

# Progresses of Flood Mitigation in China

China Institute of Water Resources and Hydropower Research (IWHR)

P. R. China



**1**

**Overview of Flood Disaster Situation**

**2**

**Achievements of Disaster Mitigation**

**3**

**Future Challenges**

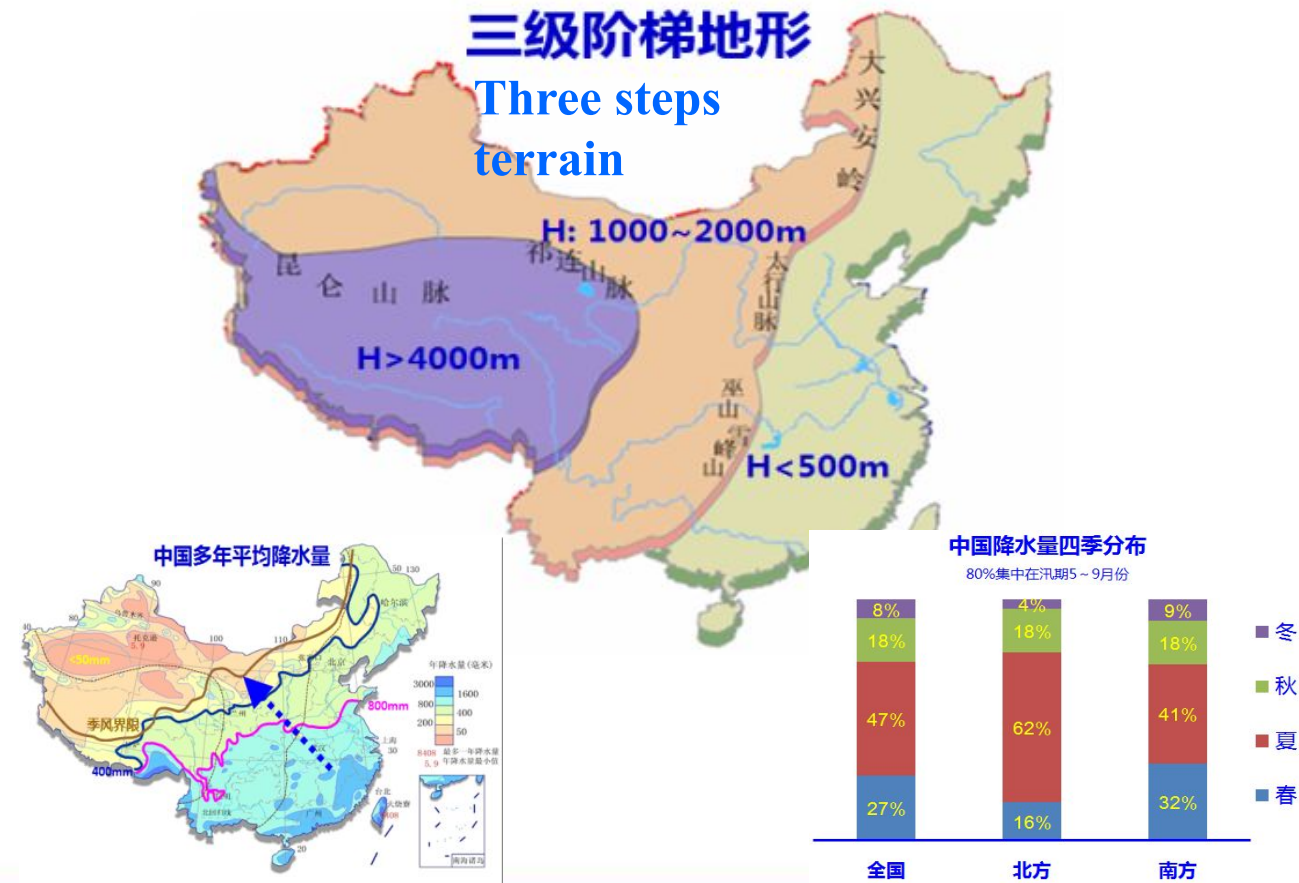
**4**

**Impact on Global Water Issues**

# 1 Overview of Flood Disaster Situation



## Physical geography and rainfall



# 1 Overview of Flood Disaster Situation

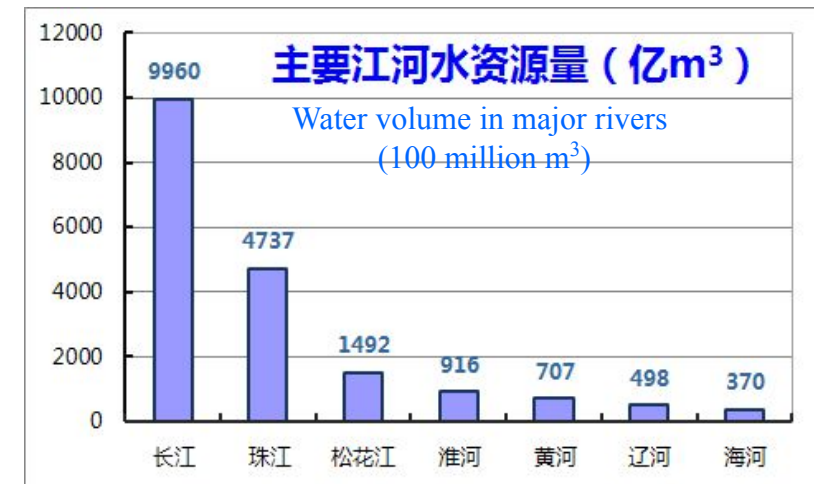


## Seven Great Rivers



**Numerous river system,  
serious flood mitigation task**

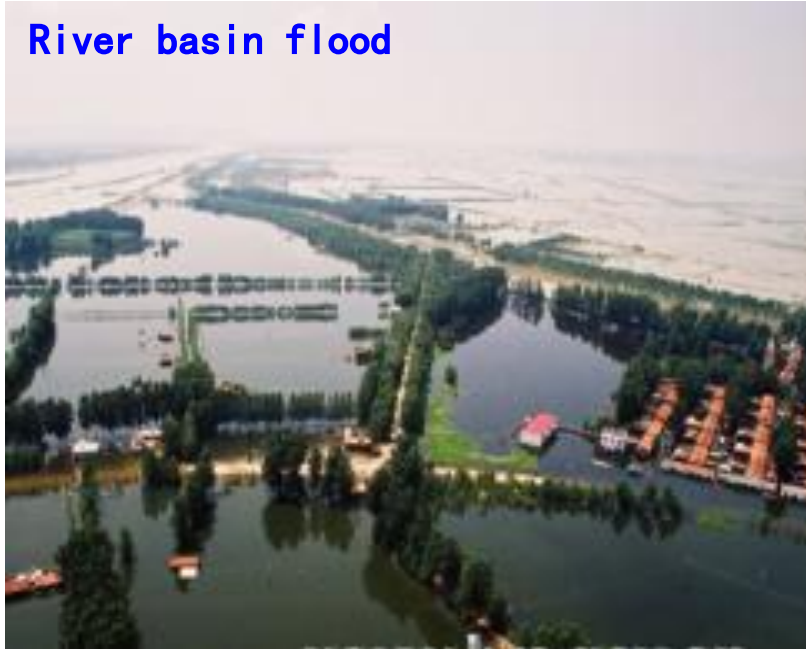
Basin areas/km <sup>2</sup>	Number of river	Total length/10 <sup>4</sup> km
> 10,000	228	13.25
> 1000	2,221	38.65
> 100	22,909	111.46
> 50	45,203	150.85



# 1 Overview of Flood Disaster Situation



River basin flood



## Various disaster types

Typhoon



Flash flood



Urban flood



Ice flood



# 1 Overview of Flood Disaster Situation



**Historical flash floods events: 53,235**

**Population at risk: 300 million**

## Extensive influence and severe disaster losses

Flood disaster distribution in China

### 中国洪涝灾害分布



# 2 Achievements of Disaster Mitigation



## 2.1 Engineering measures

□ 414,000 kilometers of dikes



Jingjiang  
dike of  
Yangtze river



Dike of Yellow river



Dike of Songhua river



Dike of Shanghai

# 2 Achievements of Disaster Mitigation



## 2.1 Engineering measures

□ 98,000 reservoirs

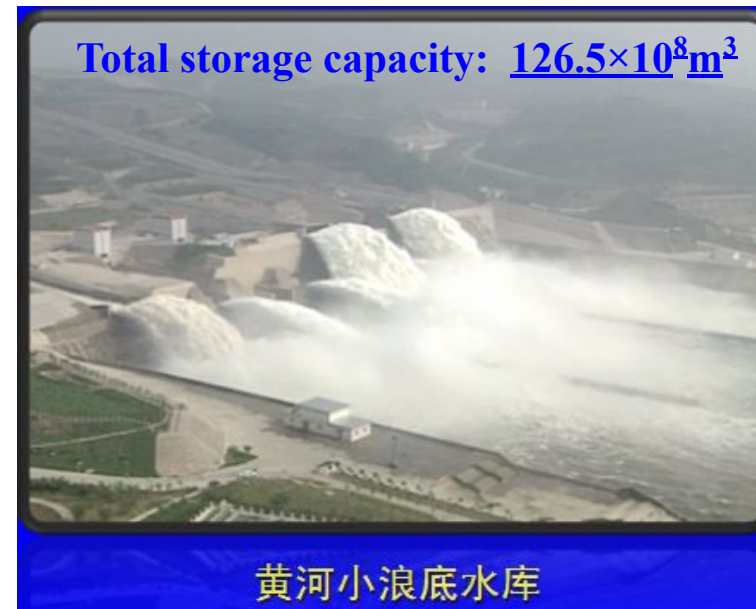
□ Total storage capacity:  $9,323 \times 10^8 \text{m}^3$

□ Large-sized reservoirs: 756

□ Medium-sized reservoirs: 3,938



Three Gorge Reservoir on Yangtze river



Xiaolangdi reservoir on Yellow river



# 2 Achievements of Disaster Mitigation



## 2.1 Engineering measures

□ 98 key flood detention basins

□ Total area of flood detention basins: 33,700km<sup>2</sup>

□ Storage capacity of flood detention basins: 1,074×10<sup>8</sup>m<sup>3</sup>



Jingjiang flood detention basin



Dongping Lake flood detention basin

# 2 Achievements of Disaster Mitigation



## 2.1 Engineering measures

- 97,000 sluices
  - Large-sized sluices: 860
  - Medium-sized sluices: 6,332



Sanshengong sluice on Yellow river



Bengbu sluice on Huai river

# 2 Achievements of Disaster Mitigation



## 2.1 Engineering measures

□ Over 2,000,000 irrigation districts

□ Irrigation districts with irrigation area of 300,000 acres: 456



Irrigation district of Ganfu plain in Jiangxi



Canal of Jiamakou irrigation district in Shanxi

# 2 Achievements of Disaster Mitigation



## 2.1 Engineering measures

- Main reaches of large rivers have the ability to withstand the biggest floods since 1949.



Dike of Yellow river's mainstream



Medium/small rivers harness project in Jiangxi

# 2 Achievements of Disaster Mitigation



## 2.1 Engineering measures

- Design standard of urban flood control projects: once in 50–200 a
- Design standard of key sea embankments: once in 50–100 a



Dike of Wuhan city



Sea embankment in Zhejiang province

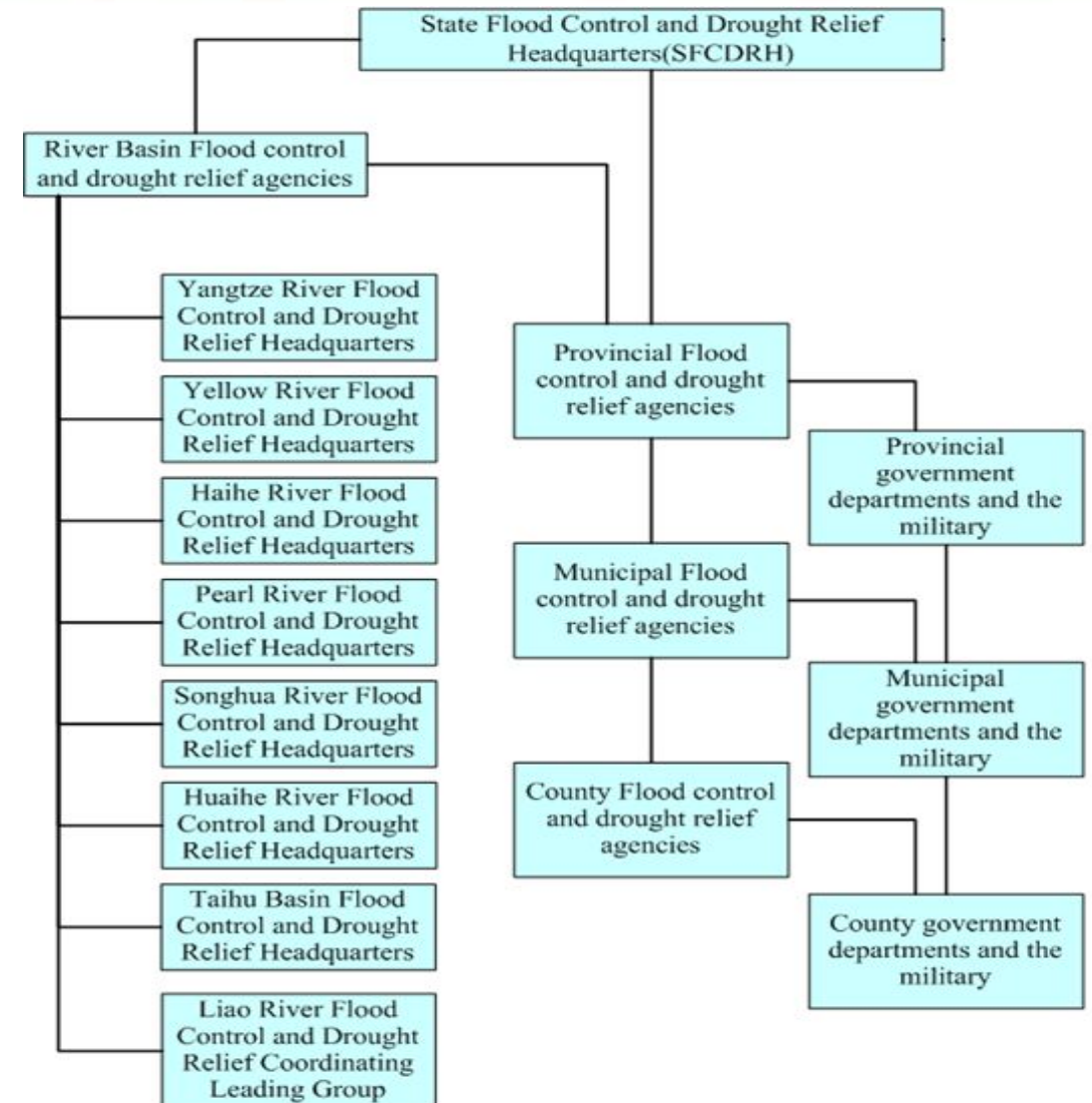
# 2 Achievements of Disaster Mitigation



## 2.2 Non-engineering measures

### □ Administrative structure

- Unified command
- Interdepartmental communication
- Identified responsibility
- Cooperation between army and civilian.



# 2 Achievements of Disaster Mitigation



## 2.2 Non-engineering measures

### □ Responsibility system

- **The chief administrative officials of people's governments at all levels shall assume overall responsibility for the work of flood control and drought management.**

# 2 Achievements of Disaster Mitigation



## 2.2 Non-engineering measures

### □ Regulation system

- Regulation system of flood control and drought mitigation has been established. A series of laws or regulations have been enacted and implemented, including water Law, Flood Control Law, Flood Prevention Regulation, Drought Relief Regulation etc.





# 2 Achievements of Disaster Mitigation



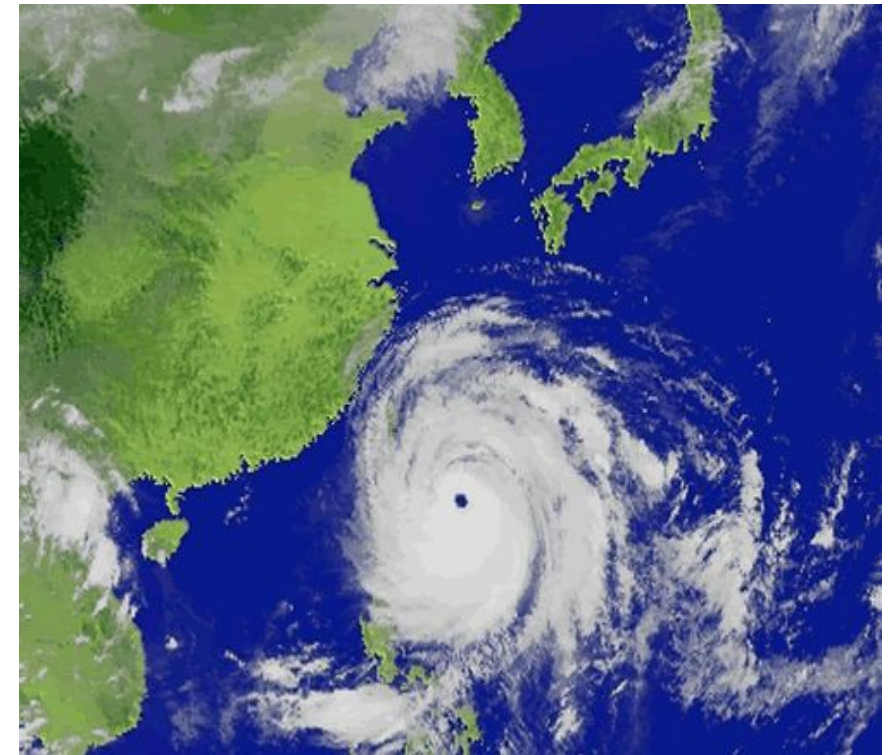
## 2.2 Non-engineering measures

### □ Early-warning and forecasting

- **Monitoring, forecasting and early-warning system for water, rainfall and typhoon have been constructed.**



Water and rainfall monitoring



Typhoon early-warning

# 2 Achievements of Disaster Mitigation



## 2.2 Non-engineering measures

### □ Project scheduling

□ Flood detention, flood diversion, flood storage, flood drainage.....

- **According to the principle that the part obeys the whole and the region obeys the watershed, Coordinate the upstream, downstream, left and right banks, and scientifically dispatch various water conservancy projects**

# 2 Achievements of Disaster Mitigation



## 2.2 Non-engineering measures

### □ Guarantee system

- **Professional rescue teams: over 300,000 people**
- **Reserved materials for flood control and drought relief: over 11 billion Yuan (about 1700 million USD)**



Flood rescue rehearsal

Reserved materials



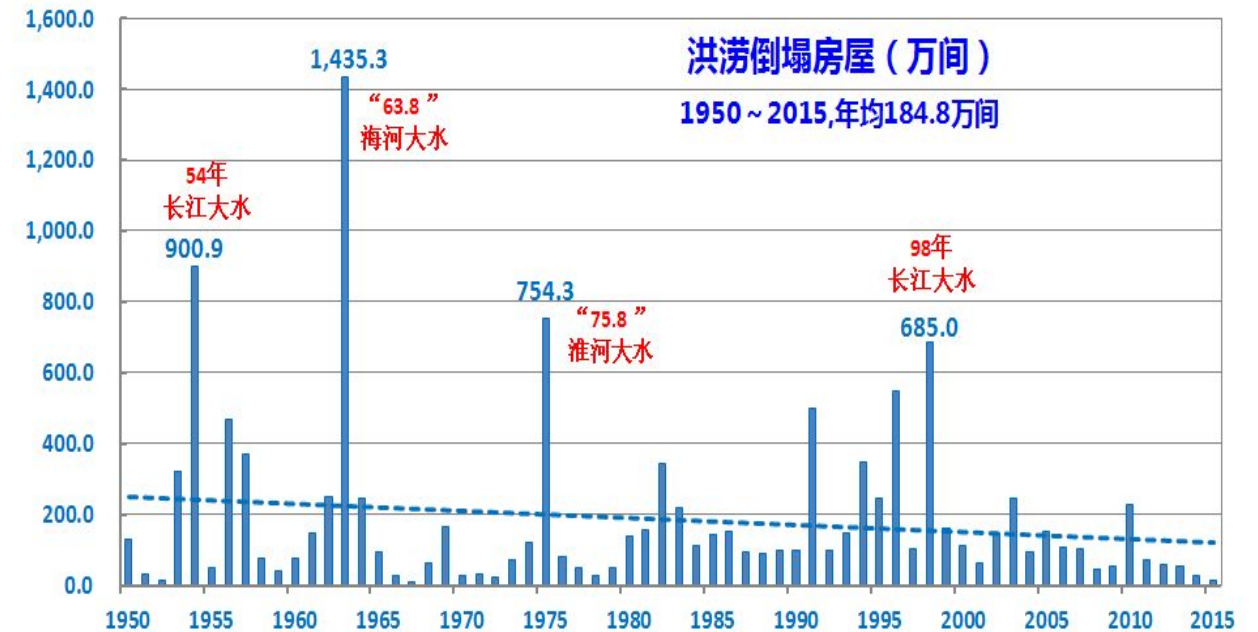
# 2 Achievements of Disaster Mitigation



## 2.3 Huge mitigation benefits

Since 1950s:

- Flood mitigation benefit: 4,600 billion RMB (725,000 million USD);
- Reduced agricultural land inundation: 0.18 billion hector;
- Reduced grain losses: 0.76 billion tons;
- Greatly reduced property collapse;
- Significantly reduced fatality.



# 2 Achievements of Disaster Mitigation



## 2.3 Huge mitigation benefits

**Year 1990-2015:**

- **Direct economic loss increased linearly by 7.4%, nearly half of GDP increase;**
- **The ratio decreased gradually: from 0.91% 20 years ago to 0.25% at present.**

# 2 Achievements of Disaster Mitigation



## 2.3 Huge mitigation benefits

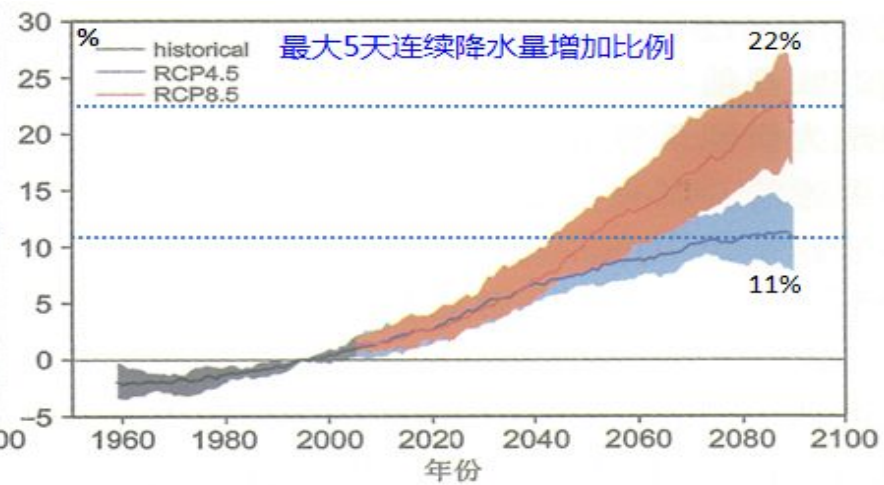
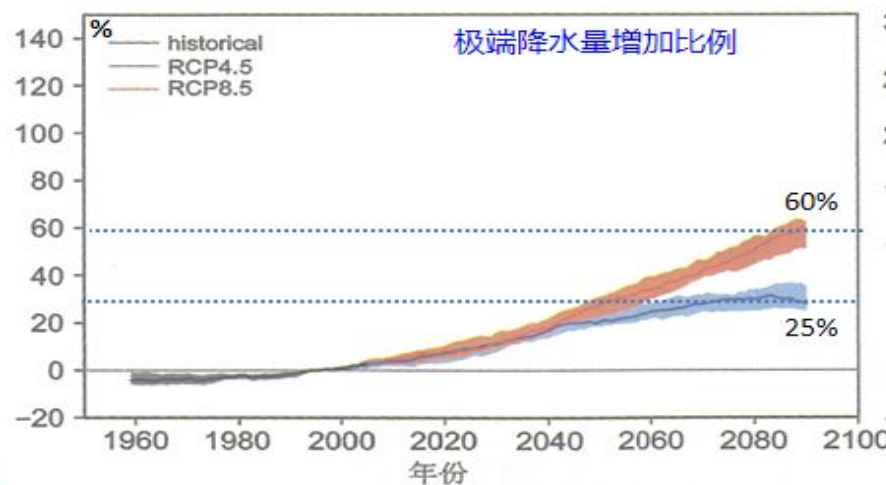
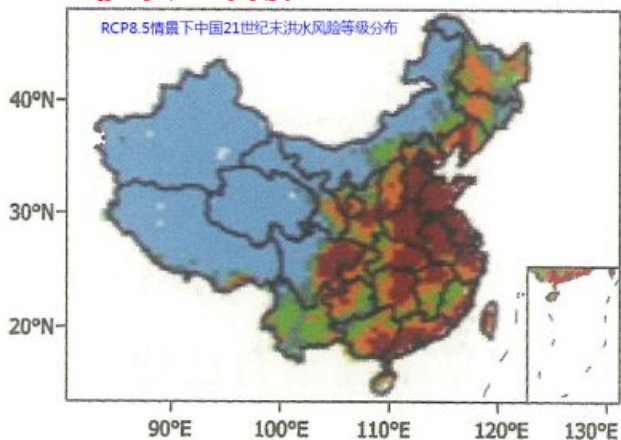
- **Human fatality due to river flood and flash flood takes 70-80% of total flood fatality.**
- **Since 2010, investment of national flash flood prevention project has reached 30 billion RMB (about 4700 million USD), as a result, population fatality induced by flash flood was greatly reduced with 680 people in average.**

# 3 Future challenges



## 3.1 Climate change will increase extreme precipitation and flood risks.

- **Future 21 century:**
- Predicted extreme precipitation event will increase, and the frequency, intensity, ratio and 5-day maximum precipitation will also be increased.
- Compared with 1986-2005, under Scenario RCP 4.5, extreme precipitation, 5-day maximum precipitation will increase by 25% and 11%, storm frequency will increase by 58%, and flood and drought risk will also increase largely.
- High risk areas include middle east, southeast coastal areas, northeast capital cities and parts in Shaanxi and Shanxi provinces.



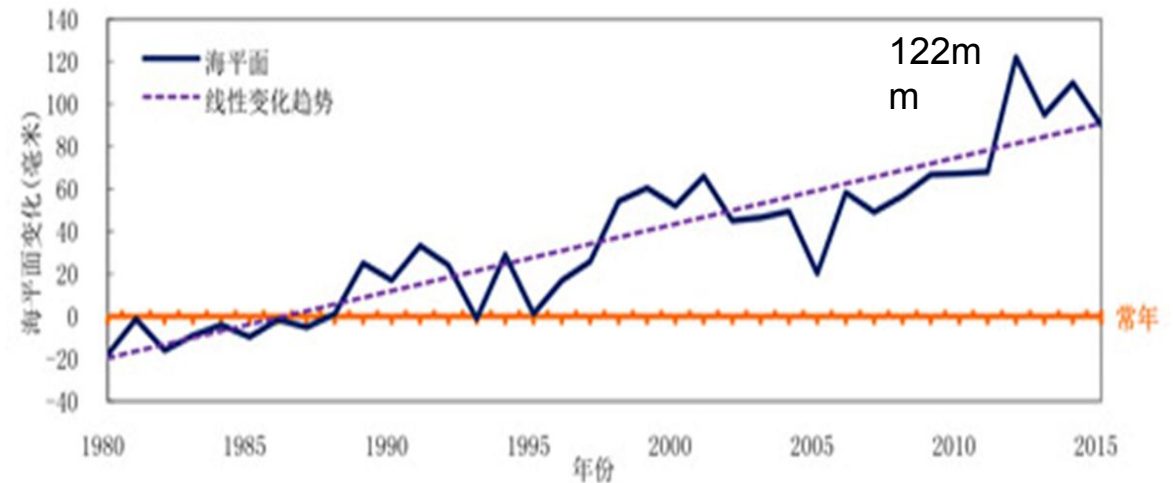
# 3 Future challenges



## 3.2 Rising of sea level will increase flood risks in coastal areas.

- From 1980 to 2005, the increasing rate of sea level is 3.0 mm/a, higher than global average, and continue to increase in the future.
- Flood drainage difficulties in coastal cities will increase, making flood control capacity of present works lower, typhoon and tidal disaster losses larger, and flood risks greater.

	2015	Future 30 years
Bohai Sea	94	+65~155
Huanghai Sea	91	+75~165
East China Sea	96	+70~160
South China Sea	82	+75~165



1980~2015年中国沿海海平面变化

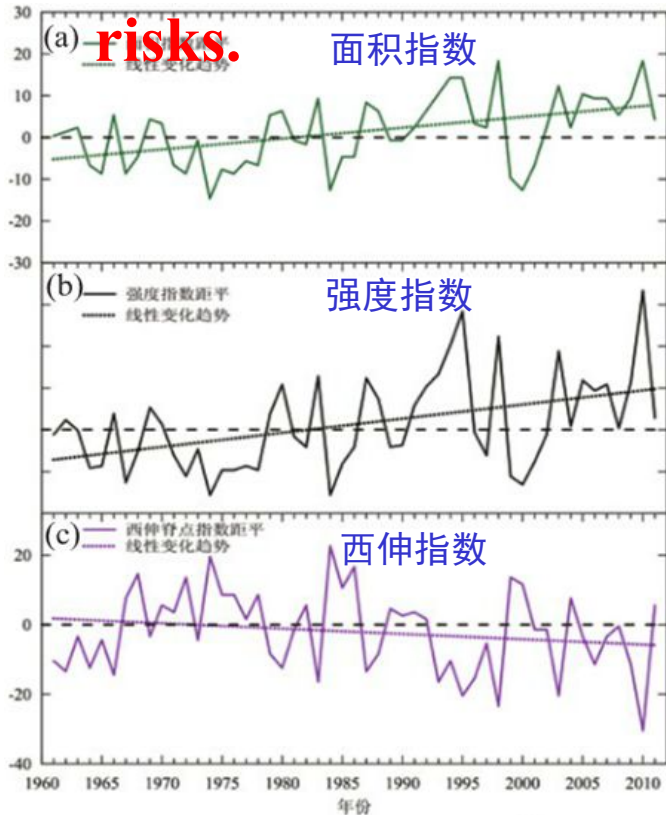


# 3 Future challenges

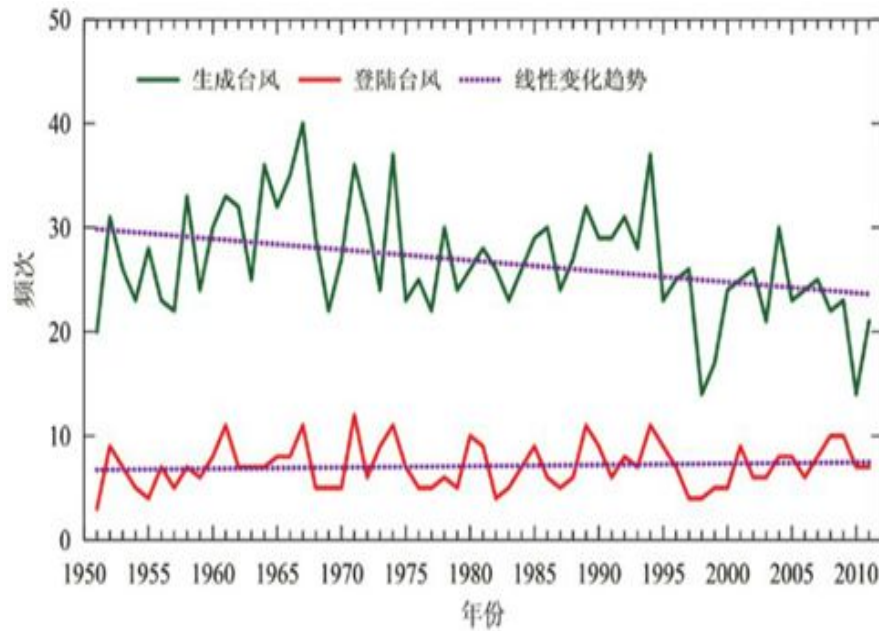


## 3.3 Extreme disaster risks of typhoon, storm and tidal will increase.

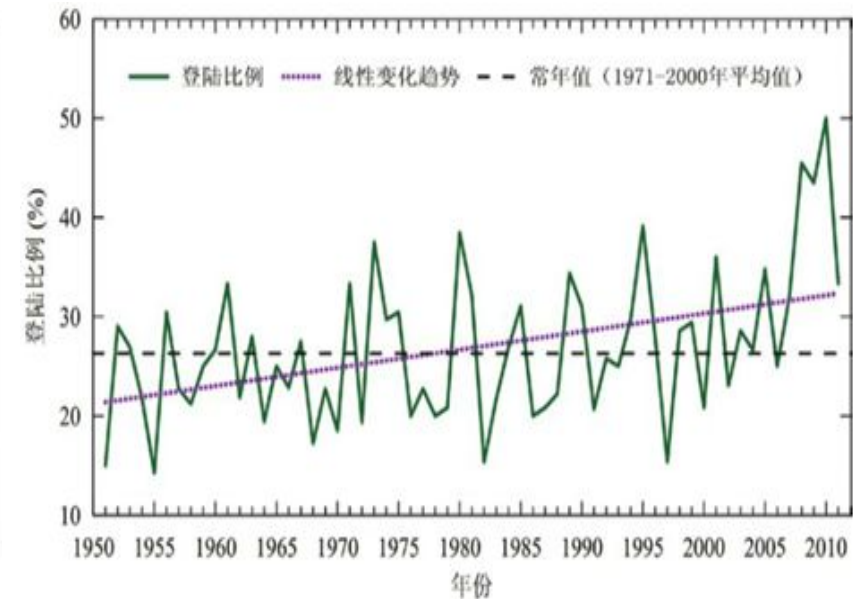
- Future: frequency of typhoon will decrease, while landing ratio and intensity will increase, as well as typhoon, storm and tidal intensity and extreme flood disaster risks.



1961-2011年夏季西太平洋副热带高压特征量距平变化



1951-2011年西北太平洋和南海生成台风频次变化



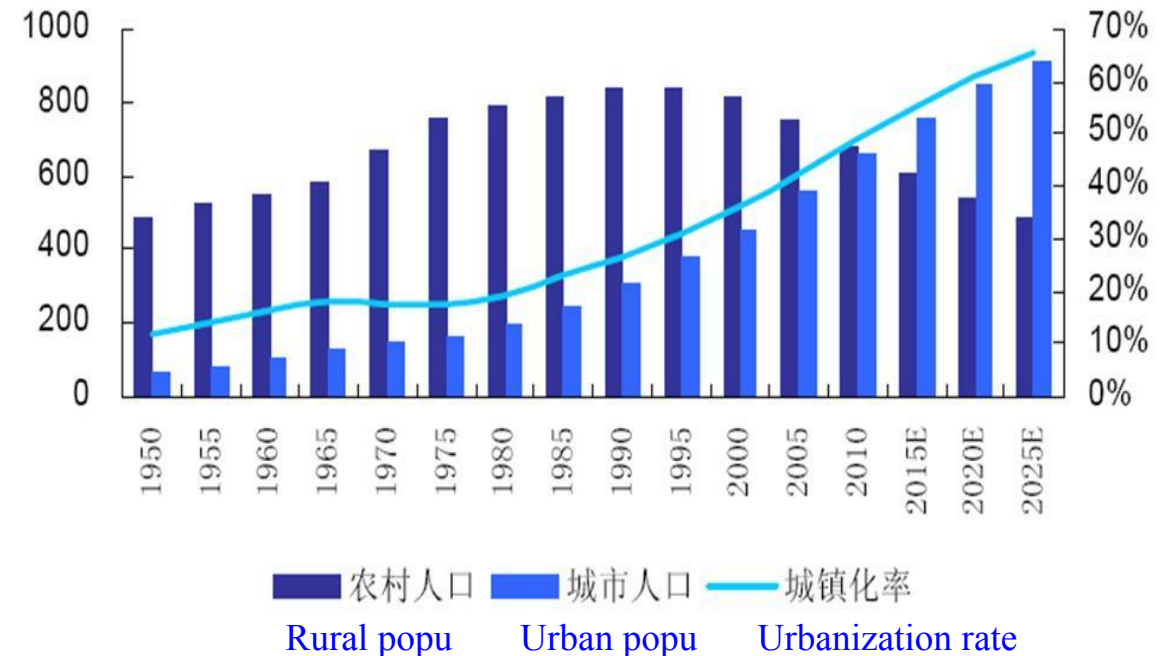
1951-2011年台风登陆中国比例变化

# 3 Future challenges



## 3.4 Social-economic development need higher requirements for flood and drought mitigation.

- The need for flood and drought mitigation is much higher for rapid development of urbanization and coastal economy, poverty alleviation, eco-civilization and beautiful China, adoption of people-oriented concept and realizations of well-off society in the future.
- There's a grand task and a long way to go.



# 4 Impact on Global Water Issues



## 4.1 Major problems

Climate change has great impact on rainfall, as a result, makes extreme precipitation frequency, intensity and areas larger. In addition, the rising of sea level and development of urbanization and social economy cause higher risks on flood and drought disasters.

Related problems are.....

- Not all the great rivers have met the planning flood standard, and there's great uncertainty in coping with extra standard flood.
- River basin flood & flash flood disaster
- Urban flood issues and influences
- Low standard of storm tidal management
- Unsafe engineering works of levee and small reservoir
- Conflict of flood mitigation and utilization
- Inadequate non-engineering works & risk management



# 4 Impact on Global Water Issues



## 4.2 Solutions

In addition to Carbon Dioxide mitigation and human activity restrictions, it is necessary to obey “No Regret” principle, continue to further improve engineering and non-engineering systems under the concepts of proper standard and harmony, and to further enhance integrated flood and drought risk management.

### □ Engineering works

□ Considering climate change impact, make researches on the changes of design conditions and design standard, and make suitable adjustments, so as to meet the standard of social-economic development.

### □ Enhance engineering weak links

□ Disqualified river basin projects, urban flood and waterlogging prevention, small and medium-sized river management, interconnected river system, drought control infrastructures, emergency water supply project, etc. Enhance operation and maintenance toward existing projects in safe and good order.

# 4 Impact on Global Water Issues



## 4.2 Solutions

### □ Non-engineering works

#### □ Complete policy and regulations, create flood risk management mechanism

- Enhance law system
- Establish flood risk notice system, improve public participation
- Establish flood insurance system, etc

#### □ Continue to develop national flood and drought command system

- Enhance the ability of monitoring, early-warning and dispatching system, improve time and accuracy of early-warning system, increase emergency decision-making ability.

#### □ Improve Emergency Response Plan

- Emphasize training to enhance practicability, decrease loss and risks toward social-economic development.

#### □ Increase science and technology support

- Emphasize risk management theories and technical researches on flood and drought control, raise scientific level of planning, constructing, operating, administrating and evaluating, emphasize interdisciplinary researches.

# 4 Impact on Global Water Issues



- Stimulation of local jobs.
- Adoption of local products.



- Reduce life losses.
- Bridge gaps in economic and social development



- Gender balance.
- Female participation is required to be at least 40%.



- Enhance collaboration among different stakeholders
- Technology and knowledge dissemination, experience sharing



- Mitigate flash flood disasters
- Enhance ecological civilization.
- Improve local resilience to climate change.



- Establish a global partnership
- Flash flood prevention & management

***Thank you!***

