中，调度飞来峡等水库群拦洪4.54亿立方米，将北江超100年一遇洪水削减至50年一遇，避免了潖江蓄滞洪区启用。应对韩江第4号洪水过程中，调度棉花滩、高陂等水库拦洪4.7亿立方米，将韩江中上游超100年一遇洪水削减为20年一遇。应对西江第2号洪水过程中，调度西江干支流16座重点水库拦洪28.02亿立方米，有力应对西江2008年以来最大洪水，其中调度桂江骨干水库拦洪3.1亿立方米，将桂林江段超100年一遇洪水削减为30年一遇。

The Huaihe River Basin: To fight the Huaihe No.1 Flood, the MWR and relevant provincial water resources departments coordinated 22 large reservoirs to reserve 5.27 billion $m^3$ of flood control capacity and used large reservoir groups to retain up to 1.329 billion $m^3$ of floodwater, thereby avoiding the activation of the Yangzhuang Flood Detention Area; instream flood discharge was maximized with river control complexes like the Bengbu Sluice fully opened in advance; and the Cihuai New River diverted 150 million $m^3$ of floodwater, effectively reducing the peak water level at Zhengyangguan Station by approximately 0.28 m and avoiding the activation of three flood detention areas (Dongfeng Lake, Shangliufang Embankment, and Xialiufang Embankment); the Hongze Lake's floodgates were put into full operation, combined with strategic diversion via drainage channels to contain the water level under the warning level and avoid using the seaward floodway. In addressing four consecutive numbered floods on the Yihe and Shuhe rivers, gate-barrages were opened three days in advance, lowering base flows in advance to prevent peak flows overlapping. During the flooding, 130 operational directives were issued to scientifically and precisely dispatch main projects on the Yihe-Shuhe-Sihe rivers, and to coordinate 12 large reservoirs including Xujiaya and Shilianghe to intercept floods of up to 660 million $m^3$ and reduce the flood peak; water projects directly managed by the basin authorities including the Liujiadaokou and Daguangzhuang complexes diverted floodwaters eastward at full capacity, discharging 8.8 billion $m^3$ via the New Yihe and New Shuhe into the sea; the Nansi Lake retained 1.26 billion $m^3$ of floodwater; and the Zhangshan Sluice of Luoma Lake discharged 6 billion $m^3$ of floodwater.

The Pearl River Basin: The MWR and relevant provincial water resources departments adjusted scheduling plans dynamically and issued 132 operational directives to large and medium-sized reservoirs, which retained 35.6 billion $m^3$ of floodwater. To fight the Beijiang No.2 Flood, the reservoir group including Feilaixia retained 454 million $m^3$ of floodwater, reducing the once-in-100-year flood in Beijiang to once-in-50-year flood and avoiding the activation of the Pajiang Flood Detention Area. To fight the Hanjiang No.4 Flood, reservoirs such as Mianhuatan and Gaobei retained 470 million $m^3$ of floodwater, reducing the flood on the middle and upper Hanjiang from a >100-year one to a 20-year one. To fight the Xijiang No.2 Flood, 16 key reservoirs along the Xijiang mainstream and tributaries retained 2.802 billion $m^3$ of floodwater, effectively mitigating the largest flood since 2008; in particular, the key reservoirs on the Guijiang intercepted 310 million $m^3$ of floodwater, reducing the once-in-100-year flood in the Guilin river section to once-in-30-year flood.

松辽流域：应对松花江吉林段 2 次编号洪水过程中，水利部调度丰满、白山水库拦洪 41 亿立方米，丰满水库 2 次洪水过程削峰率分别为 72.6% 和 64.6%，有效降低了下游干流松花江站至扶余站江段河道水位 1.37 ~ 2.18 米。应对嫩江洮儿河 3 次编号洪水过程中，水利部调度察尔森水库拦洪削峰，削峰率分别达到 91%、76% 和 45%，有效控制下游镇西断面不超警。水利部和内蒙古自治区水利厅充分利用流域有效场次降雨，调度东台子、德日苏宝冷、红山等水库，采取“全线闭口，集中下泄”等调度措施，在确保堤防安全前提下，实施河道整治、径流塑造、生态泄流等束水引流，西辽河干流水头 26 年来首次到达通辽城区。

太湖流域：应对太湖 2 次编号洪水和台风“格美”“贝碧嘉”“普拉桑”“康妮”暴雨洪水过程中，水利部和流域有关省（直辖市）水利部门错峰调度望虞河、太浦河、新孟河等骨干排水工程，加大沿长江、沿海、沿杭州湾口门排水力度，汛期沿长江、沿海、沿杭州湾口门累计排水 161.9 亿立方米，环太湖口门累计排太湖水 62.5 亿立方米。针对新安江流域持续发生的强降雨过程，水利部太湖局会同浙江、安徽 2 省水利厅首次启动新安江流域防洪联防联控机制，共同组成专家组入驻新安江电厂，协助开展水库防洪调度工作，尽可能降低新安江水库最高水位，减少高水位持续时间及对上游地区的影响。

The Songhua-Liaohe River Basin: To cope with two numbered floods in the Jilin section of the Songhua River, the MWR utilized the Fengman and Baishan reservoirs to retain 4.1 billion $m^3$ of floodwater, with Fengman achieving peak reduction rates of 72.6% and 64.6% respectively in the two numbered floods. This effectively lowered instream levels from Songhuajiang Station to Fuyu Station in the lower mainstream by 1.37-2.18 m. In addressing three numbered floods on the Tao'er River, a tributary of the Nenjiang, the MWR utilized Chaersen Reservoir to mitigate flood peaks with reduction rates reaching 91%, 76% and 45%, respectively, successfully preventing the Zhenxi section in the lower reaches from exceeding its warning level. The MWR and Nei Mogol Water Resources Department made full use of effective rainfall events and made Dongtaizi, Derisu Baoleng and Hongshan reservoirs to discharge flows in a comprehensive and concentrated manner; they carried out river channel treatment, runoff modification, and controlled ecological flow discharge while ensuring levee safety. These efforts successfully channeled and diverted the concentrated flow all the way until the Xiliao River mainstream reached Tongliao's urban area for the first time in 26 years.

The Taihu Lake Basin: To cope with two numbered floods in the Taihu Lake and rainstorm floods induced by typhoons "Geami", "Bebinca", "Pulasan", and "Kong-rey", the MWR and relevant provincial water resources departments in the basin dispatched key flood discharge projects such as the Wangyu River, Taipu River, and Xinmeng River according to differentiated timing, stepped up flood discharge through floodgates along the Yangtze River, Hangzhou Bay and coastal areas. The cumulative via-floodgate discharge during the flood season reached 16.19 billion $m^3$. The floodgates around the Taihu Lake discharged 6.25 billion $m^3$ from the lake. To cope with sustained heavy rainfall in the Xin'anjiang River Basin, the Taihu Authority, in collaboration with the water resources departments of Zhejiang Province and Anhui Province, activated the Xin'anjiang basin-wide joint flood operation for the first time. A joint expert team was stationed at the Xin'anjiang Hydropower Plant, focusing on reducing the peak reservoir level and minimizing the impacts of sustained high reservoir level on the upper reaches.

### 2.5.7 技术支撑

全国水利系统共派出工作组 7.28 万组次、34.91 万人次，专家组 2.03 万组次、8.74 万人次，赶赴一线指导水旱灾害防御工作，指导成功处置湖南团洲垸、湖南涓水、辽宁王河、内蒙古老哈河、广东西福河堤防决口等水利工程险情。长江委、水利部信息中心和中国水利水电科学研究院等单位发挥技术优势，动态开展湖南团洲垸淹没范围、钱团间堤、安全区等遥感监测，根据决口发展动态推演决口处洪水过程，优化团洲垸堤防堵口方案，为固守钱团间堤第二道防线、成功抵御洪水漫延西进、超前构筑沿悦来河第三道防线、48 小时内完成决口封堵和垸内快速退水提供了全过程技术支撑。松辽委、水利部信息中心和中国水利水电科学研究院等单位开展乌苏里江洪水漫堤遥感监测与风险分析，基于水文水动力学耦合方法推求乌苏里江干流沿程预报洪峰水面线，研判干堤及重要支流回水堤潜在漫堤风险点，针对性强化巡查、加固堤防、加筑子堤、封堵渗漏，有效应对乌苏里江 2 次超实测记录洪水。

### 2.5.8 信息发布

水利部精心策划、突出重点、主动发声，强化与中央主要媒体沟通对接，广泛深入宣传报道水利部门贯彻落实习近平总书记重要指示、二十届三中全会和中央政治局常委会会议精神，全力做好水旱灾害防御工作的举措和成效，突出反映各级水利部门扛牢防汛抗旱天职，做到守土有责、守土负责、守土尽责的担当作为，积极营造良好舆论氛围。在防汛抗旱关键节点水利部先后召开水旱灾害防御工作准备情况、“七下八上”防汛关键期水旱灾害防御工作情况、乌苏里江洪水防御工作情况等 5 场新闻发布会、通气会、媒体座谈会，权威发布相关信息；向中央主要媒体推送新闻通稿近 300 余篇，及时反映重要汛旱情信息及水利部防御工作动态；组织协调水利部相关司局、直属单位、流域管理机构及水利部工作组专家接受媒体采访 60 余人次，专业解读回应社会关切；举办“改革驱动 科技赋能 全力以赴守护江河安澜——2024 年水旱灾害防御工作”图片展览。人民日报、新华社、中央电视台、光明日报、经济日报等刊（播）发水旱灾害防御报道 4100 余篇（条），其中中央电视台《新闻联播》栏目播发 50 余条，新华社《瞭望》新闻周刊刊发专访报道《严防水旱灾害“黑天鹅”》。各级水利部门利用报纸、电视等传统媒体和微信公众号、抖音视频号等新媒体，就贯彻落实党中央国务院水旱灾害防御部署、当地水旱灾害形势、预防经验措施、预警发布、水工程调度、先进人物事迹、突发洪涝事件处置、热点关注以及水旱灾害防御科普等，开展全方位、多时段、立体化宣传，营造良好水旱灾害防御氛围。

### 2.5.7 Technical support

Nationwide 72,800 group-times of 349,100 person-times in working groups and 20,300 team-times of 87,400 person-times in expert teams were sent to frontline areas to guide flood and drought disaster prevention. The emergency situations including embankment breaches at Hunan's Tuanzhou polder and Juanshui River, Liaoning's Wanghe River, Nei Mongol's Laoha River and Guangdong's Xifu River were addressed. The Changjiang Commission, the Information Center of the MWR and China Institute of Water Resources and Hydropower Research leveraged their expertise to conduct dynamic remote sensing monitoring of submerged areas, the Qiantuan internal dike, and safe areas at Tuanzhou polder, Hunan. Based on the dynamic development of the breach, they simulated the flooding process at the breach site and optimized the breach closure plan for Tuanzhou polder. They provided technical support for: reinforcing the second defense line at the Qiantuan internal dike, successfully preventing flood from moving westward, preemptive construction of the third defense line along the Yuelai River, completing breach closure within 48 hours, and enabling rapid drainage within the polder. The Songliao Commission, the Information Center of the MWR, and China Institute of Water Resources and Hydropower Research conducted remote sensing monitoring and risk analysis of the Ussuri River's overtopping threats, forecasted peak floodwater surface profiles along the Ussuri mainstream using the hydrological-hydrodynamic coupling approach, identified potential overtopping risks along the main levee and the backwater dykes of key tributaries, and implemented targeted measures including intensified inspections, levee reinforcement, secondary embankment construction, and seepage point sealing, effectively responding to two record-breaking floods in the Ussuri River.

### 2.5.8 Information dissemination

Based on meticulous planning and prioritization of key messages, the MWR proactively engaged with central mainstream media to extensively publicize its all-out efforts in the development of flood and drought prevention measures and its achievements through implementation of central government's orders. This move highlighted the sector's unwavering commitment to flood control and drought relief, and its resolve to shoulder responsibility with diligence, and fostering a favorable public discourse. At critical junctures, it held five press conferences, briefings, and media roundtables—covering preparedness for flood and drought disaster prevention, work updates during the critical flood period ranging from late July to early August, and responses to the Ussuri River flood—to release authoritative updates. It distributed nearly 300 press releases to central media outlets to promptly communicate critical flood/drought developments and updates of its defense efforts. The MWR organized over 60 interviews with experts from its relevant departments, affiliated agencies, basin authorities, and MWR working groups to provide professional insights addressing public concerns. It hosted the photo exhibition titled "Reform-Driven, Technology-Empowered: All-out Efforts to Safeguard Rivers—2024 Flood and Drought Disaster Prevention and Control". People's Daily, Xinhua News Agency, CCTV, Guangming Daily and Economic Daily published/broadcast over 4,100 reports about the flood and drought disaster prevention, including more than 50 reports on *CCTV News* and Xinhua *Outlook Weekly's* investigative feature titled *Guarding Against the "Black Swan"* in Flood and Drought Disasters. Water resources authorities at all levels leveraged traditional media (newspapers, TV) and digital platforms (WeChat, Douyin) for a multi-dimensional, multi-phase, and integrated publicity campaign on their implementation of the arrangements for flood and drought disaster prevention and mitigation made by the CPC Central Committee and the State Council, local flood and drought disaster situation, preventive measures, release of early warnings, water project scheduling, exemplary deeds of role models, emergency responses to sudden flooding incidents, hotspots in public attention, public education on flood and drought disaster prevention and mitigation. All this fostered a favorable social atmosphere for flood and drought disaster prevention and mitigation.

### 2.5.9 部门协作

水利部派员参加国家防总、应急管理部洪涝灾害防御会商 115 次，及时通报洪水预测预报情况，共同核定全国洪涝灾情，为抗洪抢险提供支撑，及时向有关部委提供洪水预警信息，共享灾情数据，会同中国气象局持续完善山洪灾害气象预警发布机制，为做好各行业洪涝灾害防御提供支撑。商财政部安排水利救灾资金 25.89 亿元（洪涝部分），支持地方做好安全度汛隐患排查整治、防洪工程设施水毁修复和水利工程震损修复等。加强与能源、交通运输、农业农村等相关行业部门的沟通协调，形成工作合力，全方位推进现代化水库运行管理矩阵建设，提高水库防洪减灾能力，确保水库运行安全。

### 2.5.9 Cross-sectoral collaboration

The MWR participated in 115 consultations on the control and prevention of flood disasters organized by SFDH and Ministry of Emergency Management. As a result, they provided timely updates on flood forecasts, jointly verified nationwide flood disaster assessments to support emergency response, shared flood early warnings and disaster data with relevant ministries, and collaborated with the China Meteorological Administration to improve meteorological warning mechanisms for flash floods. The MWR, in collaboration with the Ministry of Finance, allocated 2.589 billion RMB (for flood control) of water disaster relief to support local efforts in identifying and eliminating hazards during flood season, repairing flood-damaged engineering facilities, and restoring earthquake-damaged water conservancy projects. It strengthened communication and coordination with other line ministries of energy, transportation, agriculture, and rural affairs to work together to comprehensively advance the development of a modernized reservoir operation and management matrix, with the purpose to enhance reservoirs' capacity for flood prevention and disaster mitigation and ensure their safe operation.

## 2.6 防御成效

2024 年，水利部门有效实施防洪“四预”措施，科学调度运用水库、河道及堤防，及时指导开展险情抢护，成功应对了江河洪水，实现了全国水库无一垮坝，大江大河重要堤防无一决口。全国减淹城镇 2330 座次，减淹耕地面积 1124.37 千公顷，避免人员转移 1115.39 万人次，最大程度保障了人民群众生命财产安全及重要基础设施安全运行。

## 2.6 Effectiveness of Flood Disaster Prevention

In 2024, China's water resources authorities, tapping into the four preemptive pillars, effectively coordinated the utilization of reservoirs, river channels and embankments, and flood detention areas, provided timely guidance for emergency responses and rescue efforts, and hence coped with river floods successfully, with zero incidents of dam collapse nationwide and embankment breach for main rivers. Cumulatively, 2,330 cities and towns and 1,124,370 ha of cropland were protected from flooding, 11.1539 million people were spared from evacuation and relocation, thus ensuring the safety of people's lives and property as well as the smooth operation of critical infrastructure to the greatest extent possible.

表 2–8 2024 年各流域汛期大中型水库防洪调度效益情况
Table 2–8 Effectiveness of joint flood control scheduling for large and medium–sized reservoirs during the 2024 flood season by river basin

| 流域<br>River/lake basin | 减淹城镇 / 座次<br>Cities/towns cumulatively protected from floods | 减淹耕地 / 千公顷<br>Cropland protected from floods/1,000 ha | 避免人员转移 / 万人次<br>Population avoiding evacuation/10,000 person–times |
|---|---|---|---|
| 全国<br>Nationwide | 2330 | 1124.37 | 1115.39 |
| 长江流域<br>The Yangtze River | 401 | 550.55 | 359.62 |
| 黄河流域<br>The Yellow River | 41 | 62.83 | 58.17 |
| 淮河流域<br>The Huaihe River | 158 | 72.54 | 64.35 |
| 海河流域<br>The Haihe River | 36 | 25.15 | 36.66 |
| 珠江流域<br>The Pearl River | 1161 | 217.65 | 280.42 |
| 松辽流域<br>The Songhua–Liaohe River | 283 | 169.49 | 252.37 |
| 太湖流域<br>The Taihu Lakes | 250 | 26.16 | 63.80 |

案例 1

## 湖南岳阳市团洲垸堤防决口险情处置

湖南岳阳市华容县团洲垸，是国家蓄滞洪区钱粮湖垸的组成部分，面积 50.15 平方千米，耕地 3.82 千公顷，户籍人口 24956 人，常住人口 7000 余人。2024 年 6 月 11 日至 7 月 2 日，长江流域连续发生 6 次强降雨过程，雨区主要集中在长江干流以及洞庭湖和鄱阳湖流域，其中团洲乡站最大 5 日累计降雨量 227.3 毫米。6 月 28 日 14 时，长江中下游干流九江站涨至警戒水位 20.00 米，形成长江 1 号洪水；7 月 4 日 15 时，莲花塘站出现洪峰水位 33.96 米。7 月 5 日下午，团洲垸洞庭湖一线大堤发生决口。7 月 8 日 22 时 33 分，经过有关各方共同努力，完成决口封堵；7 月 9 日 18 时沿悦来河第三道防线建成；8 月 1 日 7 时，垸内排水工作顺利完成，险情处置工作基本结束。决口险情未造成人员伤亡。

6 月 28 日，水利部针对湖南省启动洪水防御 Ⅲ 级应急响应，全力应对长江 1 号洪水。7 月 5 日，决口险情发生后，习近平总书记作出重要指示，要求全力开展抢险救援工作，切实保护好人民群众生命财产安全。李强总理等领导作出批示，提出明确要求。国家防汛抗旱总指挥部副总指挥、水利部部长李国英连夜召开专题会商会，研究部署抢险工作；翌日上午针对团洲垸险情召开部党组扩大会议，随后立即率工作组深入堤防决口现场，提出“依法进入紧急防汛期、优化堤防决口封堵方案、提前制定垸内排水方案、固守钱团间堤和安全区围堤、尽快构筑第三道防线、妥善安置第三道防线内群众”六项措施，科学指导险情应对处置工作。7 月 6 日，湖南省防汛抗旱指挥部宣布钱粮湖垸区域进入紧急防汛期，为土地征用、物资和力量调用提供了法律依据。同时，湖南省迅速成立前方指挥部统一指挥领导现场抢险工作。湖南省水利、应急部门深入贯彻党中央指示精神，按照李国英部长的指导意见，从加强工程调度、优化堵口方案、精准应急处置和加快垸内排水等四个方面全力开展了应对工作。

一是紧急调度水利工程。决口险情发生后，长江委紧急调度三峡水库自 7 月 6 日起按日均 18000 立方米每秒控制下泄流量，持续拦洪 12 亿立方米，调度长江上中游水库群（不含三峡水库）配合拦洪 11 亿立方米，同时湖南省调度洞庭湖湖区排水入湖泵站全部关停，加快中下游干流和洞庭湖退水速率，降低城陵矶（七里山）站水位 0.30 米，提前 1 天退出警戒，为降低“第二道防线”钱团间堤的防守压力、顺利封堵决口提供了有利条件。

二是科学优化堵口方案。长江委和湖南省水利厅第一时间派遣水文应急监测队伍赶到现场，迅即开展决口处空天地水文要素自动监测分析；中国水利水电科学研究院采用人工智能（AI）视频测流技术监测分析决口宽度和决口处流速，动态开展团洲垸淹没范围、钱团间堤、安全区等遥感监测，滚动推演决口处洪水过程，提出堵口建议。前方指挥部依据专家组建议，综合考虑现场交通条件、装备物料调配难度等因素，为保证最高效率完成堵口，制定了“抢筑裹头、双向立堵、水上抛投、突击合龙、加高加固、防渗闭气”的方案。

三是精准开展应急处置。前方指挥部依据堵口方案，采取“机械化双向立堵 + 船舶水上抛投”战法，迅速调配抢险力量和物资，24 小时连续作业，最大程度加快合龙进度。前方指挥部严格落实湖南省委书记沈晓明“严防死守第二道防线”的要求，充分落实抢险物资储备，全面开展清基扫障，迅速铺设彩条布，将 14.35 千米钱团间堤分为 6 个区域，由 12 个市级领导分别负责，每区域配备巡堤处险和水利技术人员，实行三班倒，每班每小时巡查一次，并利用手机通讯信号监视间堤范围内夜间巡堤人数，强化巡堤查险监督工作，及时有效处置钱团间堤共发生的 47 处险情。水利部组织相关单位，基于数字孪生模型，推演了间堤决口影响范围，开展第三道防线方案比选；前方指挥部基于对比分析结果确定了在悦来河与钱团间堤间修筑第三道防线方案，并迅速调集挖机、推土机等机械设备 500 余台，分 7 个工作面同步作业，经 42 个小时奋战，共填筑土方 93 万立方米，铺设彩条布 35 万平方米，于 9 日 18 时基本建成总长 13.62 千米的第三道防线堤防。整个应急处置过程，共安全转移安置团洲垸内外群众 8960 人（团洲垸内 7680 人，第三道防线与钱团间堤间 1280 人）。

四是有序组织垸内排水。决口封堵后，7 月 9 日 1 时，前方指挥部讨论确定了排水方案：前期利用临时排水设施进行强排，垸内水位降至 32.5 米后，启动团南泵站排水；水位降至 30.00 米后，抢修团北、团东、团西泵站，及早参与排水。按照排水方案，前方指挥部迅速调集排涝设备，7 月 9 日 8 时开始持续抽排水作业，高峰期最大投入排涝力量 890 人、应急排涝装备 1058 台（套）、电排 2 处，满负荷排水流量达 476.7 立方米每秒。至 8 月 1 日 7 时，累计排水 2.07 亿立方米，垸内剩余水量 0.15 亿立方米，垸内水位降至 28.22 米，较垸外水位低 4.80 米，房屋基础和主干道路全部露出水面，排水作业结束。

党中央、国务院高度关注，水利部和有关部门与湖南省各级党委政府密切协作，充分发挥法律法规、指挥机制和高新技术支撑保障作用，高效处置团洲垸险情。险情发生后，水利部第一时间启动重大水旱灾害事件调度指挥机制，主要负责同志现场指导，前后方联动，确保第一时间全面掌握险情灾情等信息，第一时间作出研判部署，第一时间指导应急处置，为防御措施跑赢洪水演进速度提供有力支撑；湖南省防汛抗旱指挥部依法宣布钱粮湖垸区域进入紧急防汛期，为土地征用、物资和力量调用提供了法律依据。同时，水利部门强化数字赋能，统筹调度卫星遥感、无人机航拍、激光雷达、人工智能（AI）视频测流等先进装备与技术，实时精准掌握险情演进情况、堤防决口宽度、洪水演进动态、淹没影响范围、排水全过程等，为决口封堵提供了精准技术支撑。

## Case 1 Hazards handling of the embankment breach in Tuanzhou polder, Yueyang, Hunan

Tuanzhou polder, located in Huarong, Yueyang of Hunan Province, is part of Qianlianghu polder, a national flood detention area. This area covers 50.15 $km^2$, and has 3,820 ha of cropland, and a registered population of 24,956 (resident population over 7,000). From June 11 to July 2, 2024, six rounds of heavy rainfall occurred consecutively in the Yangtze River Basin. The rain belt was mainly in the Yangtze mainstream, Dongting Lake and Poyang Lake. At Tuanzhouxiang station, the maximum five-day cumulative rainfall reached 227.3 mm. At 14:00 on June 28, the water level at Jiujiang station on the middle-lower Yangtze rose to the warning level of 20.00 m, forming the Yangtze No. 1 flood in 2024. At 15:00 on July 4, the peak water level of 33.96 m occurred at Lianhuatang station. In the afternoon of July 5, a breach occurred in the primary embankment along Dongting Lake in Tuanzhou polder. At 22:33 on July 8, with the joint efforts of all parties involved, the breach was successfully blocked. On July 9 at 18:00, the third defense line along the Yuelai River was completed. By 7:00 on August 1, excess water was drained from the polder and no casualties were caused.

On June 28, the MWR launched a Level III emergency response against flood for Hunan in fighting the No. 1 flood in the Yangtze River. After the breach occurred on July 5, President Xi Jinping made key instructions and called for all-out efforts in emergency rescue and disaster relief to effectively safeguard the lives and properties. Premier Li Qiang showed equal attentions to the details of implementation with clear and specific requirements. That same night, Li Guoying, SFDH Vice Commander-in-Chief and Minister of Water Resources, convened a consultation meeting. The following morning, an expanded meeting of the MWR leadership was held in response to the hazards in Tuanzhou polder, after which Minister Li Guoying immediately led a working group to the breach site. He proposed six measures including: to declare emergency state in accordance with the law and regulations, to optimize the blocking plan, to formulate a drainage plan advance, to protect the Qiantuan internal dike and the dike of the safe zones, to swiftly construct the third defense line, and to properly relocate and resettle the residents within this area. On July 6, the Hunan Provincial FDH declared emergency state for the Qianlianghu polder, providing legal grounds for land requisition, supplies allocation, and personnel mobilization. At the same time, Hunan Province promptly established a front-line command center to deploy unified on-site emergency operations. The provincial departments of water resources and emergency management fully implemented the key instructions of the central government and under the guidance of Minister Li Guoying, made full efforts from four aspects as follows.

First, emergency scheduling of water projects was implemented. After the breach occurred, the Changjiang Commission swiftly reacted and controlled the outflow from the Three Gorges Reservoir at 18,000 $m^3/s$ in daily average, starting from July 6, thereby retaining 1.2 billion $m^3$ of floodwater; the reservoir group along the upper-middle Yangtze (excluding the Three Gorges Reservoir) retained an additional 1.1 billion $m^3$ of floodwater. Also, Hunan Province ordered the complete shutdown of all drainage pump stations discharging into the Dongting Lake to accelerate the retreat of water levels along the middle and lower reaches of the Dongting Lake mainstream. This operation successfully reduced the water level at the Chenglingji (Qilishan) Station by 0.30 m, allowing it to fall below the warning level one day ahead of schedule. These measures effectively eased the pressure on the second defense line–the Qiantuan internal dike, and created favorable conditions for blocking the breach.

Second, the breach blocking plan was optimized scientifically. The Changjiang Commission and the Hunan Provincial Water Resources Department immediately dispatched a emergency hydrological monitoring team to the site to carry out automatic monitoring and analysis of hydrological data from space, sky and ground at the breach site. Team members from China Institute of Water Resources and Hydropower Research used AI-based video flow measurement to monitor and analyze the breach width and flow velocity at the spot; conducted dynamic remote sensing monitoring of the inundation extent in Tuanzhou polder, Qiantuan internal dike and safe zones, while continuously simulating the flood process at the breach to provide blocking advice. Based on these professional input, the front-line command center comprehensively considered factors such as local traffic conditions and the difficulty of allocating equipment and materials. To block as quickly as possible, a strategy was formulated with the following key steps: emergency protection of embankment heads, simultaneous closure from both directions, material throw onto the water surface, swift closure completion, elevation and reinforcement of the structure, and seepage control with air closure.

Third, hazards handling efforts were carried out with precision. Based on the breach-blocking plan, the front-line command center adopted a combined approach of "mechanized bidirectional closure and material placement from vessels on the water", rapidly mobilizing emergency forces and supplies and operating around the clock to accelerate the pace of closure. The command center strictly implemented the directive of Hunan Provincial Leader Shen Xiaoming to "defend the second defense line without compromise", ensuring full preparedness of emergency supplies, thoroughly carrying out foundation clearing and obstacle removal, and rapidly placing striped waterproof tarpaulin at the site. The 14.35-km Qiantuan internal dike was divided into six sections, each overseen by a municipal-level leader. Each section was equipped with patrol and emergency response staff and water professionals, operating in three shifts with hourly inspection. Mobile communication signals were used to monitor the number of patrol personnel at night within the embankment area, enhancing oversight and emergency handling efforts. This approach enabled the timely and effective handling of 47 hazard points along the Qiantuan internal dike. MWR organized relevant institutions to simulate the potential impact range of the breach using a digital twin model and conducted a comparative analysis of the third defense line plans. Based on the results, the front-line command center decided to construct the third defense line between the Yuelai River and the Qiantuan internal dike. Over 500 units of machinery, including excavators and bulldozers, were rapidly deployed to work simultaneously across seven fronts. After 42 hours, 930,000 $m^3$ of earth was filled, and 350,000 $m^2$ of striped waterproof tarpaulin laid, resulting in a new 13.62-km embankment as the third defense line by 18:00 on July 9. Throughout the entire process, 8,960 people were safely evacuated and resettled in and nearby the affected zone(7,680 from within the

Tuanzhou polder and 1,280 from the area between the third defense line and the Qiantuan internal dike).

Fourth, the drainage within the polder was orderly conducted. After the breach was blocked, at 01:00 on July 9, the front-line command center discussed and finalized the drainage plan. First, mobile drainage facilities were placed and used for intensive pumping. Once the water level dropped to 32.5 m, the Tuannan pump station was turned on. When the water level further dropped to 30.00 m, emergency repairs were carried out on the Tuanbei, Tuanxi, and Tuandong pumping stations to bring them into operation as early as possible. Drainage equipment were deployed swiftly according to plan. Continuous pumping operations began at 08:00 on July 9. At its peak, 890 personnel and 1,058 units (sets) of emergency drainage equipment, along with two electric pumping stations, were deployed, reaching a maximum drainage capacity of 476.7 $m^3/s$. By 07:00 on August 1, 207 million $m^3$ of water had been drained, leaving only 15 million $m^3$ within the polder. The internal water level had dropped to 28.22 m, 4.80 m lower than the outside water level, exposing the foundations of houses and all main roads above the waterline. The drainage operation was concluded.

With the strong oversight from the CPC Central Committee and the State Council, MWR, along with relevant authorities, worked closely with Hunan local governments at all levels, fully leveraging the support of legal frameworks, command mechanisms and high technologies to efficiently deal with the hazards in Tuanzhou polder. When the breach occurred, MWR immediately activated the major flood and drought disaster dispatch and command mechanism. Senior officials provided on-site guidance, enabling coordinated efforts between front-line and backend units to ensure that information was promptly and comprehensively gathered, that swift assessments and deployments were made, and that responsive actions were taken without delay. These timely measures provided strong support to outpace the progression of the flood. The Hunan Provincial FDH declared emergency state lawfully, thereby providing legal grounds for land requisition, and the mobilization of materials and personnel. Meanwhile, the water departments exploited digital technologies by coordinating the use of advanced technologies and equipment such as satellite remote sensing, drone aerial photography, LiDAR, and AI-based video flow monitoring, enabling real-time and precise tracking of the hazard progression, breach width, flood dynamic evolution, inundation areas, and the entire drainage process, thereby providing accurate technical support for blocking the breach.

## 案例 2　北江超 100 年一遇洪水应对

受强降雨影响，2024 年 4 月 20 日 20 时 45 分，珠江流域北江下游干流控制站石角水文站（广东清远市）流量涨至 12000 立方米每秒，形成北江 2024 年第 2 号洪水。4 月 22 日 8 时，石角站洪峰流量涨至 18100 立方米每秒，还原洪峰流量 19400 立方米每秒，超过 100 年一遇（19000 立方米每秒），为特大洪水。水利部及地方有关水利部门锚定“四不”目标，坚持“防住为王”，科学研判雨水情，精准调度大中型水库，加强工程巡查防守，确保了粤港澳大湾区等重点地区和京广铁路等重要基础设施防洪安全。

4 月 21 日，国家防汛抗旱总指挥部副总指挥、水利部部长李国英主持召开专题会商会，贯彻落实李强总理关于防汛工作重要批示和张国清副总理批示要求，分析研判珠江流域雨情汛情形势，针对性安排部署暴雨洪水防御工作。水利部针对广东省启动洪水防御Ⅲ级应急响应，第一时间派出 9 个工作组、专家组赶赴防汛一线督促指导地方做好水库调度、山洪灾害和中小河流洪水防御、堤防巡查防守等工作，并逐日以发送“一省一单”的形式精准指导强降雨防范应对工作。

珠江委强化“四预”措施，滚动监测预报，4 月 19 日提前 2 天预测北江流域可能发生特大洪水，启动洪水防御Ⅱ级应急响应，按照“汛情滚动通报、短临降雨点对点预警”方式，及时发布洪水预警 8 次，发送预报预警信息 2 万余条，为主动防御赢得宝贵时间，并运用珠江流域水旱灾害防御“四预”平台，模拟预演洪水演进过程，优化调整水库调度方案，提出调度建议。

广东省水利厅启动洪水防御Ⅱ级应急响应，提前调度北江上中游水库群腾空库容 3.5 亿立方米，精细调度飞来峡水库拦洪 2.04 亿立方米，削减石角站洪峰流量 1300 立方米每秒；调度上游乐昌峡、南水、锦潭、长湖等水库拦洪 2.5 亿立方米，有效减轻飞来峡水库洪水压力，进一步削减石角站洪峰流量 700 立方米每秒；及时启用西南涌、芦苞涌分洪，最大分洪流量 800 立方米每秒，分洪总量 1.39 亿立方米，有效减轻下游堤防行洪压力。通过北江流域干支流水工程联合调度，将北江洪水量级从 100 年一遇降至 50 年一遇，成功将石角站洪峰流量控制在安全泄量以内，避免了潖江蓄滞洪区的启用。洪水防御期间，北江流域所有水库“三个责任人”全部上岗到位，前置北江大堤巡堤查险 10425 人次、省级水利专业抢险队约 2000 人，及时处置险情 34 处，保障了北江流域的防洪安全。

4 月 23 日 12 时石角站实测水位 10.99 米，退至警戒水位（11.00 米）以下，北江超 100 年一遇洪水应对工作取得胜利。

## Case 2 Response to the 100-year flood in the Beijiang River

Due to intense rainfall, at 20:45 on April 20, 2024, the flow at the Shijiao Hydrological Station—a control station on the lower Beijiang in the Pearl River Basin (Qingyuan, Guangdong)—rose to 12,000 $m^3/s$, forming the Beijiang No. 2 flood in 2024. By 08:00 on April 22, the peak flow at Shijiao Station had increased to 18,100 $m^3/s$, with the reconstructed peak flow reaching 19,400 $m^3/s$ and exceeding a 100-year flood (19,000 $m^3/s$), thus classified as extreme flood. MWR and relevant local water resources departments focused relentlessly on disaster prevention at all means and conducted scientific assessments on rainfall conditions, precisely scheduled the operation of large and medium-sized reservoirs, and enhanced inspections and protection of water infrastructures. These efforts ensured safety for the Greater Bay Area and critical infrastructures such as the Beijing–Guangzhou Railway.

On April 21, Li Guoying, SFDH Vice Commander-in-Chief and Minister of Water Resources, presided over a consultation to implement the instructions from Premier Li Qiang and Vice Premier Zhang Guoqing on flood control. At the consultation rainfall and flood conditions in the Pearl River Basin were analyzed and targeted arrangements were made. Accordingly, MWR initiated a Level III emergency response against flood and dispatched nine working and expert teams to the frontline to supervise and guide local efforts in reservoir operation, flash flood prevention, flood control for small and medium-sized rivers, and embankment inspection and reinforcement. In addition, MWR provided guidance daily through a province-specific approach to ensure precise and timely measures for addressing heavy rainfall.

The Pearl River Commission strengthened the four preemptive pillars, and conducted non-stop monitoring and forecasting. On April 19, the Commission predicted the possibility of an extreme flood in the Beijiang River Basin two days in advance and initiated a Level II emergency response against flood. Guided by the mechanism of "non-stop flood forecast notifications + point-to-point short-term rainfall warning", eight flood alerts were issued timely and more than 20,000 forecast and warning messages were sent out, gaining valuable time for proactive flood defense. The Commission also leveraged the platform of the four preemptive pillars to simulate the flood evolution process, optimize and adjust reservoir scheduling plans, and provide dispatch recommendations.

Guangdong Provincial Water Resources Department initiated a Level II emergency response against flood, preemptively scheduling reservoirs in the upper and middle Beijiang to free up 350 million $m^3$ of storage capacity. The department precisely scheduled the Feilaixia Reservoir to hold back 204 million $m^3$ of floodwater, reducing the peak flow at Shijiao Station by 1,300 $m^3/s$. Upstream reservoirs including Lechangxia, Nanshui, Jintan, and Changhu were used to intercept 250 million $m^3$ of floodwater, effectively relieving pressure on Feilaixia Reservoir and further reducing the peak flow at Shijiao Station by 700 $m^3/s$. Flood diversion through the Xinan and Lubao gates were conducted in time, with a maximum diversion flow of 800 $m^3/s$ and a total volume of 139 million $m^3$, effectively easing the flood pressure for the downstream embankments. Through coordinated operation of water projects on the Beijiang mainstream and tributaries, the flood was reduced from a 100-year to a 50-year one, successfully controlling the peak flow in the Shijiao Station within the safe discharge volume and avoiding activating Pajiang flood detention area. During the flood prevention period, all designated "three responsible officials" for the reservoirs in the Beijiang River Basin were on duty. A total of 10,425 patroller-times were deployed along the Beijiang levees, along with about 2,000 members from provincial-level professional emergency response teams. Thirty-four incidents were handled in a timely manner, ensuring the safety of the Beijiang River Basin.

At 12:00 on April 23, the measured water level at Shijiao Station dropped to 10.99 m, falling below the warning level of 11.00 m. The flood control efforts in response to the over 100-year flood in the Beijiang successfully concluded.

## 案例 3　乌苏里江 2 次超实测记录洪水应对

2024 年入汛以来，受持续强降雨影响，乌苏里江干流水位持续上涨。6 月 25 日 13 时，乌苏里江干流上游虎头站水位超保并继续上涨，29 日 5 时出现洪峰水位 57.99 米，列 1951 年有实测资料以来第 1 位。随着洪水向下游演进，乌苏里江干流全线超保。6 月 28 日，水利部针对黑龙江省启动洪水防御Ⅳ级应急响应，组织精准研判降雨落区和洪水风险区域，系统梳理堤防现状，分析洪水风险，提出防御措施；7 月 1 日，国家防汛抗旱总指挥部副总指挥、水利部部长李国英主持召开会商，部署乌苏里江洪水防御工作，要求科学研判洪水过程、加强堤防巡查防守、确保人员不伤亡、堤防不决口、洪水不进城，并派出 6 个工作组、专家组赴一线协助指导洪水防御与应急抢险工作，提前在乌苏里江干流增设 4 处临时水文监测断面，并加强国际间信息协调，通过气象卫星、天气雷达、雨量站三源融合降水产品估算乌苏里江境外侧实况降雨，实现了厘米级误差洪水水位预测精度，为洪水防御赢得了先机。黑龙江省 6 月 28 日成立乌苏里江前线抗洪指挥部，组织沿江相关市县约 3 万人次对重点部位堤坝加高培厚、铺设彩条布，24 小时不间断巡堤查险，及时发现处置渗水、管涌、脱坡等险情 103 处；7 月 3—4 日，黑龙江省领导到乌苏里江饶河段督导检查巡堤查险和风险隐患处置工作。7 月 13 日 22 时，海青站水位退至警戒水位以下，乌苏里江洪水防御首战告捷。洪水过后，水利部坚持“打一仗、进一步”，组织对乌苏里江洪水防御工作进行了全面总结，针对前期洪水防御工作中的薄弱环节，安排部署了加强巡堤查险、预置抢险力量设备和洪水风险分析等准备工作，为应对乌苏里江第 2 次超实测记录洪水奠定了坚实基础。

7 月底，随着新一轮强降雨来袭，乌苏里江水位再次上涨。8 月 9 日 5 时，虎头站出现洪峰水位 58.15 米，较上一次洪峰水位（57.99 米）高 0.16 米，水位再次超实测记录。面对乌苏里江严峻的防汛形势，7 月 31 日，水利部针对黑龙江省再次启动洪水防御Ⅳ级应急响应；8 月 9 日下午，国家防总副总指挥、水利部部长李国英主持专题会商，针对此次洪水过程乌苏里江干流超保幅度和超保时长均将创历史纪录、堤防出险概率将明显增加的实际情况，安排部署了巡堤查险、加筑子堤和风险分析等精准措施；水利部组织开展遥感监测分析、洪水预报和演进分析，提前一周准确预报乌苏里江将全线超保，全过程开展乌苏里江虎头至海青江段洪水漫堤风险分析，为堤防巡查防守、风险区群众转移、加筑加高子堤、应急抢险等提供了科学指导，并派出 7 个工作组、专家组赴一线协助指导洪水防御工作。黑龙江省 8 月 11 日再次成立乌苏里江前线抗洪指挥部，全线全域统筹开展抗洪工作；8 月 17 日，黑龙江省主要领导要求各地压实责任，全面落实抗洪各项措施，及时发现和处置各种风险隐患，全力迎战洪峰，确保洪水安全过境，确保人员、堤防安全。有关地方扎实落实批示精神，全力投入洪水防御硬仗，特别是乌苏里江沿江县市及北大荒集团加强堤防巡查防守，提前预置编织袋、彩条布、砂石料、挖掘机等抢险物资设备，累计投入巡堤查险和抢险救灾人员 3 万余人次，应急处置险情 175 处。退水期间，黑龙江省继续抓好乌苏里江堤防及子堤巡查防守，紧盯险工弱段、历史出险段、回水堤段等风险部位，及时处置各类险情。8 月 26 日 22 时，海青站水位降至 40.11 米（警戒水位 40.12 米），乌苏里江干流全线退至警戒水位以下，洪水防御再次取得胜利。

## Case 3 Response to two record-breaking floods in the Ussuri River

Since the 2024 flood season began, continuous heavy rainfall caused a sustained rise in the Ussuri mainstream. At 13:00 on June 25, the water level at Hutou Station on the upper reaches exceeded the guaranteed water level and continued to rise, reaching a peak of 57.99 m at 05:00 on June 29—the highest level since observation data was available in 1951. As floodwater progressed downstream, the entire mainstream swelled above the guaranteed water level. On June 28, MWR initiated a Level IV emergency response against flood for Heilongjiang Province. Focuses were laid on accurately assessing the rainfall zones and flood risk areas, conducting a systematic review of the embankments conditions, and analyzing flood risks before a flood disaster prevention plan was made. On July 1, Li Guoying, SFDH Vice Commander-in-Chief and Minister of Water Resources, chaired a consultation to deploy flood control efforts for the Ussuri River, calling for scientific analysis and forecasting on flood processes, strengthening embankment patrol, and ensuring no casualties, no embankment breaches, and no urban flooding. Six working groups and expert teams were dispatched to the front line. Four temporary hydrological monitoring sections were added along the Ussuri mainstream in advance, and cross-border information exchange was enhanced. By integrating meteorological satellite data, weather radar, and rainfall stations, real-time rainfall estimates were made for the river's transboundary section, achieving centimeter-level accuracy in water level forecasting and gaining a strategic advantage for flood defense. On June 28, Heilongjiang Province established a front-line command center. Approximately 30,000 person-times were mobilized in cities and counties along the river to reinforce and heighten key dikes, lay striped waterproof tarpaulin, and conduct around-the-clock patrol. As a result, 103 hazards including seepage, piping, and slope failures were detected and addressed in a timely manner. From July 3 to 4, provincial leaders inspected the Raohe section of the Ussuri River to supervise dike patrol and risk handling. At 22:00 on July 13, the water level at Haiqing Station dropped below the warning level, marking the first success in flood defense on the Ussuri River. After the flood, MWR carried out a comprehensive review to address insufficiency and weak links in dike patrol, pre-positioning of emergency equipment and teams, and flood risk analysis. These efforts proved important to coping with the second record-breaking flood in the Ussuri River.

At the end of July, with a new round of heavy rainfall, the Ussuri River swelled up again. At 5:00 on August 9, the Hutou Station recorded a peak flow of 58.15 m, 0.16 m higher than the last peak(57.99m) and once again exceeding the historically recorded water level. Facing the severe flood situation, MWR reactivated a Level IV emergency response against flood in Heilongjiang Province on July 31. In the afternoon of August 9, Li Guoying, SFDH Vice Commander-in-Chief and Minister of Water Resources, convened a consultation. Given that the flood would exceed the guaranteed level in both magnitude and duration—potentially setting historical records—and that the probability of embankment hazards would significantly increase, Minister Li ordered enhanced embankment patrol and inspection, construction of temporary dikes, and risk analysis. MWR organized remote sensing analysis, flood forecasting and progression analysis, accurately predicting one week in advance that the entire Ussuri mainstream would exceed the guaranteed level. Throughout the flood process, risk analysis on possible overflow from Hutou to Haiqing sections of the river was conducted, providing scientific guidance for embankment patrols and protection, residents evacuation, construction and reinforcement of temporary dikes, and emergency rescue efforts. Seven working groups and expert teams were dispatched to the front line. On August 11, Heilongjiang Province re-established the front-line command center to coordinate flood defense efforts across the entire river. On August 17, main leaders of Heilongjiang emphasized the need for ensuring accountability at all levels; comprehensively implementing multiple countermeasures for flood control; identifying and handling various hazards in a timely manner so as to control the flood peak and ensure safe passage of floodwater and the safety of both people and embankments. Local governments effectively executed the instructions. Particularly, cities and counties along the Ussuri River, together with the Beidahuang Group, reinforced embankment patrol and defense, pre-positioned emergency supplies and equipment including sandbags, tarpaulin, gravel, and excavators. Over 30,000 person-times of workers were deployed for embankment patrol and emergency response, with 175 hazards addressed during the actions. When floodwater was receding, Heilongjiang Province continued to strengthen patrol and defense of both the main and temporary embankments, with a focus on vulnerable sections, hazard-prone areas, and backwater-affected embankment segments, ensuring timely handling of all hazards. By 22:00 on August 26, the water level at Haiqing Station had dropped to 40.11 m (below the warning level of 40.12 m). Another effective response to the flood event was realized.

## 案例 4 广西融安县精准预警山洪灾害

2024 年 7 月 1 日凌晨 1—6 时，广西柳州市融安县板榄镇发生强降雨，其中泗安村里当屯 5 小时降雨量达 205.5 毫米，最大 1 小时降雨量达 95.5 毫米。6 时泗安村暴发山洪，里当屯和古陇屯 12 栋房屋倒塌、13 栋受损。在灾害发生前，危险区 37 户 112 名群众已提前转移避险，无一人伤亡。

6 月 30 日 16 时，广西壮族自治区水利厅、气象局联合发布山洪灾害气象预警：预计 6 月 30 日 20 时至 7 月 1 日 20 时融安县发生山洪灾害的可能性大（橙色预警），提醒各地做好监测、巡查、预警和转移避险等防范工作。7 月 1 日 4 时 2 分，广西山洪灾害监测预报预警平台显示融安县泗安村里当屯站 3—4 时降雨量达 43.5 毫米（1 小时准备转移阈值 35 毫米），触发准备转移预警，融安县水利局立即向乡镇和村级责任人发布准备转移预警信息。4 时 3 分，融安县气象台发布暴雨橙色预警，预计未来 3 小时融安县大将、雅瑶、板榄等北部乡镇还将有 20 ~ 40 毫米降雨。柳州市水利局立即电话“叫应”融安县水利局，提醒相关乡镇做好防范工作。泗安村山洪灾害防御责任人收到预警信息后，立即组织巡查责任人巡查河道水位和隐患点情况，第一时间上报村委会和板榄镇人民政府。镇政府综合研判后于 4 时 10 分开始组织群众向安全区域转移。4 时 26 分，广西山洪灾害监测预报预警平台通过智能语音“叫应”县级责任人，融安县水利局电话“叫应”乡镇和村级责任人，通知做好泗安村危险区群众转移避险。5 时 2 分，广西山洪灾害监测预报预警平台显示融安县泗安村里当屯站 4—5 时降雨量达到 49 毫米（1 小时立即转移阈值 48 毫米），触发立即转移预警，向镇村责任人发出立即转移预警信息。融安县水利局立即跟进督促泗安村人员转移避险，此时危险区群众已全部转移完毕。泗安村村委会安排人员轮流值守，严禁人员擅自返回。

此次山洪灾害“零伤亡”，得益于“叫应叫醒”措施有效、“谁组织、转移谁、何时转、转何处、不擅返”五个关键环节责任落实到位。广西壮族自治区水利厅建立逐级预警“叫应”机制，实现预警响应闭环。收到暴雨预警信息，市级水利局对县级水利局“叫应”提醒，县级水利局对乡镇“叫应”提醒，层层落实工作部署；自治区山洪灾害监测预报预警平台发布实时监测预警信息，责任人短信签收并对预警信息作出反馈，对于未及时反馈的，系统自动通过人工智能语音电话向相关责任人呼叫。各地落实转移避险五个关键环节责任和措施，坚决果断组织转移避险。

## Case 4 Precise early warning of a flash flood in Rongan County, Guangxi

Between 01:00 and 06:00 on July 1, 2024, intense rainfall hit Banlan Town in Rong'an, Liuzhou of Guangxi Zhuang Autonomous Region. In Lidangtun of Si'an village, a total of 205.5 mm of rainfall was recorded within five hours, with a peak hourly rainfall of 95.5 mm. At 6:00, a flash flood struck the village, causing the collapse of 12 buildings and damage to 13 buildings in Lidangtun and Gulongtun. Prior to the disaster, 112 residents from 37 households in high-risk areas had been evacuated in advance and no casualties were incurred.

At 16:00 on June 30, Guangxi Provincial Water Resources Department and Meteorological Department jointly issued a meteorological warning for flash flood disasters, predicting that from 20:00 on June 30 to 20:00 on July 1, the risk of flash floods in Rong'an County was high (orange alert). The warning urged local authorities to prepare for the flood by reinforcing monitoring, inspection, early warning, and evacuation efforts. At 04:02 on July 1, the Guangxi flash flood disaster monitoring and early warning platform showed that the rainfall at Lidangtun Station (Si'an, Rong'an reached 43.5 mm between 03:00 and 04:00 (35 mm for issuing one-hour evacuation-ready alert), hence triggering an evacuation-ready alert. Rong'an County water resources bureau immediately sent the warning message to township and village-level responsible persons. At 04:03, the Rong'an County Meteorological TV Channel issued an orange alert on rainstorm, forecasting an additional 20–40 mm of rainfall in northern towns including Dajiang, Yayao, and Banlan over the next three hours. Liuzhou municipal water resources bureau promptly issued "call and response" reminders to the Rong'an County to strengthen flood defense in the affected towns. Upon receiving the early warning, the person in charge in Si'an Village immediately deployed patrol personnel to check river water levels and potential risky spots, and reported to the village committee and the local government of Banlan Town. Following a comprehensive assessment, the township local government began organizing the evacuation of residents at 04:10. At 04:26, the Guangxi monitoring and early warning platform was used to issue "call and response" reminders to county-level responsible personnel via intelligent voice system. At the same time, the Rong'an County water resources bureau phoned township and village-level officials, instructing them to proceed with the evacuation of residents in high-risk areas. At 05:02, the platform showed that the rainfall at Lidangtun Station between 04:00 and 05:00 had reached 49 mm—surpassing the one-hour evacuation-now indicator of 48 mm—triggering an evacuation-now alert. This warning was transferred to township and village-level officials afterwords. Rong'an County water resources bureau then followed up to ensure that evacuation actions in Si'an Village were being fully implemented. By that time, all at-risk residents had already been safely relocated. The village committee arranged duty shifts to prevent any unauthorized return to danger zones.

The achievement of zero-casualty during this flash flood event was attributed to the effective implementation of the mechanisms on warning messages delivery and the thorough execution of responsibilities across five key elements: who organizes the evacuation, who is evacuated, when to evacuate, where to evacuate to, and prevention of unauthorized return. Guangxi provincial water resources department established a tiered "call and response" reminder system to ensure a closed-loop warning mechanism. Upon receiving the heavy rain warning, the city-level water department alerted the county-level department, which then notified the township authorities, ensuring the response was implemented at every level. The flash flood platform issued real-time alerts, persons in charge were required to confirm via text message and respond accordingly. If no timely response was received, the system automatically initiated AI voice calls to the designated responsible persons. Across the region, authorities implemented evacuation protocols decisively, with all five key elements fully in place to ensure swift and orderly relocation of at-risk people.

## 案例 5 新疆博湖县梯次发布山洪灾害预警

2024 年 8 月 7 日夜间至 8 日凌晨，新疆维吾尔自治区巴音郭楞蒙古自治州（简称巴州）博湖县东部山区出现强降雨过程，吉格代沟（流域面积 242 平方千米）、比来依力克沟（流域面积 116 平方千米）面平均降雨量 26.2 毫米，最大点降雨量 62.5 毫米，强降雨导致山洪暴发，吉格代沟洪峰流量 164 立方米每秒，比来依力克沟洪峰流量 65 立方米每秒。由于预警及时、“叫应”闭环、转移果断，位于流域沟口处的库代力克村（88 户 185 人）、闹音呼都克村（4 户 12 人）2 个危险区 92 户 197 名群众提前转移避险，无一人伤亡。

一是基于未来 24 小时预报降雨发布预报预警。8 月 7 日 18 时，自治区水利厅联合气象局发布未来 24 小时山洪灾害气象风险预警，其中巴州博湖县为橙色预警；18 时 35 分，博湖县水利局向县、乡、村三级防汛责任人“点对点”发送预警信息 93 条。18 时 50 分，网格长、包户干部通过电话、微信工作群等方式提醒村民做好随时转移准备。

二是基于未来 2 小时预报降雨发布短临预警。8 月 7 日 23 时 20 分，水利部针对博湖县发布山洪灾害临近黄色预报预警，8 日 0 时 20 分，升级为橙色预警。0 时 35 分，自治区水利厅、巴州水利局及时转发水利部发布的短临预报预警信息，要求博湖县水利局提醒基层政府和有关部门紧盯河道（沟道）险段，安排专人巡查，做好危险区群众转移准备。

三是基于实时监测降雨自动发布监测预警。8 月 7 日 23 时 5 分，自治区山洪灾害监测预报预警平台监测到库代力克村、闹音呼都克村 1 小时降雨量 17.0 毫米（预警阈值 16.0 毫米），自动触发准备转移预警；8 月 8 日 1 时 5 分，库代力克村、闹音呼都克村 3 小时降雨量 54.0 毫米（预警阈值 46.0 毫米），自动触发立即转移预警；并通过电话“叫应”责任人，提醒做好人员转移避险工作。

四是逐户喊醒果断组织人员转移避险。收到准备转移预警和短临预警后，巴州、博湖县水利局与博湖县政府迅即会商研判，责令相关责任人立即组织危险区群众转移避险。库代力克村、闹音呼都克村责任人收到转移指令后，立即通过无线预警广播、手摇报警器、铜锣等方式通知危险区内村民，网格长、包户干部同步逐户逐人开展“喊醒”叫应，确保“不落一人、不留盲区”。8 月 8 日 1 时 30 分，危险区 92 户 197 人全部撤离至安全地带，并安排村干部值班守护，严防人员擅自返回。2 时许，危险区内水位暴涨，多处房屋进水、道路冲毁、农田受淹。因预警及时、“叫应”闭环、转移人员管控得力，92 户 197 名群众成功避险，实现人员零伤亡。

## Case 5 Tiered early warning of a flash flood in Bohu County, Xinjiang

From the night of August 7 to the early morning of August 8, 2024, heavy rainfall occurred in the eastern mountainous area of Bohu County, Bayingolin Mongol Autonomous Prefecture, Xinjiang Uygur Autonomous Region. The Jigde and Bilayilik gullies (having drainage areas of 242 $km^2$ and 116 $km^2$ respectively) recorded an average rainfall of 26.2 mm, with a maximum point rainfall of 62.5 mm. The intense rainfall triggered flash floods, with peak flows reaching 164 $m^3/s$ in the Jigde Gully and 65 $m^3/s$ in the Bilayilik Gully. Relying on timely warnings, a closed-loop "call and response" mechanism, and decisive evacuations, all 197 residents from 92 households in two high-risk villages located at the gully outlets—Kudalik Village (185 people of 88 households) and Naoyinhudk Village (12 people of 4 households)—were safely evacuated ahead of the flood, with no casualties caused.

First, forecasts and early warnings were first issued based on 24-hour rainfall forecast. At 18:00 on August 7, the water resources and meteorological departments of Xinjiang jointly issued a 24-hour flash flood risk warning, with Bohu County on orange alert. At 18:35, Bohu county water resources bureau sent 93 text alerts to flood control officials at the county, township, and village levels. By 18:50, community section chiefs and household liaison officials had begun reminding villagers via phone calls and WeChat groups to prepare for evacuation anytime.

Second, warnings on short-term and imminent flash flood were issued based on 2-hour rainfall forecast. At 23:20 on August 7, MWR issued a yellow alert on imminent flash flood for Bohu County and elevated it to an orange alert at 00:20 on August 8. By 00:35, Xinjiang provincial water resources department and Bazhou county bureau promptly relayed the warning messages from the Ministry, instructing the Bohu County water resources authorities to remind local governments and departments to closely monitor high-risk sections of rivers and gullies, assign personnel for inspections, and prepare at-risk residents for evacuation.

Third, automatic warnings were also issued based on monitoring rainfall data. At 23:05 on August 7, the Xinjiang flash flood monitoring and early warning platform detected one-hour rainfall totals of 17.0 mm in Kudalik Village and Naoyinhudk Village, exceeding the warning threshold of 16.0 mm, thus automatically triggering an evacuation-ready alert. At 01:05 on August 8, 3-hour rainfall reached 54.0 mm in these two villages, surpassing the 46.0 mm threshold, automatically triggering an evacuation-now alert. The platform also activated phone alerts to persons in charge, reminding them on prompt evacuation and risk avoidance.

Fourth, door-to-door wake-up calls were made and decisive organization of evacuation and risk avoidance realized. Upon receiving the warnings and alert, Bayingolin Prefecture and Bohu County water resources departments immediately convened a consultation with the county government and then instructed responsible persons to promptly organize the evacuation of at-risk residents. Upon receiving the evacuation orders, the two village officials used wireless broadcasts, hand-cranked sirens, and gongs to alert villagers. Community section chiefs and household liaison officials went door-to-door to wake up and urge for evacuation, ensuring "no one left behind, no area overlooked". By 01:30, all the 197 at-risk people in 92 households had been safely evacuated. Village officials were assigned on nigh watch to prevent any authorized return. At around 02:00, the at-risk area was suddenly flooded with a surge in the water level, submerging homes, damaging roads, and inundating farmland. With timely warnings, the closed-loop "call and response" mechanism, and strong evacuation controls in place, all 197 residents were protected from flash floods with no casualties caused.

# 3 干旱灾害防御

DROUGHT DISASTER PREVENTION

## 3.1 旱情

2024 年，我国旱情总体偏轻，阶段性、区域性特征明显。西南地区冬春连旱持续时间长程度重，伏秋期间高温少雨极端性强；华北西北黄淮地区夏旱发展快范围广。全国旱情有 3 个主要特点。

（1）整体轻局地重。全国旱情总体偏轻，农作物受旱面积、因旱饮水困难人口和大牲畜数量均较近 10 年均值偏少。局部地区旱情较重，云南冬春连旱持续时间长达 6 个月，全省 16 个市（州）均出现不同程度旱情，高峰时有 38.9 万人因旱饮水困难，昆明、曲靖等地部分城镇供水处于紧平衡状态。夏旱时河南、河北分别有 1876 千公顷、883 千公顷耕地受旱，占全省耕地面积的 1/4 和 1/5。内蒙古旱情持续时间近 3 个月，覆盖全区大部，呼伦贝尔市一度有 567 千公顷耕地受旱，约占全市耕地面积的 1/4；阿拉善盟、锡林郭勒盟分别有 16000 千公顷、9333 千公顷草场受旱，超过当地草场面积的 4/5 和 1/2。

（2）阶段性、区域性特征明显。全年旱情分为冬春旱、夏旱和伏秋旱 3 个阶段，干旱发生的时段不连续。冬春旱和伏秋旱均集中在西南地区，涉及云南和重庆两省（直辖市）大部、四川东部和南部、广西和贵州局部等地，其中四川部分地区多季受旱。夏旱主要发生在河北、山西、江苏、安徽、山东、河南、陕西、甘肃 8 省冬麦区，集中在“三夏”时段内。

（3）长江流域涝旱急转。6—7 月，长江流域降雨量较常年同期偏多近 3 成，长江发生 3 次编号洪水，部分地区发生严重的洪涝灾害。8—12 月流域降雨量较常年同期偏少近 3 成，来水量较常年同期偏少 3 成，四川、重庆、贵州、湖北、湖南发生伏秋旱，中下游干流、汉江及洞庭湖、鄱阳湖水位偏枯，发生了明显的涝旱急转。

## 3.1 Droughts

In 2024, droughts were moderate in general nationwide, with distinct temporal and regional characteristics. Southwest China suffered from prolonged and severe droughts in winter and spring while experienced extreme high-heat and dryness during Mid-Summer and autumn period. In Northeast, Northwest China and the Huanghuai Plain, the summer droughts developed quickly and impacted a wide region. In general, drought in 2024 took on the following three characteristics.

(1) Droughts were moderate in general with some localities suffering gravely. Nationwide drought losses were moderate in general, with the affected cropland area, the population and the number of bigger-sized livestock having difficulties accessing drinking water were

less than their respective preceding decadal averages. Some regions suffered badly. Yunnan Province experienced a six-month prolonged drought from winter to spring that affected 16 cities to varying degrees; at its peak 389,000 people experienced difficulties accessing drinking water; water supply in cities and towns such as Kunming and Qujing barely met the demand. In Henan and Hebei provinces, summer droughts affected 1,876,000 ha and 883,000 ha of cropland, accounting for 25% and 20% of the province-wide cropland, respectively. In Nei Mongol, droughts lasted for nearly 3 months, affecting most parts of the region. At certain time, up to 567,000 ha of cropland in Hulunbuir was affected, accounting for 25% of the city-wide cropland; Alxa League and Xilingol League have 16 million ha and 9.333 million ha of pasture affected, which were more than 80% and 50% of then functional pasture, respectively.

(2) Droughts had prominent temporal and regional characteristics. Droughts in 2024 were divided into three distinct stages—winter-spring drought, summer drought, and Mid-Summer and autumn drought. Winter-spring droughts, Fú-Qiū droughts were concentrated in Southwest China, affecting most parts of Yunnan and Chongqing, the east and south of Sichuan, as well as parts of Guangxi and Guizhou; in particular, some areas in Sichuan was struck by droughts in more than one season. Summer droughts mainly occurred in eight provinces growing winter wheat, including Hebei, Shanxi, Jiangsu, Anhui, Shandong, Henan, Shaanxi and Gansu; and the drought occurred during the three stages of summer farming period (a critical period usually from late May to mid-June when farmers are busy with harvesting, planting, and field management).

(3) Abrupt flood-drought transition occurred in the Yangtze River Basin. From June to July, rainfall in the Yangtze basin was nearly 30% more than normal over the same period, causing three numbered floods in the Yangtze River and severe flood disasters in parts of the basin. During August to December, rainfall within the basin was nearly 30% less than normal while the river inflow 30% less than normal, resulting in late-summer and autumn droughts in Sichuan, Chongqing, Guizhou, Hubei and Hunan, and lower-than-normal water levels in the mid-lower Yangtze mainstream, Hanjiang River, Dongting Lake and Poyang Lake. The basin suffered an acute flood and drought alternation.

## 3.2 主要干旱过程

### 3.2.1 西南地区冬春连旱

1—4 月，云南大部、四川南部、贵州西部北部等地累计降雨量较常年同期偏少 2 ~ 5 成，其中云南中部北部、四川西南部偏少 6 ~ 9 成；云南元江南盘江、贵州赤水河等主要江河来水量较常年同期偏少 4 ~ 6 成，云南金沙江支流桑园河等 23 条河流断流，抚仙湖、泸沽湖和勐烈河、威远江等中小河流出现历史最低水位；3 月上旬，云南曲靖红河楚雄昆明、四川内江宜宾、广西南宁等地水库蓄水量较常年同期偏少 2 ~ 5 成，云南、四川分别有 300 多座、40 多座水库干涸。云南、四川、广西、贵州发生冬春连旱，部分地区人畜因旱饮水困难突出，春季农业生产用水紧张。4 月上中旬，4 省（自治区）一度有 379 千公顷耕地受旱，40.5 万人、16.7 万头大牲畜因旱饮水困难。4 月下旬西南地区陆续出现降雨过程，加上抗旱措施有力有效，广西、贵州旱情解除，云南、四川旱情至 6 月逐步解除。

## 3.2 Major Drought Processes

### 3.2.1 Winter-spring drought in Southwest China

From January to April, most parts of Yunnan, the south of Sichuan, the west and north of Guizhou received 20%-50% less cumulative precipitation than normal, among which rainfall in the central and north of Yunnan and the southwest of Sichuan was 60%-90% less than normal; the inflow to main rivers such as the Yuanjiang and Nanpan rivers in Yunnan, and Chishui River in Guizhou was 40%-60% less than normal. In total 23 rivers including the Sangyuan tributary of the Jinsha River in Yunnan dried up, while small and medium-sized rivers and lakes including the Fuxian Lake, Lugu Lake, Menglie River and Weiyuan River recorded the lowest water levels in history. In early March, water storage in reservoirs in Qujing, Honghe, Chuxiong and Kunming of Yunnan, Neijiang and Yibin of Sichuan, as well as Nanning of Guangxi was 20%-50% less than normal. Over 300 and 40 reservoirs dried up in Yunnan and Sichuan, respectively. Yunnan, Sichuan, Guangxi and Guizhou went through dry spells in winter and spring, causing severe difficulties accessing drinking water for both people and livestock in some of the regions and stressed supplies of spring irrigation water. In early and mid-April, at one time up to 379,000 ha of cropland in four provinces/autonomous regions were affected, and 405,000 people and 167,000 bigger-sized livestock had difficulties accessing drinking water. In late April, rainfall occurred in Southwest China and drought relief measures began to take effect, drought was subdued in Guangxi and Guizhou and gradually eased in Yunnan and Sichuan till June.

### 3.2.2 华北西北黄淮地区夏旱

5—6 月，华北大部、西北东部和黄淮等地累计面降雨量较常年同期偏少 2 ~ 4 成，河北南部、山西南部、江苏西北部、安徽北部、山东西部、河南北部东部、陕西中东部等地偏少 5 ~ 8 成；黄河中下游干流及支流渭河、北洛河、汾河来水量较常年同期偏少 1 ~ 6 成，淮河上游干流及支流沙颍河、山东沂河沭河来水量偏少 5 ~ 9 成；华北黄淮等地 35℃以上高温日数达 10~28 天；蓄水形势总体较好，但河北张家口、山西大同、陕西延安西安等地中小水库蓄水量较常年同期偏少 2 ~ 4 成。“三夏”时节，持续少雨导致土壤缺墒，叠加高温加剧土壤失墒，旱情迅速蔓延，6 月中旬旱情高峰期，河北、山西、江苏、安徽、山东、河南、陕西、甘肃 8 省一度有 5484 千公顷耕地受旱，主要影响玉米、大豆等作物适期播种和已出苗作物生长，部分农村人口用水也受到影响。6 月底旱区陆续出现降雨过程，加上各级水利部门全力抗旱，旱情逐步解除。

### 3.2.2 Summer drought in North and Northwest China, and Huanghuai Plain

From May to June, cumulative precipitation across most parts of North China, east of Northwest China, and the Huanghuai Plain was 20%- 40% less than normal. In certain areas—south of Hebei, south of Shanxi, northwest Jiangsu, north of Anhui, west of Shandong, north and east of Henan, and central to east of Shaanxi—it was 50%-80% less. Water inflow to the mid-lower Yellow River mainstream and its Weihe, Beiluo, and Fenhe tributaries all experienced reductions of 10%-60%. Similarly, the upper Huaihe mainstream and its tributaries—Shaying River, and Yihe River and Shuhe River in Shandong—saw reductions of 50%-90%. During the same period, North China and the Huanghuai Plain experienced 10 to 28 days when temperatures exceeded 35°C. While overall water storage remained adequate, small and medium-sized reservoirs in areas such as Zhangjiakou in Hebei, Datong in Shanxi, Yan'an and Xi'an in Shaanxi held 20%-40% less water than normal. During the critical summer period from late May to mid-June, the persistent dryness led to soil moisture deficits, which were further aggravated by high temperatures. Drought conditions became worse and worse. At the peak in mid-June, drought affected up to 5,484,000 ha of cropland across eight provinces of Hebei, Shanxi, Jiangsu, Anhui, Shandong, Henan, Shaanxi, and Gansu, disrupting the sowing of maze and soy beans on schedule, hindering the growth after sprout, and impacting domestic water supplies in some rural areas. By late June, rainfall gradually returned to the drought-affected regions and drought relief efforts at all levels were intensified, the drought was gradually subdued.

### 3.2.3 西南地区伏秋旱

8—9 月，西南东部累计面降雨量较常年同期偏少 2 ~ 4 成，其中重庆、四川中东部偏少 5 成以上；四川雅砻江渠江、贵州赤水河乌江来水量较常年同期偏少 5 ~ 8 成，重庆嘉陵江、四川岷江沱江偏少 2 ~ 5 成；重庆 35℃以上高温日数达 44 天，较常年同期偏多 29 天，为 1961 年以来最多，四川有 9 个气象站出现日最高气温历史同期极值。重庆、四川、贵州等地出现旱情，其中重庆、四川两地山丘区人饮困难情况突出，9 月下旬 3 省（直辖市）一度有 100 千公顷耕地受旱，6.5 万人、5.5 万头大牲畜因旱饮水困难。9 月底旱区出现多次降雨过程，水稻等作物陆续收获，旱情逐步解除。

此外，内蒙古 6—8 月降雨、来水偏少，大部地区出现旱情，对农牧业造成一定影响，7 月中旬高峰时全区有 1051 千公顷耕地、39333 千公顷草场受旱，16.8 万头大牲畜因旱饮水困难。9 月旱区出现降雨，加上秋粮作物成熟和牧区牲畜出栏，旱情逐步解除。

长江流域 8 月以后降雨、来水偏少，中下游干流、支流汉江及洞庭湖、鄱阳湖水位快速下降，持续低于常年同期，汉口站、九江站水位一度低于发生严重干旱的 2022 年同期，低水位增加了沿江沿湖地区取水难度，对河道航运也造成一定影响；湖南、湖北 2 省出现短历时旱情，9 月下旬一度有 154 千公顷耕地受旱，5.6 万人、1 万头大牲畜因旱饮水困难，10 月中旬旱区出现降雨，加之晚稻成熟收获，旱情逐步解除。

### 3.2.3 Mid-Summer and autumn drought in Southwest China

From August to September, cumulative precipitation in the eastern part of Southwest China was 20%-40% less than normal over the same period; in particular, it was over 50% less than normal in Chongqing and the central and east of Sichuan. The inflow to the Qujiang tributary of Yalong River in Sichuan and to the Wujiang tributary of Chishui River in Guizhou was 50%-80% less than normal; inflow to the Jialing River in Chongqing and the Tuojiang tributary of Minjiang in Sichuan was 20%-50% less than normal. Chongqing experienced 44 days with temperatures exceeding 35°C, 29 days more than normal over the same period and the most since 1961. Nine meteorological stations in Sichuan recorded the highest daily temperatures for the same period in history. Drought conditions emerged in Chongqing, Sichuan, and Guizhou, with prominent drinking water difficulties in hilly areas of Chongqing and Sichuan. In late September, drought affected 100,000 ha of cropland across the three provinces/municipality, and 65,000 people and 55,000 bigger-sized livestock experienced drinking water disruptions due to drought. By the end of September, multiple rounds of rainfall occurred in drought-affected areas, rice and other crops produced yields, and the drought was gradually subdued.

In addition, from June to August, precipitation and river inflow in Nei Mongol were below normal, leading to drought emerging in most areas and impacting agriculture and animal husbandry. At the peak in mid-July, 1,051,000 ha of cropland and 39,333,000 ha of pasture were affected, and 168,000 bigger-sized livestock experienced drinking water difficulties. By September, rainfall occurred in the drought-affected areas, and autumn grains and livestock reached maturity, the drought was subdued as a result.

Since August, precipitation and river inflow in the Yangtze River Basin were below normal. The water levels of mid-lower Yangtze mainstream, the Hanjiang, Dongting Lake and Poyang Lake dropped rapidly and remained persistently below normal. In particular, the water levels at Hankou Station and Jiujiang Station were once lower than during the severe drought of 2022. Water intake along the river and lakes were difficult and river navigation was impacted. Short-duration droughts occurred in Hunan and Hubei Provinces. In late September, drought affected 154,000 ha of cropland, and 56,000 people and 10,000 bigger-sized livestock experienced drinking water disruptions. By mid-October, rainfall occurred in the drought-affected areas and later rice was harvested, so the drought was gradually eliminated.

山东枣庄市周村水库受旱情影响水位骤降（6 月 23 日）
Zhoucun Reservoir in Zaozhuang City, Shandong Province, suffered a sudden drop in water level due to drought (June 23)

## 3.3　干旱灾情

2024 年全国农作物因旱受灾面积 1206.24 千公顷，较近 10 年平均值偏少 84.09%；农作物因旱绝收面积 135.42 千公顷，较近 10 年平均值偏少 83.04%；因旱粮食损失 17.36 亿千克，较近 10 年平均值偏少 85.33%；有 174.55 万人因旱饮水困难，较近 10 年平均值偏少 73.55%；有 136.22 万头大牲畜因旱饮水困难，较近 10 年平均值偏少 72.72%；直接经济损失 83.59 亿元，较近 10 年平均值偏少 81.51%。

## 3.3　Disasters and Losses

In 2024, a total of 1,206,240 ha of cropland were affected by drought nationwide, 84.09% less than the preceding decadal average; 135,420 ha suffered crop failure, 83.04% less than the preceding decadal average; the grain yield loss attributed to drought was 1.736 billion kg, down by 85.33% from the preceding decadal average; a total of 1.7455 million people experienced difficulties accessing drinking water due to drought, 73.55% less than the preceding decadal average; and 1.3622 million bigger-sized livestock experienced difficulties accessing drinking water due to drought, down by 72.72% from the preceding decadal average. The direct economic loss totaled 8.359 billion RMB, down by 81.51% from the preceding decadal average.

表 3–1 2024 年全国农作物因旱受灾面积、绝收面积情况（单位：千公顷）
Table 3–1 Cropland area affected and failed by drought in 2024 (in 1,000 ha)

| 地区 Region | 农作物因旱受灾面积 Cropland area affected by drought | 农作物旱绝收面积 Cropland area failed by drought | 地区 Region | 农作物因旱受灾面积 Cropland area affected by drought | 农作物旱绝收面积 Cropland area failed by drought |
|---|---|---|---|---|---|
| 全国 Nationwide | 1206.24 | 135.42 | 河南 Henan | 5.60 | |
| 北京 Beijing | | | 湖北 Hubei | 122.82 | 5.10 |
| 天津 Tianjin | | | 湖南 Hunan | 23.09 | 3.13 |
| 河北 Hebei | 33.06 | 5.31 | 广东 Guangdong | | |
| 山西 Shanxi | 263.36 | 64.38 | 广西 Guangxi | | |
| 内蒙古 Nei Mongol | 132.47 | 5.61 | 海南 Hainan | 0.01 | |
| 辽宁 Liaoning | | | 重庆 Chongqing | 98.25 | 14.30 |
| 吉林 Jilin | | | 四川 Sichuan | 91.48 | 7.08 |
| 黑龙江 Heilongjiang | | | 贵州 Guizhou | 77.65 | 6.15 |
| 上海 Shanghai | | | 云南 Yunnan | 109.71 | 4.00 |
| 江苏 Jiangsu | | | 西藏 Xizang | 0.01 | |
| 浙江 Zhejiang | | | 陕西 Shaanxi | 183.46 | 19.38 |
| 安徽 Anhui | | | 甘肃 Gansu | | |
| 福建 Fujian | | | 青海 Qinghai | | |
| 江西 Jiangxi | | | 宁夏 Ningxia | 3.38 | |
| 山东 Shandong | 58.35 | 0.97 | 新疆 Xinjiang | 3.54 | 0.01 |

注 数据来源于应急管理部，空白表示无灾情。
Note The data come from the Ministry of Emergency Management, and spaces in blank denote no losses or damages.

表 3-2 2024 年全国因旱饮水困难情况

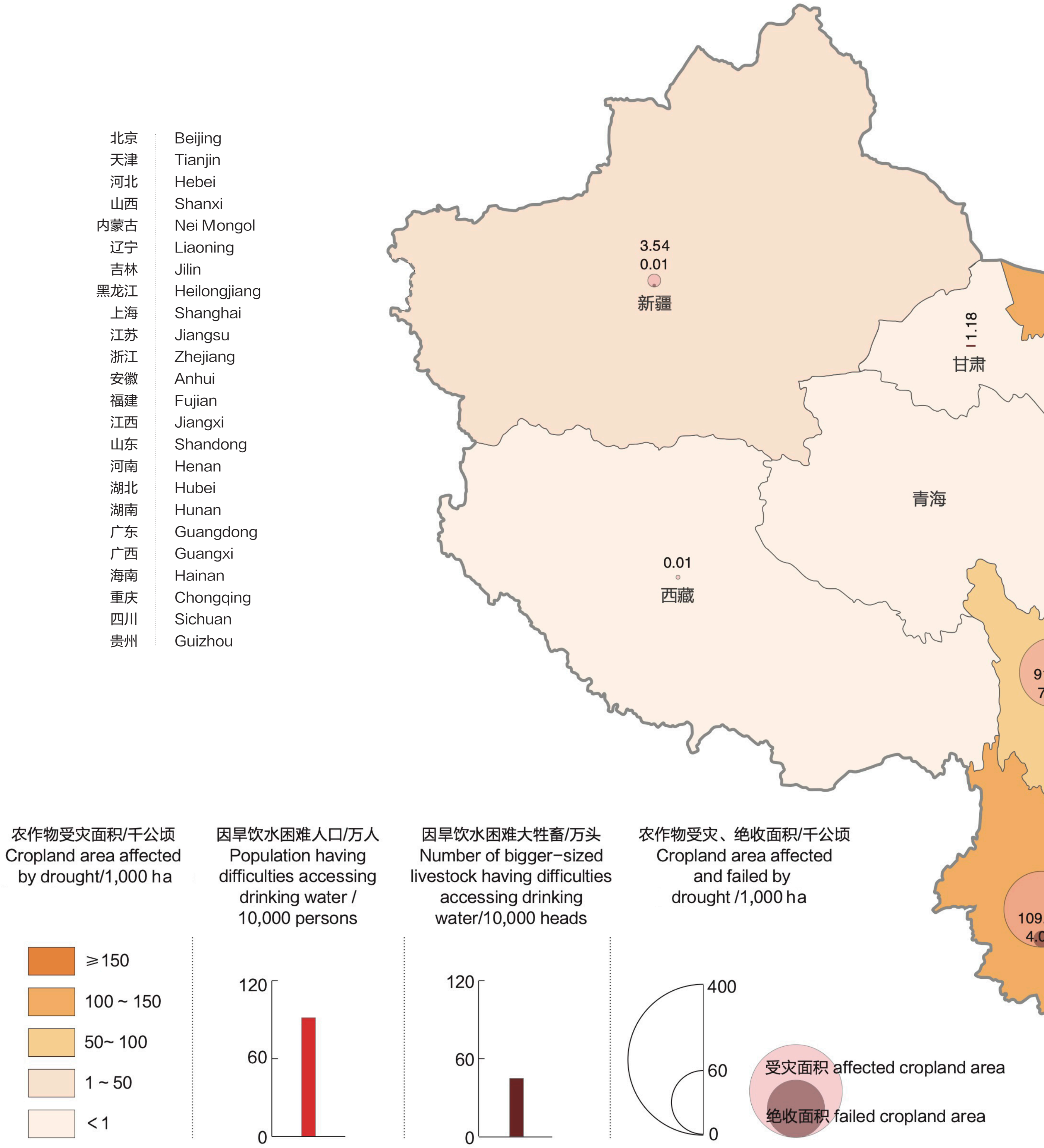
Table 3-2 Difficulties accessing drinking water attributed to drought nationwide in 2024

| 地区 Region | 因旱饮水困难人口 / 万人 Population having difficulties accessing drinking water /10,000 persons | 因旱饮水困难大牲畜 / 万头 Number of bigger-sized livestock having difficulties accessing drinking water/10,000 heads | 地区 Region | 因旱饮水困难人口 / 万人 Population having difficulties accessing drinking water /10,000 persons | 因旱饮水困难大牲畜 / 万头 Number of bigger-sized livestock having difficulties accessing drinking water/10,000 heads |
|---|---|---|---|---|---|
| 全国 Nationwide | 174.55 | 136.22 | 河南 Henan | | |
| 北京 Beijing | | | 湖北 Hubei | 12.81 | 6.37 |
| 天津 Tianjin | | | 湖南 Hunan | 1.32 | 0.25 |
| 河北 Hebei | 0.01 | | 广东 Guangdong | | |
| 山西 Shanxi | | 0.41 | 广西 Guangxi | 4.16 | |
| 内蒙古 Nei Mongol | 0.14 | 47.91 | 海南 Hainan | 2.73 | 0.30 |
| 辽宁 Liaoning | | | 重庆 Chongqing | 21.11 | 9.56 |
| 吉林 Jilin | | | 四川 Sichuan | 10.83 | 8.21 |
| 黑龙江 Heilongjiang | | | 贵州 Guizhou | 2.62 | 1.03 |
| 上海 Shanghai | | | 云南 Yunnan | 118.02 | 56.45 |
| 江苏 Jiangsu | | | 西藏 Xizang | | |
| 浙江 Zhejiang | 0.02 | | 陕西 Shaanxi | | 4.55 |
| 安徽 Anhui | | | 甘肃 Gansu | | 1.18 |
| 福建 Fujian | | | 青海 Qinghai | | |
| 江西 Jiangxi | | | 宁夏 Ningxia | | |
| 山东 Shandong | 0.78 | | 新疆 Xinjiang | | |

注 空白表示无灾情。
Note The spaces in blank denote no losses or damages.

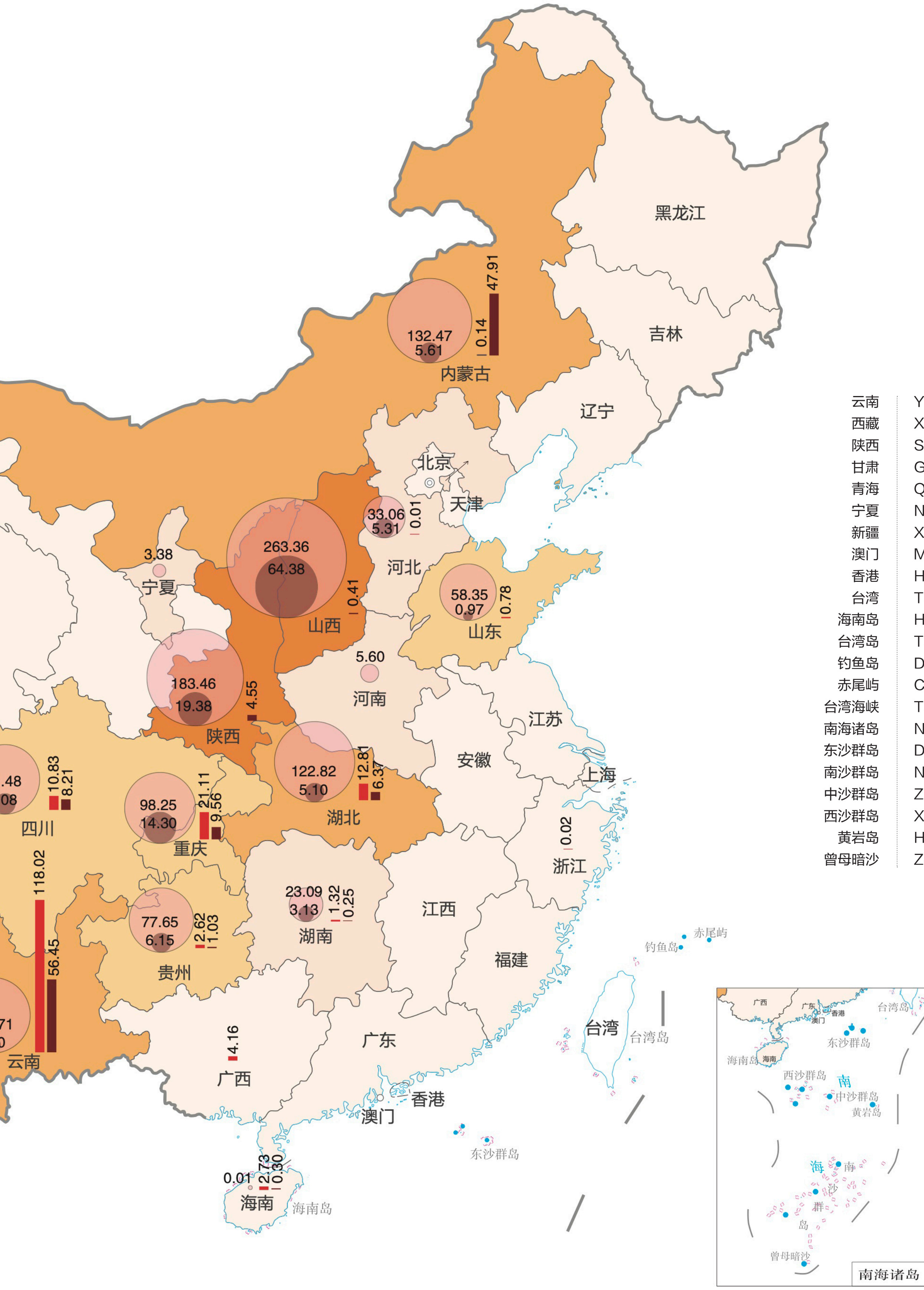
图 3-1 2024 年全国干旱灾害分布

Figure 3-1 Overview of drought disasters nationwide in 2024

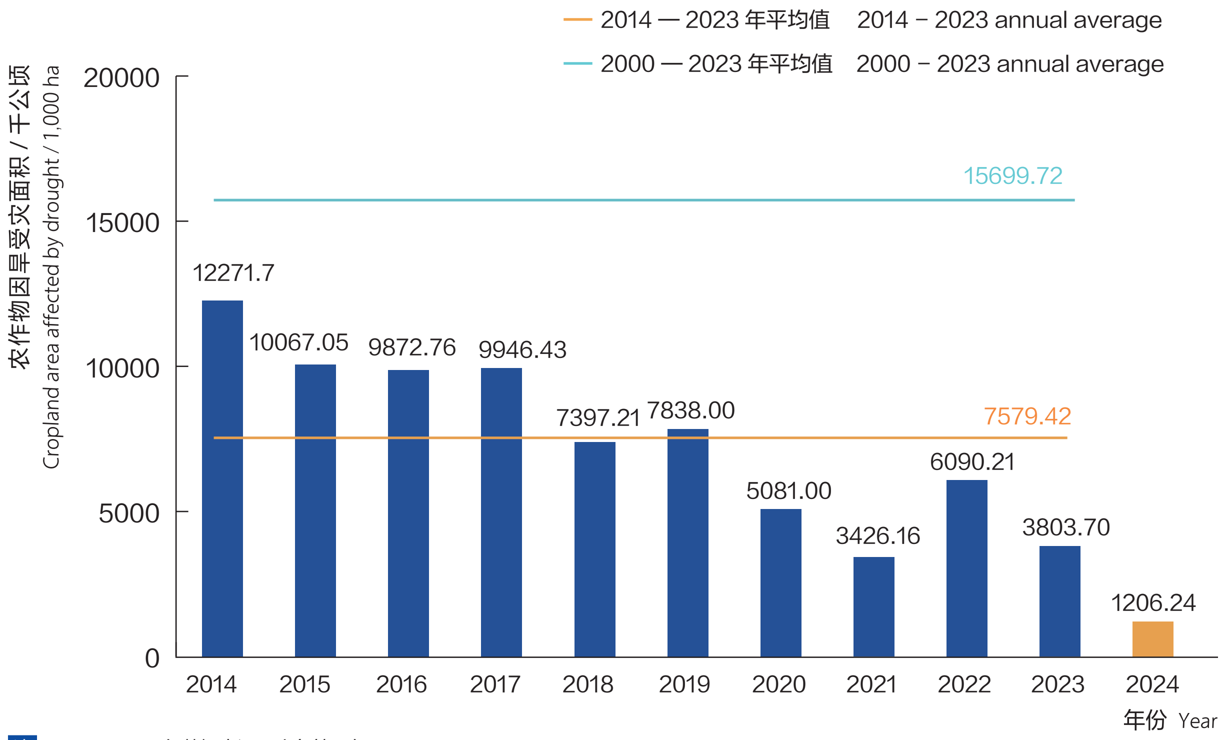



**注** 农作物受灾面积、绝收面积数据来源于应急管理部，香港特别行政区、澳门特别行政区、台湾省资料暂缺。

**Note** The data of cropland area affected by drought and cropland area failed by drought come from the Ministry of Emergency Management, data of Hong Kong SAR, Macao SAR and Taiwan are currently unavailable.

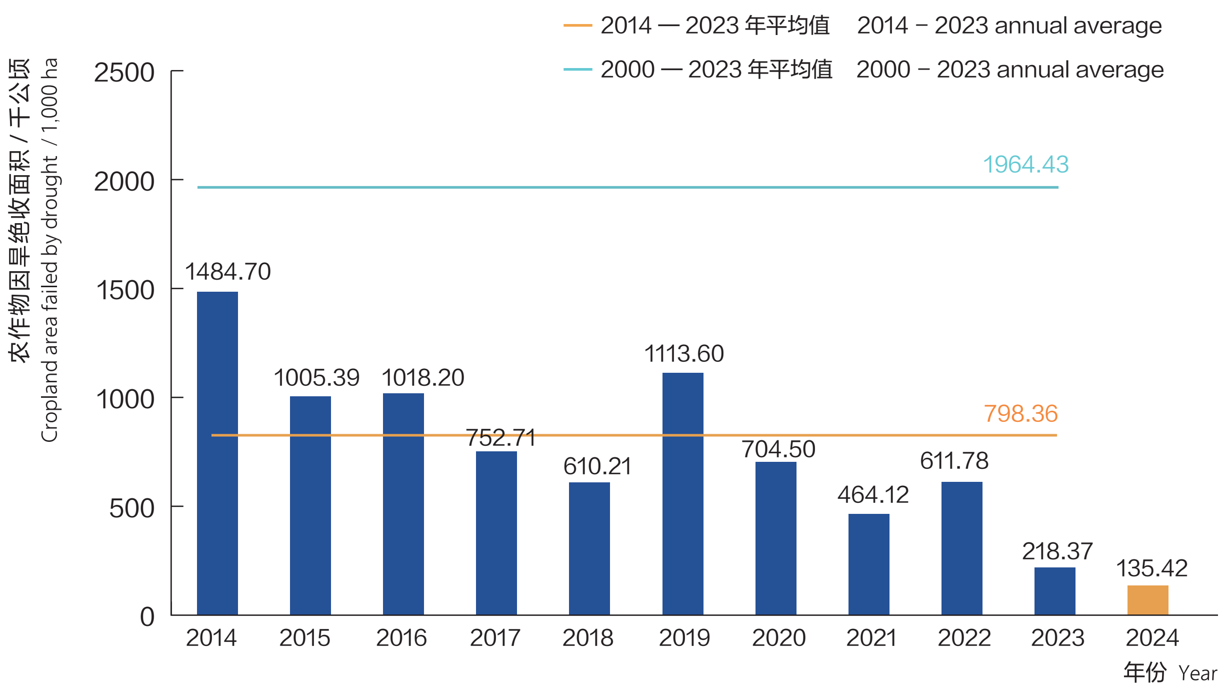



| | |
|---|---|
| 云南 | Yunnan |
| 西藏 | Xizang |
| 陕西 | Shaanxi |
| 甘肃 | Gansu |
| 青海 | Qinghai |
| 宁夏 | Ningxia |
| 新疆 | Xinjiang |
| 澳门 | Macao |
| 香港 | Hong Kong |
| 台湾 | Taiwan |
| 海南岛 | Hainan Dao |
| 台湾岛 | Taiwan Dao |
| 钓鱼岛 | Diaoyu Dao |
| 赤尾屿 | Chiwei Yu |
| 台湾海峡 | Taiwan Haixia |
| 南海诸岛 | Nanhai Zhudao |
| 东沙群岛 | Dongsha Qundao |
| 南沙群岛 | Nansha Qundao |
| 中沙群岛 | Zhongsha Qundao |
| 西沙群岛 | Xisha Qundao |
| 黄岩岛 | Huangyan Dao |
| 曾母暗沙 | Zengmu Ansha |




注 2019—2024 年数据来源于应急管理部。
Note The data during 2019–2024 come from the Ministry of Emergency Management.

图 3–2　2014—2024 年全国农作物因旱受灾面积
Figure 3–2　Cropland area affected by drought in China, 2014–2024




注 2019—2024 年数据来源于应急管理部。
Note The data during 2019–2024 come from the Ministry of Emergency Management.

图 3–3　2014—2024 年全国农作物因旱绝收面积
Figure 3–3　Cropland area failed by drought in China, 2014–2024

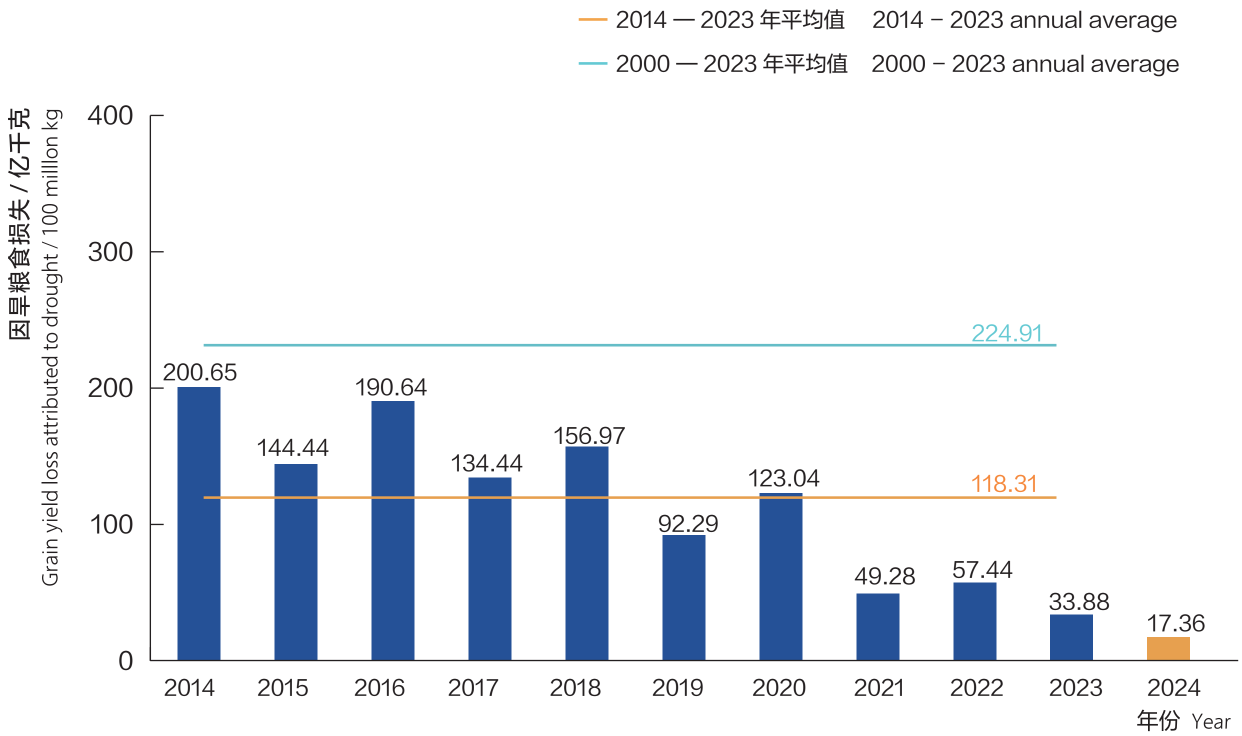



图 3-4　2014—2024 年全国因旱粮食损失

Figure 3-4　Grain yield loss attributed to drought in China, 2014-2024

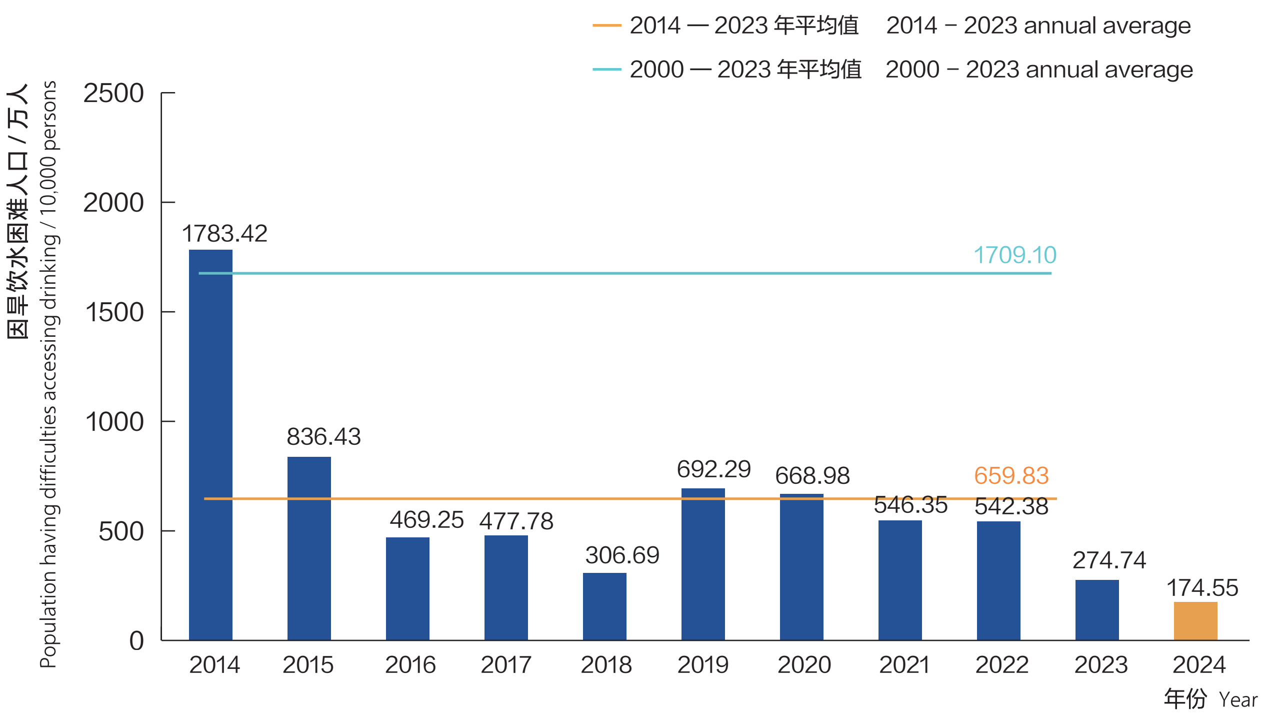



图 3-5　2014—2024 年全国因旱饮水困难人口

Figure 3-5　Population having difficulties accessing drinking water by drought in China, 2014-2024

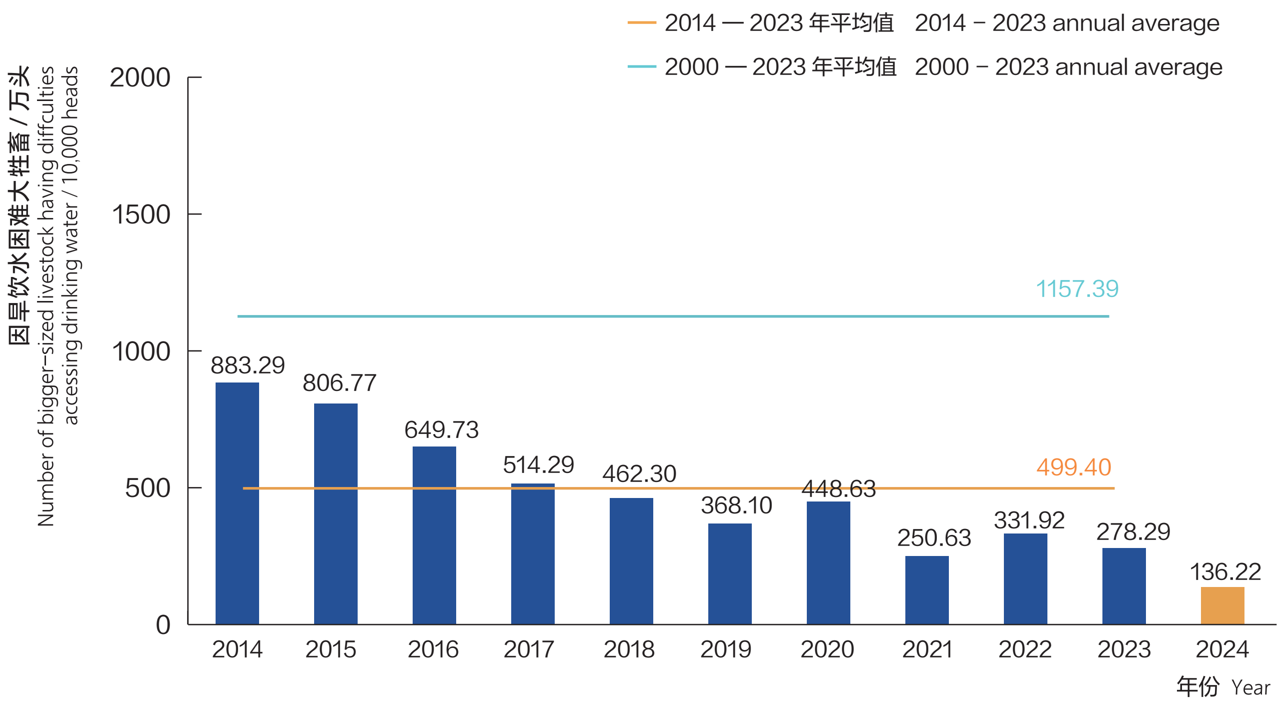



图 3-6 2014—2024 年全国因旱饮水困难大牲畜

Figure 3-6 Number of bigger-sized livestock having difficulties accessing drinking water by drought in China, 2014-2024

## 3.4 防御工作

水利部锚定“确保城乡居民饮水安全，确保规模化养殖和大牲畜用水安全，全力保障灌区农作物时令灌溉用水”目标，精准范围、精准对象、精准时段、精准措施，指导支持受旱地区做好各项抗旱保供水保灌溉工作。

## 3.4 Prevention and Control

MWR set the goals of ensuring urban and rural household drinking water safety, ensuring water use for large-scale breeding and bigger-sized livestock, and securing seasonal irrigation for irrigation districts. Guidance and support was provided to drought-stricken areas with a precise judgement on scope, targets, timing, and measures to fight against drought and ensure water supply and irrigation.

### 3.4.1 工作部署

国家防总副总指挥、水利部部长李国英在全国水利工作会、水旱灾害防御工作会等会议上对抗旱工作提出明确要求，春旱期间赴云南省调研抗旱保供水工作，夏旱期间主持专题会商会有针对性安排部署抗旱保灌溉保供水工作。水利部针对河北、河南启动干旱防御Ⅲ级应急响应，针对山西、江苏、安徽、山东、四川、云南、陕西、甘肃启动干旱防御Ⅳ级应急响应，多次发出通知对春旱应对、秋冬季抗旱蓄水和保障粤港澳大湾区供水安全等工作进行部署，先后派出 9 个工作组赴山西、安徽、江西、河南、湖北、湖南、云南等地旱区一线调研旱情，指导落实水工程抗旱调度、抗旱应急水源工程建设等措施。黄委、长江委、淮委、海委分别启动干旱防御Ⅲ级、Ⅳ级应急响应，指导支持受旱地区做好抗旱工作。河南、重庆、河北、山西、安徽、山东、四川、云南、陕西、甘肃等地及时启动干旱防御Ⅲ级、Ⅳ级应急响应，旱区各级党委、政府对抗旱工作作出安排部署，压实责任，落实各项供水保障措施。

### 3.4.1 Arrangements

Li Guoying, SFDH Vice Commander-in-Chief and Minister of Water Resources, put forward explicit requirements at national working meetings. During the spring drought, Minister Li conducted an inspection in Yunnan on drought relief and water supply security; during the summer drought, he presided over special meetings to make targeted arrangements. MWR launched Level III emergency responses against drought for Hebei and Henan, and Level IV emergency responses for Shanxi, Jiangsu, Anhui, Shandong, Sichuan, Yunnan, Shaanxi, and Gansu. Multiple notices were issued to deploy spring drought relief, autumn and winter drought resistance and water storage, and ensure water supply security in the Greater Bay Area. Nine working groups were sent to drought-stricken regions including Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan, and Yunnan to conduct on-site inspections and guide the implementation of measures such as project scheduling for drought relief and emergency water source project construction. The Yellow River Commission, Changjiang Commission, Huaihe River Commission, and Haihe River Commission launched Level III and Level IV emergency responses respectively, to guide and support drought relief efforts in the affected areas. Level III and Level IV emergency responses were promptly launched in Henan, Chongqing, Hebei, Shanxi, Anhui, Shandong, Sichuan, Yunnan, Shaanxi, and Gansu. Governments at all levels in drought-stricken areas made arrangements for drought relief, ensured responsibilities were fulfilled, and effectively implemented various water supply measures.

### 3.4.2 “四预”措施

水利部密切监测全国雨情、水情、墒情、旱情，应用全国旱情监测预警综合平台开展动态监测和分析评估，支撑抗旱会商决策，指导各流域、各地区强化江河湖库旱警水位（流量）管理，调整补充相关站点和预警阈值，全国站点增加至 1565 个，已基本实现在线监测，部分地区将其作为发布干旱预警、启动应急响应和开展水工程抗旱调度等的主要参考指标。加强旱情中长期预报，累计发布干旱预警 108 次。旱情快速发展和严重期间启动抗旱应急值班和旱情日报制度，动态掌握旱情态势和抗旱工作情况。旱区各地提前预演干旱影响，立足最不利情况滚动开展供需水形势分析，制定供水保障应急预案。夏旱期间黄委、淮委、海委和河北、安徽、山东、河南等省水利部门，逐一梳理流域区域骨干水库供水能力，逐一梳理引调水工程供水能力，逐一梳理相关区域用水需求，紧急制定水工程抗旱应急调度方案。水利部会同广东、广西 2 省（自治区）和电力调度部门等制定《2024—2025 年珠江枯水期压咸补淡应急水量调度方案》，筑牢当地、近地、远地梯次供水保障“三道防线”，保障粤港澳大湾区供水安全。

### 3.4.3 工程调度

各级水利部门科学精准实施水工程抗旱调度和应急水量调度，为抗旱提供稳定水源保障。冬春连旱期间，云南做好昆明市应急供水和牛栏江－滇池补水工程调度，累计向昆明市应急供水 2.12 亿立方米，实施了 2024 年昆明市中心城区抗旱救灾应急供水——德泽水库干河泵站取水口提升改造工程项目建设，新增供水量 0.6 亿立方米，保障了城市供水安全和滇池生态安全。夏旱期间，黄河、淮河、海河流域控制性水工程和南水北调等引调水工程全面进入抗旱调度模式，先后 12 次加大黄河小浪底水库下泄流量由 700 立方米每秒至 4460 立方米每秒，山东、河南合计引水量 23.8 亿立方米，海河流域潘家口、大黑汀、岳城水库向下游河北、河南相关灌区提供灌溉用水 0.9 亿立方米，淮河流域蚌埠闸及引江济淮、江水北调等工程加大引调水力度，南水北调东、中线工程向沿线地区应急调水 13.3 亿立方米，保障旱区水源供给。枯水期精细调度以三峡为核心的长江上游水库群向中下游补水，三峡水库 10 月 19 日起下泄流量按不小于 7000 立方米每秒控制，保证枯水期沙市水位不低于 29.50 米、汉口水位不低于 12.50 米，满足沿江地区取水和航运需求。组织实施 2023—2024 年珠江枯水期压咸补淡应急水量调度，梯次供水保障水库群累计应急补水 15.9 亿立方米，有效压制河口咸潮，保障了粤港澳大湾区供水安全，实现了供水、生态、发电、航运多方共赢。组织实施年初望虞河、新孟河引江济太调水和夏秋季望虞河引江济太调水，全年累计引长江水 11.25 亿立方米、直接入太湖 2.64 亿立方米，通过太浦河闸泵向下游供水 11.71 亿立方米，有效增加了流域优质水资源量，促进了太湖及周边河网水体流动，保障了水源地供水安全。

### 3.4.2 The "four preemptive pillars"

MWR closely monitored national rainfall, water regime, soil moisture and drought conditions, used the National Integrated Drought Monitoring and Early Warning Platform to conduct dynamic monitoring, analysis and assessment to support drought-related consultations and decision-making; guided river basins and regions in strengthening the management of drought alert water levels (flows) for rivers, lakes and reservoirs, and adjusted/supplemented relevant stations and early warning thresholds. Stations with online monitoring increased to 1,565 nationwide. In some regions, these monitoring data were used as the main basis for issuing drought alerts, launching emergency responses, and scheduling projects fro drought relief. Mid- and long-range drought forecast was strengthened, and 108 drought alerts were issued in total. During the rapid development and severe periods of drought, emergency duty shifts and daily drought reporting mechanisms were activated to dynamically track the drought evolution and drought relief efforts. Drought-affected regions carried out drought impact simulations and conducted dynamic analyses of water supply-demand balances to formulate contingency water supply plans based on the worst-case scenarios.

During the summer drought, the Yellow River Commission, Huaihe River Commission, Haihe River Commission, as well as water resources departments of Hebei, Anhui, Shandong and Henan conducted reviews on the water supply capacities of their backbone reservoirs and water diversion projects, examined the water demand in each area, and swiftly developed project scheduling plans for drought relief. MWR, together with Guangdong, Guangxi, and the power dispatch departments, formulated the *2024–2025 Emergency Water Dispatch Plan for Saltwater Intrusion Prevention during the Dry Season in the Pearl River Basin* and developed a three-tiered water supply guarantee system from local, nearby to remote sources, thus ensuring water supply security for the Greater Bay Area.

### 3.4.3 Project scheduling

Water resources authorities at all levels carried out scientific and precise project scheduling for drought relief and emergency water dispatch to secure water supplies. During the prolonged winter-spring drought, Yunnan ensured emergency water supply for Kunming by dispatching the Niulan River-Dianchi water supply project, providing 212 million m³ of water to Kunming under emergency situations. To secure emergency water supply capacity to the Kunming downtown area, the Ganhe pumping station’s water intake structures at Deze Reservoir were upgraded, adding another 60 million m³ of water supply. As a result, the urban water supply was guaranteed and the ecological security of Dianchi Lake protected.

During the summer drought, major controlling water projects and water diversion projects such as the the South-to-North Water Diversion in the river basins of the Yellow River, Huaihe, and Haihe were all under drought-relief operation mode. The discharge from the Xiaolangdi Reservoir on the Yellow River was increased 12 times from 700 $m^3/s$ to 4,460 $m^3/s$, with a total of 2.38 billion $m^3$ diverted to Shandong and Henan. In the Haihe River Basin, the Panjiakou, Daheiting and Yuecheng reservoirs provided 90 million $m^3$ of irrigation water to irrigation districts in Hebei and Henan. In the Huaihe River Basin, the Bengbu Sluice Work and Yangtze-to-Huaihe Water Diversion Project and the Yangtze-to-North Jiangsu Water Diversion Project increased water transfer, and the east and middle routes of the South-to-North Water Diversion Project diverted 1.33 billion $m^3$ of water to the drought-affected areas along the routes.

During the dry season, precise dispatch was carried out with the upstream reservoir group in the Yangtze River Basin, centered on the Three Gorges, to supplement the middle and lower reaches. From October 19 onwards, the discharge from the Three Gorges Reservoir was controlled at no less than 7,000 $m^3/s$, ensuring that water levels during the dry season at Shashi and Hankou stations remained above 29.50 m and 12.50 m respectively and met the water intake and navigation needs along the river.

云南德泽水库抗旱应急提水工程建设现场
Emergency water diversion work was in progress at Deze Reservoir in Yunnan

The 2024-2025 Emergency Water Dispatch Plan for Saltwater Intrusion Prevention during the Dry Season in the Pearl River Basin was implemented, and the reservoir group for emergency drought relief cumulatively dispatched 1.59 billion $m^3$ of water, effectively checking saltwater intrusion at the river mouth and ensuring water supply security for the Greater Bay Area. Water supply, ecological protection, hydropower generation, and navigation were ensured.

Early-year and summer–autumn water diversion from the Wangyu River and Xinmeng River to Taihu Lake was organized, with a total of 1.125 billion $m^3$ of Yangtze water diverted throughout the year and 264 million $m^3$ directly flowed into Taihu Lake. And 1.171 billion $m^3$ was delivered downstream via Taipu River sluice pumps, effectively increasing high-quality water resources in the basin, promoting water flow in Taihu Lake and surrounding river networks, and ensuring water supply in water source areas.

### 3.4.4 饮水保障

组织受旱地区全面摸排城乡供水情况，滚动统计因旱饮水困难人口、大牲畜数量，督促指导旱区各地根据饮水困难人口分布、水源情况和供水工程规模类别等，因地制宜科学制定供水保障方案，及时采取水源调度、管网延伸、新建水源、拉水送水等措施确保供水安全。重点关注难以通过工程措施保障的地区和低收入、失能老人等特殊困难群体，确保不落一户、不落一人。滚动研判旱情对大牲畜饮水和规模化养殖产业用水的影响，统筹保障用水需求。云南、重庆、四川等地，全力推进引、调、提等抗旱应急水源工程建设，在保障饮水安全中发挥了重要作用。江西、湖北、湖南等地采取降低取水口位置、延长取水管线、渠道清淤等应急措施，保障沿长江、汉江和洞庭湖、鄱阳湖周边地区低水位情况下的取水。

### 3.4.4 Drinking water security

A comprehensive survey on urban and rural water supply in drought-affected areas was organized, with statistics constantly collected on populations and bigger-sized livestock experiencing drinking water difficulties due to drought. Local governments in drought-stricken regions were urged and guided to scientifically develop tailored water supply security plans based on the distribution of affected populations, water source conditions, and the scale and type of water supply projects. Measures such as source dispatching, pipeline extension, construction of new water sources, and water delivery by trucks were promptly adopted to ensure drinking water safety. Particular attention was given to areas where engineering measures alone could not secure supply, as well as to vulnerable groups such as low-income households and elderly people with disabilities, thus ensuring that no household and no individual was left behind. Continuous assessments were conducted to evaluate the impact of drought on drinking water for bigger-sized livestock and the water needs of large-scale livestock husbandry, so as to coordinate and secure water demand.

Yunnan, Chongqing and Sichuan forcefully advanced the construction of emergency water source projects involving water diversion, transfer and extraction. Such projects played an important role in securing drinking water supply. Jiangxi, Hubei and Hunan adopted emergency measures such as lowering intake elevations, extending intake pipelines, and desilting channels to ensure water intake under low water level conditions along the Yangtze River, Hanjiang River, Dongting Lake, and Poyang Lake.

重庆武隆区双河镇抗旱应急水源工程
Emergency water source project in Shuanghe Town, Wulong District, Chongqing

### 3.4.5 灌溉保障

华北西北黄淮地区夏旱期间，水利部优化抗旱水源配置，精准调度灌区水源，加强用水秩序管理，强化节约用水，确保能引尽引、能灌尽灌，514 处大中型灌区累计灌溉水量超过 25 亿立方米，保障了 3800 余千公顷玉米、大豆等作物播种、出苗用水，确保了农业灌区水源供给，发挥了灌区在农业保粮增产中的压舱石作用。

### 3.4.5 Irrigation security

During the summer drought in North China, Northwest China, and the Huanghuai region, MWR optimized the allocation of emergency water sources, precisely dispatched water sources for irrigation districts, enhanced orderly water use management, and strengthened water saving to ensure that all possible water sources were used and all farmland were irrigated. A total of 514 large and medium-sized irrigation districts received more than 2.5 billion $m^3$ of water, securing water supply for crop sowing and sprouting across over 3,800,000 ha of land planted with corns and soybeans, etc. These efforts ensured a stable water supply for irrigation districts and reinforced their role as a ballast for grain production and yield increase.

### 3.4.6 抗旱投入

水利部商财政部累计安排中央水利救灾资金 7.35 亿元（抗旱部分），支持河北、山西、内蒙古、江苏、安徽、山东、河南、重庆、四川、云南、陕西、甘肃等省（自治区、直辖市）建设抗旱应急水源工程、购置提水运水设备等抗旱减灾工作。云南安排各级抗旱资金 2.54 亿元，累计投入抗旱人员 54 万人，全面开展“地下找水、天上要水、山泉引水、应急调水、全民节水”五个行动，累计解决 118 万人和 56 万头大牲畜因旱饮水困难问题。河南累计投入抗旱资金 12.79 亿元，出动劳力 136.7 万人，开动机电井 50.5 万眼、泵站 942 座，出动机动抗旱设备 32.3 万台套，投入抗旱灌溉和城乡供水，累计抗旱灌溉 5933 千公顷次，实现了粮食产量稳中有增。

河南开封市兰考县三义寨泵站抗旱保供水现场
Impacted by drought, emergency water supply is in progress at Sanyizhai Pumping Station in Lankao County, Kaifeng, Henan

### 3.4.6 Financial and in-kind input for drought relief

MWR, in consultation with the Ministry of Finance, allocated (for drought relief) 735 million RMB of the central water disaster relief fund to support work such as construction of emergency water source projects and the procurement of equipment for water extraction and transport in Hebei, Shanxi, Nei Mongol, Jiangsu, Anhui, Shandong, Henan, Chongqing, Sichuan, Yunnan, Shaanxi and Gansu.

Yunnan Province allocated 254 million RMB in drought relief funds at all levels, mobilized 540,000 drought relief personnel, and maximized water supply by sourcing water from underground, air, mountain springs, and emergency diversion and also saving water society-wide. These actions resolved drinking water difficulties for 1.18 million people and 560,000 bigger-sized livestock.

Henan Province invested 1.279 billion RMB in drought relief funds, mobilized 1.367 million personnel, activated 505,000 electromechanical wells and 942 pump stations, and deployed 323,000 sets of mobile drought relief equipment for emergency irrigation and urban-rural water supply. A total of 5.933 million ha of farmland were irrigated during the drought, contributing to a stable and even increasing grain yield.

### 3.4.7 部门协作

水利部会同农业农村部、应急管理部、中国气象局先后编发《科学应对汛期自然灾害 奋力夺取粮食和农业丰收预案》《关于切实做好黄淮海抗高温抗干旱保夏播保全苗工作的紧急通知》，合力做好农业防灾减灾工作。长江、珠江枯水期调度期间加强与相关部门的沟通协调，在确保供水安全的前提下，统筹兼顾生态、航运、发电等需求，实现多方共赢。

### 3.4.7 Cross-sectoral collaboration

The MWR, in collaboration with the Ministry of Agriculture and Rural Affairs, the Ministry of Emergency Management, and the China Meteorological Administration, jointly issued the *Contingency Plan for Coping with Natural Disasters during Flood Season and Ensuring Harvest*, and the *Urgent Notice on Coping with High Temperature and Drought in the Huang-Huai-Hai Region to Secure Summer Sowing and Seedling*, to jointly strengthen agricultural disaster prevention and mitigation efforts.

During the dry-season scheduling of the Yangtze River and Pearl River basins, the MWR enhanced coordination and communication with relevant ministries to accommodate water demands for ecosystems, navigation, and power generation while ensuring water supply security.

## 3.5 防御成效

2024 年，水利部认真贯彻落实党中央、国务院决策部署，超前谋划、有序应对，指导旱区明确责任、细化措施，各级水利部门“上下联动、携手发力”，全力做好各项抗旱工作。全国各地累计完成抗旱浇灌面积 4640 千公顷，因旱饮水困难人口均采取措施得到保障，确保了城乡居民饮水安全，确保规模化养殖和大牲畜用水安全，保障了灌区农作物时令灌溉用水，为全年粮食丰产作出贡献。

## 3.5 Effectiveness of Drought Disaster Prevention

In 2024, the MWR earnestly implemented the decisions and arrangements of the central government, made proactive plans, and responded in an orderly manner. Drought-stricken areas were guided to clarify responsibilities and refine measures, and water resources departments at all levels coordinated efforts and worked together to carry out drought relief work with full force. A total of 4,640,000 ha of cropland received emergency irrigation, drinking water difficulties of people were eased, drinking water needs of urban and rural residents as well as large-scale breeding and bigger-sized livestock were secured, seasonal irrigation demands by crops in irrigation districts were met, thus contributing to a good grain harvest for the year.

**案例 1** 云南省抗旱保供水

2024 年云南省旱情呈现出开始时间早、发展速度快、持续时间长、抗旱成效显著的特点。云南省水利厅从 2024 年 3 月 1 日起全面开展“地下找水、天上要水、山泉引水、应急调水、全民节水”五个行动。

一是实施地下打井行动。组建工作专班开展实地调查和系统勘探，全省共打井 610 眼，总投资 1.3 亿元，日供水量 9.8 万立方米，可保障 72.2 万人口供水。

二是实施人工增雨行动。从 2024 年省级抗旱经费中安排 1500 万元作为人工增雨工作经费，截至 6 月上旬，累计实施飞机增雨作业 42 架次、地面增雨作业 2952 点次，评估增加降雨量约 12.2 亿立方米。

三是实施山泉引水行动。完成山泉引水工程 277 件，总投资 3.2 亿元，日引水量 9.9 万立方米，可保障 76.3 万人口供水。

四是实施应急调水行动。全省组织实施 292 件应急抗旱保供水工程，总投资 13.5 亿元，新增日供水量 164.4 万立方米，保障 290 万人口供水，2024 年 4 月 30 日前全部通水运行。

五是实施全民节水行动。2023 年 10 月至 2024 年 5 月，按月开展省、市、县、乡、村 5

级供需水平衡分析。2024 年 3 月以来，在云南发布、云南日报、云南网等 10 余个省级平台和市（州）、县级媒体全覆盖发布《节水倡议书》；发布节约用水宣传稿件 155 篇。

## Case 1 Drought relief and water supply assurance in Yunnan

In 2024, the drought in Yunnan Province was characterized by an early onset, rapid development, and prolonged duration. Yet the drought relief work was outstanding. Starting from March 1, 2024, the Yunnan Provincial Water Resources Department comprehensively launched the initiative of maximizing water supply by sourcing water from underground, air, mountain springs, and emergency diversion and also saving water society-wide.

First, the groundwater well drilling initiative was implemented. A dedicated task force was established for on-site investigations and systematic exploration. A total of 610 wells were drilled across the province, with a total investment of 130 million RMB, resulting in a daily water supply capacity of 98,000 $m^3$ that were could meet the drinking water needs of 722,000 people.

Second, the artificial rainfall enhancement initiative was implemented with 15 million RMB from the 2024 provincial drought relief fund. As of early June, 42 aircraft operations and 2,952 ground-based operations had been carried out, generating an estimated 1.22 billion $m^3$ of additional rainfall.

Third, the spring water diversion initiative was implemented. A total of 277 spring water diversion projects were completed with a total investment of 320 million RMB. These projects added a daily water supply capacity of 99,000 $m^3$ that were sufficient to serve 763,000 people.

Fourth, the emergency water transfer initiative was implemented. A total of 292 emergency water diversion projects were launched across the province, with a total investment of 1.35 billion RMB. These projects provided an additional 1.644 million $m^3$ of daily water supply capacity that could sustain 2.9 million people. All projects were completed and operational by April 30, 2024.

Fifth, the public water saving initiative was implemented. From October 2023 to May 2024, water supply-demand balance analyses were conducted monthly across five levels: province, city, county, town, and village. Since March 2024, over 10 provincial-level media, including Yunnan Release, Yunnan Daily, and Yunnan Net, as well as municipal and county-level media, have announced the *Water Saving Initiative*. A total of 155 articles on water-saving awareness were released.

### 案例 2 黄河流域夏旱调度

黄委高度重视 2024 年黄河流域部分省（自治区）严重旱情，全面落实李国英部长 6 月 14 日华北地区抗旱会商会提出的“确保城乡居民饮水安全，确保规模化养殖和大牲畜用水安全，全力保障灌区农作物时令灌溉用水”目标要求，精准范围、精准对象、精准时段、精准措施，指导相关受旱省（自治区）全力做好各项抗旱工作。

一是精准范围。研判和掌握流域旱情发展范围，及时将刘家峡、万家寨、三门峡、小浪底等流域控制性水库转为应急抗旱调度模式。

二是精准对象。动态收集各省（自治区）旱情状况，摸清流域各地区旱情特点，掌握不同地区人畜饮水、农灌用水需求，分门别类落实抗旱供水保障措施。

三是精准时段。通过研判旱情发展态势，根据沿黄灌区农作物结构及其生长阶段，及时准确掌握灌溉用水需求，保障灌区农作物时令用水，用足、用好每一方抗旱水源。应急抗旱调度期间，山东、河南投运引黄涵闸 103 座，累计引水 11.99 亿立方米。

四是精准措施。强化会商研判旱情发展变化，精准调整水库下泄流量，及时启动应急响应和发布预警，派出工作组指导抗旱工作。6 月 1 日至 7 月 4 日，刘家峡、万家寨、小浪底等 3 座水库合计下泄水量 102.48 亿立方米。应急抗旱调度期间，小浪底水库共下泄水量 26.59 亿立方米，最大下泄流量 4460 立方米每秒，满足河南、山东、山西相关灌区灌溉需求，各灌区基本实现能引尽引、应灌尽灌。

## Case 2 Water dispatch against the summer drought in the Yellow River Basin

The Yellow River Commission attached great importance to combating the severe drought affecting parts of the Yellow River Basin and fully implemented the goals set forth by Minister Li Guoying at the North China drought consultation meeting on June 14, namely to “ensure urban and rural drinking water safety, ensure water for large-scale breeding and bigger-sized livestock, and make every effort to secure seasonal irrigation demand in irrigation districts” .The Commission guided drought-affected provinces and regions to carry out drought relief efforts based on precision in scope, targets, timing, and measures.

First, precision in scope. The development of drought conditions across the basin was assessed in a timely manner, and key control reservoirs in the basin, including Liujiaxia, Wanjiazhai, Sanmenxia, and Xiaolangdi, were switched to emergency drought dispatch mode.

Second, precision in targets. Drought conditions in each province and region were dynamically collected and analyzed to understand regional characteristics and determine drinking water demands for human and livestock drinking as well as demands for agricultural irrigation. Tailored water supply guarantee measures were implemented accordingly.

Third, precision in timing. By assessing the evolving drought conditions and considering the cropping structure and growth stages in irrigation districts along the Yellow River, irrigation water demands were timely and accurately grasped to ensure seasonal irrigation, making full and efficient use of all available drought relief water sources. During the emergency drought dispatch period, 103 Yellow River diversion sluices were operated in Shandong and Henan and cumulatively 1.199 billion $m^3$ of water was diverted.

Fourth, precision in measures. Drought consultations and analyses were strengthened to adjust reservoir outflows precisely. Emergency responses and alerts were launched in a timely manner, and working groups were dispatched to guide drought relief efforts. From June 1 to July 4, the Liujiaxia, Wanjiazhai, and Xiaolangdi reservoirs jointly released 10.248 billion $m^3$ of water. During this period, Xiaolangdi Reservoir alone released 2.659 billion $m^3$ of water, with a maximum discharge rate of 4,460 $m^3/s$. Involved irrigation districts in Henan, Shandong, and Shanxi received adequate water for irrigation by diverting from all possible sources and hence ensuring irrigation to the greatest extent.

# 4 基础工作

FOUNDATIONAL WORK

## 4.1 体制机制法治

为进一步提升水旱灾害防御能力，水利部印发《关于加快构建水旱灾害防御工作体系的指导意见》《加快构建水旱灾害防御工作体系的实施意见》，要求贯通“四情”防御、强化“四预”措施、绷紧“四个链条”、完善“四制（治）”，从责任落实、决策支持、调度指挥三方面加快建立水旱灾害防御工作体系。各流域机构、各省（自治区、直辖市）结合各自实际梳理细化水旱灾害防御相关制度办法，组织编制构建水旱灾害防御工作体系的实施方案。责任落实方面，黄委公布了沿黄重要堤段、重点水库、重点城市和主要蓄滞洪区防汛行政责任人名单，层层夯实委、省、市、县、班组 5 级防汛责任制；广东省落实约 1000 名市级、1 万名县级和 18 万名镇村级防汛责任人，其中水库、堤防等水利工程防汛责任人约 5.6 万人。决策支持方面，长江委加快推进长江口风暴潮监测预警中心建设，逐步构建长江流域及西南诸河功能齐全的综合监测站网，持续推进长江流域全覆盖水监控系统建设；福建省通过水利“一张图”汇聚各类水工程、雨量站、水文站相关信息，整合资源、共享共用，推进“千库联调”系统建设。调度指挥方面，水利部印发《水利部重大水旱灾害事件调度指挥机制》，进一步理顺指挥调度规则，确保第一时间全面掌握险情灾情等相关信息，第一时间作出研判部署，第一时间指导应急处置，为迅速、有序、高效应对水旱灾害防御事件提供制度支撑；海委制定印发《海河流域洪水防御协调联动工作机制》，进一步构建完善流域上下游、左右岸、干支流协调联动的防汛“一盘棋”工作格局；安徽省运用基站定位、智能语音等技术，建立自动触发叠加人工兜底的红色预警“叫应”机制，打通预警信息发布“最后一公里”。水利部贯彻党中央有关立法规划部署，落实全国人大常委会、国务院有关要求，组织开展了《中华人民共和国防洪法》《蓄滞洪区运用补偿暂行办法》修改工作。

## 4.1 Institutional and Legal Framework

To further enhance the capacity for flood and drought disaster prevention, the MWR issued *Guiding Opinions on Accelerating the Establishment of a Flood and Drought Disaster Prevention System* and *Implementation Opinions on Accelerating the Establishment of a Flood and Drought Disaster Prevention System*, required the integration of the four situations defense, strengthening the four preemptive pillars, tightening the four chains, improving the four management and governance systems;calling for enhancing integrated capacity with focuses laid on accountability, decision-making support, and scheduling command. River basin commissions and provincial-level authorities (including in autonomous regions and municipalities) refined relevant institutional measures and formulated implementation plans based on local realities.

In terms of responsibility implementation, the Yellow River Commission published the list of flood control administrative responsible persons for key embankment sections, major reservoirs, critical cities, and main flood detention areas along the Yellow River, reinforcing the commission-province-city-county-work team responsibility system. In Guangdong Province, approximately 1,000 city-level, 10,000 county-level, and 180,000 town and village-level flood control responsible persons were designated, including around 56,000 responsible persons for water conservancy projects such as reservoirs and embankments.

In terms of decision-making support, the Changjiang Commission accelerated the development of the Yangtze Estuary Storm Surge Monitoring and Early Warning Center, and gradually established a comprehensive monitoring station network across the basin and rivers in Southwest China. Basin-wide coverage by a water monitoring system was also advanced. Fujian Province integrated various data from water projects, rainfall stations, and hydrological stations into its "unified water resources map", which consolidated and shared resources to facilitate the construction of a "joint operation of thousand reservoirs" system.

In terms of scheduling command, the MWR issued *Scheduling Command Mechanism for Major Flood and Drought Disaster Events*, further clarifying the rules and stepping up timely and swift responses. Such efforts provided institutional support for quick, orderly, and efficient response to flood and drought disasters. The Haihe Commission issued *Coordinated Flood Prevention Mechanism for the Haihe River Basin*, further improving coordinated joint response among upstream and downstream areas, left and right riverbanks, and mainstream and tributaries under its unified planning mechanism. Anhui Province applied technologies such as base station positioning and smart voice systems to establish a red alert "call-and-respond" mechanism, which combined automated triggering with manual confirmation to bridge the "last mile" in early warning information release.

The MWR also implemented the legislative plans of the CPC Central Committee and fulfilled requirements of the NPC Standing Committee and the State Council by organizing revision work for the *Flood Control Law of the People's Republic of China* and the *Interim Compensation Measures for the Use of Flood Detention Areas*.

## 4.2 方案预案

水利部批复《2024 年长江流域水工程联合调度运用计划》《2024 年珠江流域水工程联合调度运用计划》《雄安新区起步区安全度汛方案》和《三峡水库 2024 年蓄水计划》，印发《关于加强应急水量调度预案工作的通知》。各流域管理机构加快推进防御洪水方案（9 件）、洪水调度方案（14 件）以及超标洪水防御预案（24 件）的制修订工作。

有关流域管理机构按照《关于做好 2024 年蓄滞洪区运用准备工作的通知》要求，组织对国家蓄滞洪区运用预案进行修订完善。长江委印发《2024 年度金沙江下游梯级水库联合优化调度方案》，组织批复三峡水利枢纽、金沙江观音岩水电站防洪抢险应急预案。黄委组织编制了年度黄河上游、中下游水工程联合防洪调度方案、黄河调水调沙预案和中下游洪水应急调度方案，批复了 11 座黄委直接调度管理的大型水库年度调度运用计划，组织批复黄河羊曲水电站蓄水计划及调度方案、黄河古贤水利枢纽工程 2024 年度汛方案和超标准洪水应急预案，沿黄有关省（自治区）及委属有关单位修订完善所辖区域黄河防洪预案、重要水文站测报方案、洪水预报方案、通信保障预案及物资保障预案等各类方案预案。淮委组织编制《2024 年淮河流域水工程联合调度运用计划》。珠江委编制完成《粤港澳大湾区防洪安全保障方案》，指导广东省完善《湛江蓄滞洪区运用预案》。松辽委编制印发《松花江防汛抗旱总指挥部防汛抗旱应急预案》《辽河防汛抗旱总指挥部防汛抗旱应急预案》和《松辽委关于加强松辽流域水工程统一联合调度的意见》，修订《松辽委水旱灾害防御应急响应工作规程》，批复《尼尔基水利枢纽防洪抢险应急预案》。太湖局组织编制《苏州河西闸防汛应急调度规则》《长三角生态绿色一体化发展示范区超标准洪水应对措施研究报告》。

## 4.2 Contingency Planning

The MWR approved the *2024 Joint Scheduling and Operation Plan for Water Projects in the Yangtze River Basin*, the *2024 Joint Scheduling and Operation Plan for Water Projects in the Pearl River Basin*, the *2024 Flood Safety Plan for the Start-up Zone of Xiong'an New Area*, and the *2024 Impoundment Plan for the Three Gorges Reservoir*. It also issued the *Notice on Strengthening Emergency Water Dispatch Preparedness Plans*. River basin commissions accelerated the formulation and revision of nine flood defense plans, 14 flood dispatch plans, and 24 contingency plans for extreme floods.

In accordance with the *Notice on Preparing for the Operation of Flood Detention Areas in 2024*, relevant river basin commissions organized the revision and improvement of operation plans for national flood detention areas.

The Changjiang Commission issued the *2024 Optimized Joint Dispatch Plan for Cascade Reservoirs in the Lower Jinsha River,* and approved the emergency flood response plans for the Three Gorges Water Control Project and the Guanyinyan Hydropower Station on the Jinsha River.

The Yellow River Commission organized the preparation of the annual joint flood control dispatch plans for water projects in the upper, middle, and lower Yellow River, the water diversion and sediment regulation plan, and the emergency flood dispatch plan for the middle and lower reaches. The commission also approved the annual dispatch and operation plans for 11 major reservoirs under its direct management, the impoundment and dispatch plan for the Yangqu Hydropower Station, the 2024 flood preparedness plan and contingency plan for extreme floods for the Guxian Water Control Project. Local water resources departments as well as agencies under the supervision of the Yellow River Commission along the Yellow River revised flood defense plans for monitoring of key hydrological stations, flood forecast, communication support, and material supply contingency.

The Huaihe Commission compiled the *2024 Joint Scheduling and Operation Plan for Water Projects in the Huaihe River Basin*.

The Pearl River Commission completed the *Flood Safety Assurance Plan for the Greater Bay Area* and guided Guangdong Province in improving the *Flood Detention Area Operation Plan for the Pajiang River*.

The Songliao Commission compiled and issued the *Flood and Drought Emergency Response Plan of the Songhua River Flood and Drought Command Headquarters*, the *Flood and Drought Emergency Response Plan of the Liaohe River Flood and Drought Command Headquarters*, and the *Opinions on Enhancing Unified Joint Dispatch of Water Projects in the Songliao River Basin*. The commission also revised the *Emergency Response Procedures for Flood and Drought Disaster Prevention in the Songliao River Basi*n and approved the *Emergency Flood Response Plan for the Nierji Water Control Project*.

The Taihu Authority organized the development of the *Emergency Flood Dispatch Rules for the Western Sluice of Suzhou River* and the *Research Report on Response Measures to Extreme Floods in the Yangtze River Delta Eco-Green Integrated Development Demonstration Zone*.

## 4.3 蓄滞洪区建设管理

水利部加快推进国家蓄滞洪区建设，2024 年在建国家蓄滞洪区 36 处，其中新开工建设小清河、东淀、永定河等 15 处国家蓄滞洪区，共安排中央资金 430.86 亿元，涉及北京、天津、河北等 8 省（直辖市），在建项目数量、投资规模均处于历史最高水平。积极推进数字孪生蓄滞洪区建设，指导加快推进康山、华阳河、小清河等在建工程数字孪生建设，以及蒙洼、恩县洼等数字孪生试点建设。商财政部首次下达 2024 年度中央财政补助资金 2.97 亿元，支持国家蓄滞洪区工程维修养护，保障工程良性运行。印发《水利部关于加强蓄滞洪区内非防洪建设项目洪水影响评价管理的意见》，优化蓄滞洪区非防洪建设项目洪水影响评价分级管理，强化事中事后监管，将国家蓄滞洪区已建成安全区（安全台）外的非防洪建设项目洪水影响评价审批权限上收至水利部。印发关于开展国家蓄滞洪区内非防洪建设项目遥感监管工作的通知，常态化规范化开展非防洪建设项目遥感监测监管，及时发现纠正苗头性违建项目，维护蓄滞洪容积和功能。印发关于开展国家蓄滞洪区划界技术工作的通知，组织开展国家蓄滞洪区划界技术工作。

## 4.3 Construction and Management of Flood Detention Areas

The MWR accelerated the construction of national flood detention areas. In 2024, a total of 36 national flood detention areas were under construction, including 15 newly launched projects such as Xiaoqing River, Dongdian, and Yongding River. A total of 43.086 billion RMB of central government funding was allocated, covering 8 provinces and municipalities including Beijing, Tianjin, and Hebei. Both the number of projects under construction and the scale of investment reached record highs.

Efforts to advance digital twin for flood detention areas were promoted. The MWR provided guidance for accelerating digital twin development for ongoing projects such as Kangshan, Huayang River, and Xiaoqing River, as well as pilot digital twin development for established ones such as Mengwa and Enxianwa.

In consultation with the Ministry of Finance, the MWR secured, for the first time, 297 million RMB of central financial subsidies in 2024 to the maintenance and upkeep of national flood detention area projects, ensuring their sound operation.

The MWR issued the *Opinions on Strengthening Flood Impact Assessment Management for Non-Flood Control Construction Projects within National Flood Detention Areas,* which optimized the classification management system for flood impact assessment of such projects, reinforced operational and post-operation supervision, and centralized the approval authority for flood impact assessments of non-flood control construction projects located outside designated safe zones/platforms within national flood detention areas to the MWR.

A notice on conducting remote sensing supervision of non-flood control construction projects in national flood detention areas was also issued, standardizing routine remote sensing monitoring and regulation of such projects, so as to promptly detect and correct early-stage unauthorized constructions and safeguard flood detention volume and functionality.

Additionally, the MWR issued a notice on launching the technical delineation work for national flood detention areas, and organized such activities to formally define boundaries for national flood detention areas.

## 4.4 山洪灾害防治

水利部会同财政部下达 2024 年中央水利发展资金 16 亿元，支持地方开展监测能力提升、小流域山洪灾害“四预”能力建设、群测群防体系建设等山洪灾害防治非工程措施建设及运行维护。利用 2023 年增发国债资金 175.8 亿元，开展 1891 条山洪沟防洪治理，持续提升沿河村镇和重要基础设施防冲能力，组织各有关省份对照国家发改委、财政部下达的项目清单，详细梳理项目台账，上图入库形成可视化成果。发布水利行业标准《山洪灾害防御预案编制技术导则》（SL/T 666—2024）。先后组织召开山洪灾害防御工作现场会、项目建设管理会、西部地区技术帮扶专项培训会、线上技术培训会等 10 余次，指导地方开展风险隐患排查整治、动态预警阈值调整应用、X 波段水利测雨雷达建设、小流域山洪灾害“四预”能力建设、山洪灾害防御预案修订完善等任务，部署规范项目建设管理工作。

## 4.5 洪水风险图编制

水利部会同财政部下达 2024 年中央水利发展资金 10 亿元，支持地方开展重点地区洪水风险图编制项目建设，包括 171 处防洪保护区、44 处蓄滞洪区、35 处洪泛区、27 座防洪城市、2483 条（段）中小河流及 3679 座重点中小型水库洪水风险图编制和专项评估等任务。组织编制《洪水风险图编制与专项评估技术要求》，组织开发洪水影响分析与损失评估软件、避洪转移分析软件、洪水风险图绘制系统、洪水风险图编制成果汇交系统和洪水风险实时推演与动态展示系统。

## 4.4 Flash Flood Disaster Management

The MWR, in conjunction with the Ministry of Finance, allocated 1.6 billion RMB from the 2024 central water development funds to support local development and maintenance of non-engineering flash flood disaster prevention capacity. This included enhancing monitoring capacity, developing the “four preemptive pillars” for flash flood management in small watersheds, and establishing mass monitoring and prevention systems.

A total of 17.58 billion RMB from the 2023 treasury bond was utilized to implement flood control measures in 1,891 gullies prone to flash floods, thus continuously improving the resilience against the erosion and flood of riverside villages and critical infrastructure. Provinces were instructed to align their efforts with the project list issued by the National Development and Reform Commission and the Ministry of Finance, to comprehensively organize project records, upload them to the database, and generate visualized results.

The MWR also issued *Technical Guidelines for the Preparation of Flash Flood Disaster Prevention Plans* (SL/T 666-2024) as a new industry standard. Over ten events were organized, including on-site flash flood disaster prevention conferences, project construction and management meetings, special technical support training sessions for western regions, and online technical training sessions. These efforts guided local authorities in tasks such as flash flood risk identification and remediation, dynamic adjustment and application of early warning thresholds, X-band radar rainfall monitoring, capacity building for the four preemptive pillars in small basins, and the revision and improvement of flash flood disaster prevention plans, while also standardizing project construction and management practices.

## 4.5 Flood Risk Mapping

The MWR, in conjunction with the Ministry of Finance, allocated one billion RMB from the 2024 central water development funds to support local governments in implementing flood risk mapping projects for key areas. Flood risk maps and specialized assessments were conducted for 171 flood protection zones, 44 flood detention areas, 35 floodplains, 27 flood control cities, 2,483 small and medium-sized rivers (river sections), and 3,679 key small and medium-sized reservoirs.

The MWR organized the compilation and launch of the *Technical Requirements for Flood Risk Mapping and Specialized Assessment*. It also organized the development of supporting tools and platforms, including flood impact analysis and loss assessment software, evacuation analysis software, a flood risk mapping system, a flood risk map submission system, and a real-time simulation and dynamic visualization system for flood risk.

## 4.6 复盘分析

水利部坚持问题导向、结果导向，全面系统调查分析重大灾害事件发生过程，利用卫星无人机遥感监测、数字孪生洪水推演技术、国家山洪灾害监测预报预警平台、全国旱情监测预警综合平台等，及时复盘检视典型洪涝、山洪、干旱灾害事件及其应对过程，总结经验，查找防御短板，提出改进建议。

针对湖南团洲垸和湘潭涓水、内蒙古赤峰老哈河、辽宁铁岭王河、广东广州西福河、海南琼海万泉河等 6 场洪涝灾害事件，提出进一步细化巡堤查险要求、利用人工智能识别等新技术提高巡堤查险效率、及时清除河道内碍洪物、加强数字孪生“四预”建设等建议。针对广东梅州、陕西宝鸡、四川汉源和康定、湖南资兴、辽宁葫芦岛等 6 起山洪（或伴生泥石流）灾害事件，提出建构单元最小、全面覆盖、严密有效的基层山洪灾害防御责任体系，全面落实直达一线的“预报预警、监测预警、现地预警”三阶段预警发布和“叫应”机制以及配置可不依赖公共通信网络的新型入户报警叫应设备等建议。针对西南地区冬春连旱和华北西北黄淮地区夏旱防御，提出加强水源工程运维管理、利用遥感技术进行大范围旱情监测、动态开展旱区水量供需分析、以村镇为单元编制抗旱保供水方案等建议。

## 4.6 Review and Analysis

The MWR, adopting a problem-oriented and results-driven approach, conducted comprehensive and systematic investigations and analyses of major disaster events. Leveraging satellite and drone-based remote sensing, digital twin flood simulation technology, the National Flash Flood Monitoring, Forecasting and Early Warning Platform, and the National Integrated Drought Monitoring and Early Warning Platform, timely reviews were conducted of typical flood, flash flood, and drought disasters and their response efforts. These reviews summarized lessons learned, identified weaknesses in disaster prevention and mitigation, and proposed improvement measures.

For six flood events, specifically in Tuanzhou polder and the Juanshui River in Xiangtan, Hunan; the Laoha River in Chifeng, Nei Mongol; the Wanghe River in Tieling, Liaoning; the Xifu River in Guangzhou, Guangdong; and the Wanquan River in Qionghai, Hainan, suggestions were proposed to further refine patrol and risk detection requirements, apply AI-based technologies to improve risk identification efficiency, promptly clear flood-obstructing debris from river channels, and strengthen digital-twin-driven implementation of the four preemptive pillars.

For six flash flood (or associated debris flow) events in Meizhou, Guangdong; Baoji, Shaanxi; Hanyuan and Kangding, Sichuan; Zixing, Hunan; and Huludao, Liaoning, recommendations were made to establish a comprehensive, fine-grided, and meticulously designed grassroots flash flood defense responsibility system. These also include full implementation of the three-tier early warning system that encompasses forecast-based warning, monitoring-based warning, and on-site warning, with direct outreach mechanisms to the forefront of flood control, and the deployment of innovative household alerting devices independent of public communication networks.

Regarding drought prevention efforts during the prolonged winter–spring drought in Southwest China and the summer drought in North China, Northwest China, and the Huang-Huai-Hai region, suggestions were put forward to enhance the operation and maintenance of water source projects, apply remote sensing for large-scale drought monitoring, conduct dynamic analysis of water supply-demand balance in drought-affected areas, and develop localized drought relief and water supply assurance plans at the town and village levels.

附录
APPENDIX

# 1950—2024 年全国水旱灾情统计

STATISTICS OF FLOOD AND DROUGHT DISASTERS IN CHINA, 1950-2024

附表 1  1950—2024 年全国洪涝灾情统计
Appendix table 1　Flood disasters and losses, 1950–2024

| 年份<br>Year | 农作物受灾面积<br>/ 千公顷<br>Affected cropland area/1,000 ha | 农作物成灾面积<br>/ 千公顷<br>Failed cropland area/1,000 ha | 因灾死亡人口<br>/ 人<br>Deaths/person | 因灾失踪人口<br>/ 人<br>Missing persons/person | 倒塌房屋<br>/ 万间<br>Collapsed dwellings/10,000 rooms | 直接经济损失<br>/ 亿元<br>Direct economic losses/100 million RMB |
|---|---|---|---|---|---|---|
| 1950 | 6559.00 | 4710.00 | 1982 | — | 130.50 | — |
| 1951 | 4173.00 | 1476.00 | 7819 | — | 31.80 | — |
| 1952 | 2794.00 | 1547.00 | 4162 | — | 14.50 | — |
| 1953 | 7187.00 | 3285.00 | 3308 | — | 322.00 | — |
| 1954 | 16131.00 | 11305.00 | 42447 | — | 900.90 | — |
| 1955 | 5247.00 | 3067.00 | 2718 | — | 49.20 | — |
| 1956 | 14377.00 | 10905.00 | 10676 | — | 465.90 | — |
| 1957 | 8083.00 | 6032.00 | 4415 | — | 371.20 | — |
| 1958 | 4279.00 | 1441.00 | 3642 | — | 77.10 | — |
| 1959 | 4813.00 | 1817.00 | 4540 | — | 42.10 | — |
| 1960 | 10155.00 | 4975.00 | 6033 | — | 74.70 | — |
| 1961 | 8910.00 | 5356.00 | 5074 | — | 146.30 | — |
| 1962 | 9810.00 | 6318.00 | 4350 | — | 247.70 | — |
| 1963 | 14071.00 | 10479.00 | 10441 | — | 1435.30 | — |
| 1964 | 14933.00 | 10038.00 | 4288 | — | 246.50 | — |
| 1965 | 5587.00 | 2813.00 | 1906 | — | 95.60 | — |
| 1966 | 2508.00 | 950.00 | 1901 | — | 26.80 | — |
| 1967 | 2599.00 | 1407.00 | 1095 | — | 10.80 | — |
| 1968 | 2670.00 | 1659.00 | 1159 | — | 63.00 | — |
| 1969 | 5443.00 | 3265.00 | 4667 | — | 164.60 | — |
| 1970 | 3129.00 | 1234.00 | 2444 | — | 25.20 | — |
| 1971 | 3989.00 | 1481.00 | 2323 | — | 30.20 | — |
| 1972 | 4083.00 | 1259.00 | 1910 | — | 22.80 | — |
| 1973 | 6235.00 | 2577.00 | 3413 | — | 72.30 | — |
| 1974 | 6431.00 | 2737.00 | 1849 | — | 120.00 | — |

续表 Continued

| 年份 Year | 农作物受灾面积 / 千公顷 Affected cropland area/1,000 ha | 农作物成灾面积 / 千公顷 Failed cropland area/1,000 ha | 因灾死亡人口 / 人 Deaths/person | 因灾失踪人口 / 人 Missing persons/ person | 倒塌房屋 / 万间 Collapsed dwellings/ 10,000 rooms | 直接经济损失 / 亿元 Direct economic losses/ 100 million RMB |
|---|---|---|---|---|---|---|
| 1975 | 6817.00 | 3467.00 | 29653 | — | 754.30 | — |
| 1976 | 4197.00 | 1329.00 | 1817 | — | 81.90 | — |
| 1977 | 9095.00 | 4989.00 | 3163 | — | 50.60 | — |
| 1978 | 2820.00 | 924.00 | 1796 | — | 28.00 | — |
| 1979 | 6775.00 | 2870.00 | 3446 | — | 48.80 | — |
| 1980 | 9146.00 | 5025.00 | 3705 | — | 138.30 | — |
| 1981 | 8625.00 | 3973.00 | 5832 | — | 155.10 | — |
| 1982 | 8361.00 | 4463.00 | 5323 | — | 341.50 | — |
| 1983 | 12162.00 | 5747.00 | 7238 | — | 218.90 | — |
| 1984 | 10632.00 | 5361.00 | 3941 | — | 112.10 | — |
| 1985 | 14197.00 | 8949.00 | 3578 | — | 142.00 | — |
| 1986 | 9155.00 | 5601.00 | 2761 | — | 150.90 | — |
| 1987 | 8686.00 | 4104.00 | 3749 | — | 92.10 | — |
| 1988 | 11949.00 | 6128.00 | 4094 | — | 91.00 | — |
| 1989 | 11328.00 | 5917.00 | 3270 | — | 100.10 | — |
| 1990 | 11804.00 | 5605.00 | 3589 | — | 96.60 | 239.00 |
| 1991 | 24596.00 | 14614.00 | 5113 | — | 497.90 | 779.08 |
| 1992 | 9423.30 | 4464.00 | 3012 | — | 98.95 | 412.77 |
| 1993 | 16387.30 | 8610.40 | 3499 | — | 148.91 | 641.74 |
| 1994 | 18858.90 | 11489.50 | 5340 | — | 349.37 | 1796.60 |
| 1995 | 14366.70 | 8000.80 | 3852 | — | 245.58 | 1653.30 |
| 1996 | 20388.10 | 11823.30 | 5840 | — | 547.70 | 2208.36 |
| 1997 | 13134.80 | 6514.60 | 2799 | — | 101.06 | 930.11 |
| 1998 | 22291.80 | 13785.00 | 4150 | — | 685.03 | 2550.90 |
| 1999 | 9605.20 | 5389.12 | 1896 | — | 160.50 | 930.23 |
| 2000 | 9045.01 | 5396.03 | 1942 | — | 112.61 | 711.63 |

续表 Continued

| 年份 Year | 农作物受灾面积 / 千公顷 Affected cropland area/1,000 ha | 农作物成灾面积 / 千公顷 Failed cropland area/1,000 ha | 因灾死亡人口 / 人 Deaths/person | 因灾失踪人口 / 人 Missing persons/ person | 倒塌房屋 / 万间 Collapsed dwellings/ 10,000 rooms | 直接经济损失 / 亿元 Direct economic losses/ 100 million RMB |
|---|---|---|---|---|---|---|
| 2001 | 7137.78 | 4253.39 | 1605 | — | 63.49 | 623.03 |
| 2002 | 12384.21 | 7439.01 | 1819 | — | 146.23 | 838.00 |
| 2003 | 20365.70 | 12999.80 | 1551 | — | 245.42 | 1300.51 |
| 2004 | 7781.90 | 4017.10 | 1282 | — | 93.31 | 713.51 |
| 2005 | 14967.48 | 8216.68 | 1660 | — | 153.29 | 1662.20 |
| 2006 | 10521.86 | 5592.42 | 2276 | — | 105.82 | 1332.62 |
| 2007 | 12548.92 | 5969.02 | 1230 | — | 102.97 | 1123.30 |
| 2008 | 8867.82 | 4537.58 | 633 | 232 | 44.70 | 955.44 |
| 2009 | 8748.16 | 3795.79 | 538 | 110 | 55.59 | 845.96 |
| 2010 | 17866.69 | 8727.89 | 3222 | 1003 | 227.10 | 3745.43 |
| 2011 | 7191.50 | 3393.02 | 519 | 121 | 69.30 | 1301.27 |
| 2012 | 11218.09 | 5871.41 | 673 | 159 | 58.60 | 2675.32 |
| 2013 | 11777.53 | 6540.81 | 775 | 374 | 53.36 | 3155.74 |
| 2014 | 5919.43 | 2829.99 | 486 | 91 | 25.99 | 1573.55 |
| 2015 | 6132.08 | 3053.84 | 319 | 81 | 15.23 | 1660.75 |
| 2016 | 9443.26 | 5063.49 | 686 | 207 | 42.77 | 3643.26 |
| 2017 | 5196.47 | 2781.19 | 316 | 39 | 13.78 | 2142.53 |
| 2018 | 6426.98 | 3131.16 | 187 | 32 | 8.51 | 1615.47 |
| 2019 | 6680.40 | 3928.97 | 573 | 85 | 10.30 | 1922.70 |
| 2020 | 7190.00 | 4118.21 | 230 | 49 | 9.00 | 2669.80 |
| 2021 | 4760.43 | 2643.05 | 512 | 78 | 15.20 | 2458.92 |
| 2022 | 3413.73 | 1834.57 | 143 | 28 | 3.13 | 1288.99 |
| 2023 | 4633.29 | 2320.90 | 309 | | 13.00 | 2445.75 |
| 2024 | 6035.81 | — | 436 | | 5.70 | 2598.10 |

注 2019—2024 年数据来源于应急管理部；"—" 表示没有统计数据；因灾失踪人口从 2008 年开始作为指标统计。
Note Data during 2019–2024 are from the Ministry of Emergency Management; "–" means statistics don't exist; missing persons attributed to disasters was determined as a statistical indicator since 2008.

附表 2  1950—2024 年全国干旱灾情统计
Appendix table 2  Drought disasters and losses, 1950–2024

| 年份 Year | 农作物因旱受灾面积 / 千公顷 Affected cropland area/1,000 ha | 农作物因旱成灾面积 / 千公顷 Damaged cropland area/1,000 ha | 农作物因旱绝收面积 / 千公顷 Area of crop failure/1,000 ha | 因旱粮食损失 / 亿千克 Crop losses/100 million kg | 因旱饮水困难人口 / 万人 People with drinking water difficulties/10,000 persons | 因旱饮水困难大牲畜 / 万头 Number of bigger-sized livestock having difficulties accessing drinking water/10,000 heads | 直接经济损失 / 亿元 Direct economic losses/100 million RMB |
|---|---|---|---|---|---|---|---|
| 1950 | 2398.00 | 589.00 | — | 19.00 | — | — | — |
| 1951 | 7829.00 | 2299.00 | — | 36.88 | — | — | — |
| 1952 | 4236.00 | 2565.00 | — | 20.21 | — | — | — |
| 1953 | 8616.00 | 1341.00 | — | 54.47 | — | — | — |
| 1954 | 2988.00 | 560.00 | — | 23.44 | — | — | — |
| 1955 | 13433.00 | 4024.00 | — | 30.75 | — | — | — |
| 1956 | 3127.00 | 2051.00 | — | 28.60 | — | — | — |
| 1957 | 17205.00 | 7400.00 | — | 62.22 | — | — | — |
| 1958 | 22361.00 | 5031.00 | — | 51.28 | — | — | — |
| 1959 | 33807.00 | 11173.00 | — | 108.05 | — | — | — |
| 1960 | 38125.00 | 16177.00 | — | 112.79 | — | — | — |
| 1961 | 37847.00 | 18654.00 | — | 132.29 | — | — | — |
| 1962 | 20808.00 | 8691.00 | — | 89.43 | — | — | — |
| 1963 | 16865.00 | 9021.00 | — | 96.67 | — | — | — |
| 1964 | 4219.00 | 1423.00 | — | 43.78 | — | — | — |
| 1965 | 13631.00 | 8107.00 | — | 64.65 | — | — | — |
| 1966 | 20015.00 | 8106.00 | — | 112.15 | — | — | — |
| 1967 | 6764.00 | 3065.00 | — | 31.83 | — | — | — |
| 1968 | 13294.00 | 7929.00 | — | 93.92 | — | — | — |
| 1969 | 7624.00 | 3442.00 | — | 47.25 | — | — | — |
| 1970 | 5723.00 | 1931.00 | — | 41.50 | — | — | — |
| 1971 | 25049.00 | 5319.00 | — | 58.12 | — | — | — |
| 1972 | 30699.00 | 13605.00 | — | 136.73 | — | — | — |
| 1973 | 27202.00 | 3928.00 | — | 60.84 | — | — | — |
| 1974 | 25553.00 | 2296.00 | — | 43.23 | — | — | — |
| 1975 | 24832.00 | 5318.00 | — | 42.33 | — | — | — |

续表 Continued

| 年份 Year | 农作物因旱受灾面积 / 千公顷 Affected cropland area/1,000 ha | 农作物因旱成灾面积 / 千公顷 Damaged cropland area/1,000 ha | 农作物因旱绝收面积 / 千公顷 Area of crop failure/1,000 ha | 因旱粮食损失 / 亿千克 Crop losses/100 million kg | 因旱饮水困难人口 / 万人 People with drinking water difficulties/10,000 persons | 因旱饮水困难大牲畜 / 万头 Number of bigger-sized livestock having difficulties accessing drinking water/10,000 heads | 直接经济损失 / 亿元 Direct economic losses/100 million RMB |
|---|---|---|---|---|---|---|---|
| 1976 | 27492.00 | 7849.00 | — | 85.75 | — | — | — |
| 1977 | 29852.00 | 7005.00 | — | 117.34 | — | — | — |
| 1978 | 40169.00 | 17969.00 | — | 200.46 | — | — | — |
| 1979 | 24646.00 | 9316.00 | — | 138.59 | — | — | — |
| 1980 | 26111.00 | 12485.00 | — | 145.39 | — | — | — |
| 1981 | 25693.00 | 12134.00 | — | 185.45 | — | — | — |
| 1982 | 20697.00 | 9972.00 | — | 198.45 | — | — | — |
| 1983 | 16089.00 | 7586.00 | — | 102.71 | — | — | — |
| 1984 | 15819.00 | 7015.00 | — | 106.61 | — | — | — |
| 1985 | 22989.00 | 10063.00 | — | 124.04 | — | — | — |
| 1986 | 31042.00 | 14765.00 | — | 254.34 | — | — | — |
| 1987 | 24920.00 | 13033.00 | — | 209.55 | — | — | — |
| 1988 | 32904.00 | 15303.00 | — | 311.69 | — | — | — |
| 1989 | 29358.00 | 15262.00 | 2423.33 | 283.62 | — | — | — |
| 1990 | 18174.67 | 7805.33 | 1503.33 | 128.17 | — | — | — |
| 1991 | 24914.00 | 10558.67 | 2108.67 | 118.00 | 4359.00 | 6252.00 | — |
| 1992 | 32980.00 | 17048.67 | 2549.33 | 209.72 | 7294.00 | 3515.00 | — |
| 1993 | 21098.00 | 8658.67 | 1672.67 | 111.80 | 3501.00 | 1981.00 | — |
| 1994 | 30282.00 | 17048.67 | 2526.00 | 233.60 | 5026.00 | 6012.00 | — |
| 1995 | 23455.33 | 10374.00 | 2121.33 | 230.00 | 1800.00 | 1360.00 | — |
| 1996 | 20150.67 | 6247.33 | 686.67 | 98.00 | 1227.00 | 1675.00 | — |
| 1997 | 33514.00 | 20010.00 | 3958.00 | 476.00 | 1680.00 | 850.00 | — |
| 1998 | 14237.33 | 5068.00 | 949.33 | 127.00 | 1050.00 | 850.00 | — |
| 1999 | 30153.33 | 16614.00 | 3925.33 | 333.00 | 1920.00 | 1450.00 | — |
| 2000 | 40540.67 | 26783.33 | 8006.00 | 599.60 | 2770.00 | 1700.00 | — |
| 2001 | 38480.00 | 23702.00 | 6420.00 | 548.00 | 3300.00 | 2200.00 | — |

续表 Continued

| 年份 Year | 农作物因旱受灾面积 / 千公顷 Affected cropland area/1,000 ha | 农作物因旱成灾面积 / 千公顷 Damaged cropland area/1,000 ha | 农作物因旱绝收面积 / 千公顷 Area of crop failure/1,000 ha | 因旱粮食损失 / 亿千克 Crop losses/100 million kg | 因旱饮水困难人口 / 万人 People with drinking water difficulties/10,000 persons | 因旱饮水困难大牲畜 / 万头 Number of bigger-sized livestock having difficulties accessing drinking water/10,000 heads | 直接经济损失 / 亿元 Direct economic losses/100 million RMB |
|---|---|---|---|---|---|---|---|
| 2002 | 22207.33 | 13247.33 | 2568.00 | 313.00 | 1918.00 | 1324.00 | — |
| 2003 | 24852.00 | 14470.00 | 2980.00 | 308.00 | 2441.00 | 1384.00 | — |
| 2004 | 17255.33 | 7950.67 | 1677.33 | 231.00 | 2340.00 | 1320.00 | — |
| 2005 | 16028.00 | 8479.33 | 1888.67 | 193.00 | 2313.00 | 1976.00 | — |
| 2006 | 20738.00 | 13411.33 | 2295.33 | 416.50 | 3578.23 | 2936.25 | 986.00 |
| 2007 | 29386.00 | 16170.00 | 3190.67 | 373.60 | 2756.00 | 2060.00 | 1093.70 |
| 2008 | 12136.80 | 6797.52 | 811.80 | 160.55 | 1145.70 | 699.00 | 545.70 |
| 2009 | 29258.80 | 13197.10 | 3268.80 | 348.49 | 1750.60 | 1099.40 | 1206.59 |
| 2010 | 13258.61 | 8986.47 | 2672.26 | 168.48 | 3334.52 | 2440.83 | 1509.18 |
| 2011 | 16304.20 | 6598.60 | 1505.40 | 232.07 | 2895.45 | 1616.92 | 1028.00 |
| 2012 | 9333.33 | 3508.53 | 373.80 | 116.12 | 1637.08 | 847.63 | 533.00 |
| 2013 | 11219.93 | 6971.17 | 1504.73 | 206.36 | 2240.54 | 1179.35 | 1274.51 |
| 2014 | 12271.70 | 5677.10 | 1484.70 | 200.65 | 1783.42 | 883.29 | 909.76 |
| 2015 | 10067.05 | 5577.04 | 1005.39 | 144.41 | 836.43 | 806.77 | 579.22 |
| 2016 | 9872.76 | 6130.85 | 1018.20 | 190.64 | 469.25 | 649.73 | 484.15 |
| 2017 | 9946.43 | 4490.02 | 752.71 | 134.44 | 477.78 | 514.29 | 437.88 |
| 2018 | 7397.21 | 3667.23 | 610.21 | 156.97 | 306.69 | 462.30 | 483.62 |
| 2019 | 7838.00 | 4760.17 | 1113.60 | 92.29 | 692.29 | 368.10 | 457.40 |
| 2020 | 5081.00 | 2759.08 | 704.50 | 123.04 | 668.98 | 448.63 | 249.20 |
| 2021 | 3426.16 | 1949.00 | 464.12 | 49.28 | 546.35 | 250.63 | 200.87 |
| 2022 | 6090.21 | 2858.39 | 611.78 | 57.44 | 542.38 | 331.92 | 512.85 |
| 2023 | 3803.70 | 1488.90 | 218.37 | 33.88 | 274.74 | 278.29 | 205.51 |
| 2024 | 1206.24 | — | 135.42 | 17.36 | 174.55 | 136.22 | 83.59 |

注 2019—2024 年数据第 2、3、4、8 列来源于应急管理部；第 2 列“农作物因旱受灾面积”2019 年之前为“作物因旱受灾面积”；第 3 列“农作物因旱成灾面积”2019 年之前为“作物因旱成灾面积”；第 4 列“农作物因旱绝收面积”2019 年之前为“作物因旱绝收面积”；“—”表示没有统计数据。

Note Data during 2019–2024 in columns 2, 3, 4，8 are from the Ministry of Emergency Management; “ – ” means statistics don't exist.