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Climate and Environment Changes in China

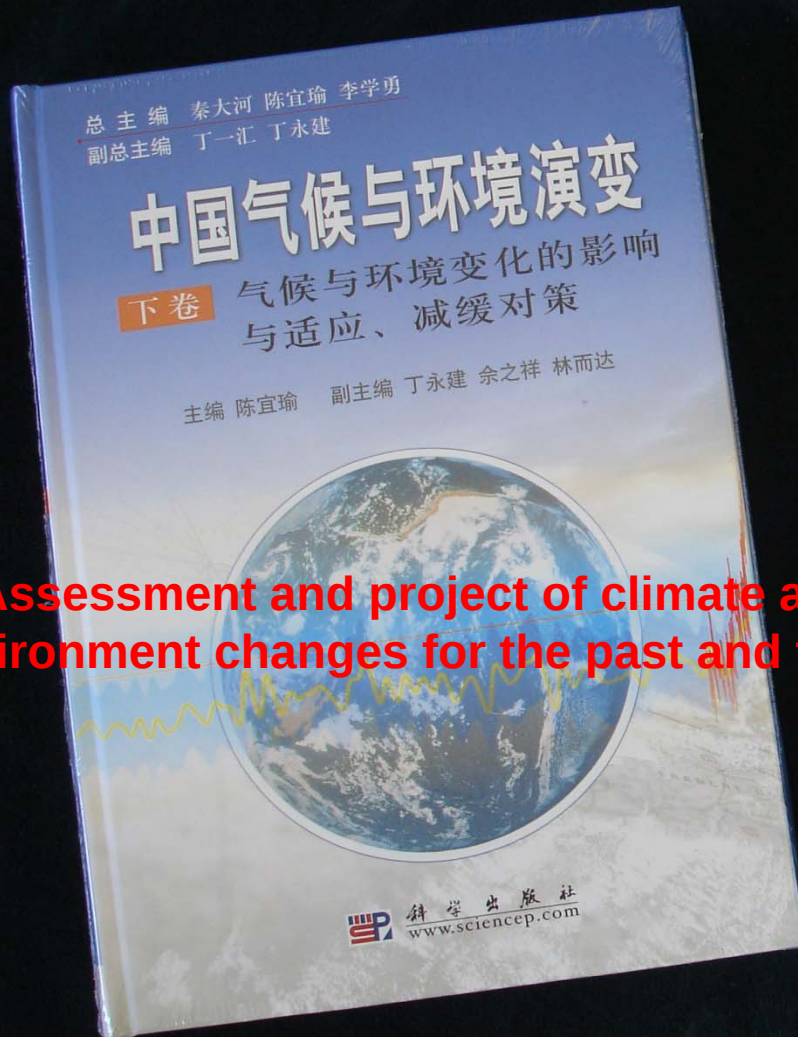
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and
Chinese Academy of Sciences

23 June 2008
Japan, CHINA



Climate and Environment Changes in China

Volume I and Volume II



Assessment and project of climate and Environment changes for the past and future

Impacts nature, economy , social,;
adaptation and mitigation
response strategies

8 10:52AM

Outline

1. Climate Change in China
2. Evolution of Ecology and Environment in China
3. Future Changes and Impacts
4. Response Strategies
5. Conclusions

Land $960 \times 10^4 \text{ km}^2$
Ocean $300 \times 10^4 \text{ km}^2$

Topography: the three steps

本图由中国科学院、国家计划委员会地理研究所计算机编辑与制图中心根据《中华人民共和国国家自然地图集》中的1:1000万“中国自然景观图”编绘而成。引用先进的印前处理及注记的计算机输入、编辑处理、合成、并缩小输出分色加网软件。

由西安伟航地图制印公司赞助印制
编辑设计:施祖辉
印前处理:齐清文、张忠、陈力等。
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Monsoon climate

1.Climate Change in China





Reasons for Climate Change

Natural

Anthropogenic

Ocean

Land

Volcano

**Solar
Activity**

**Natural
Variability**

**Greenhouse
Gases**

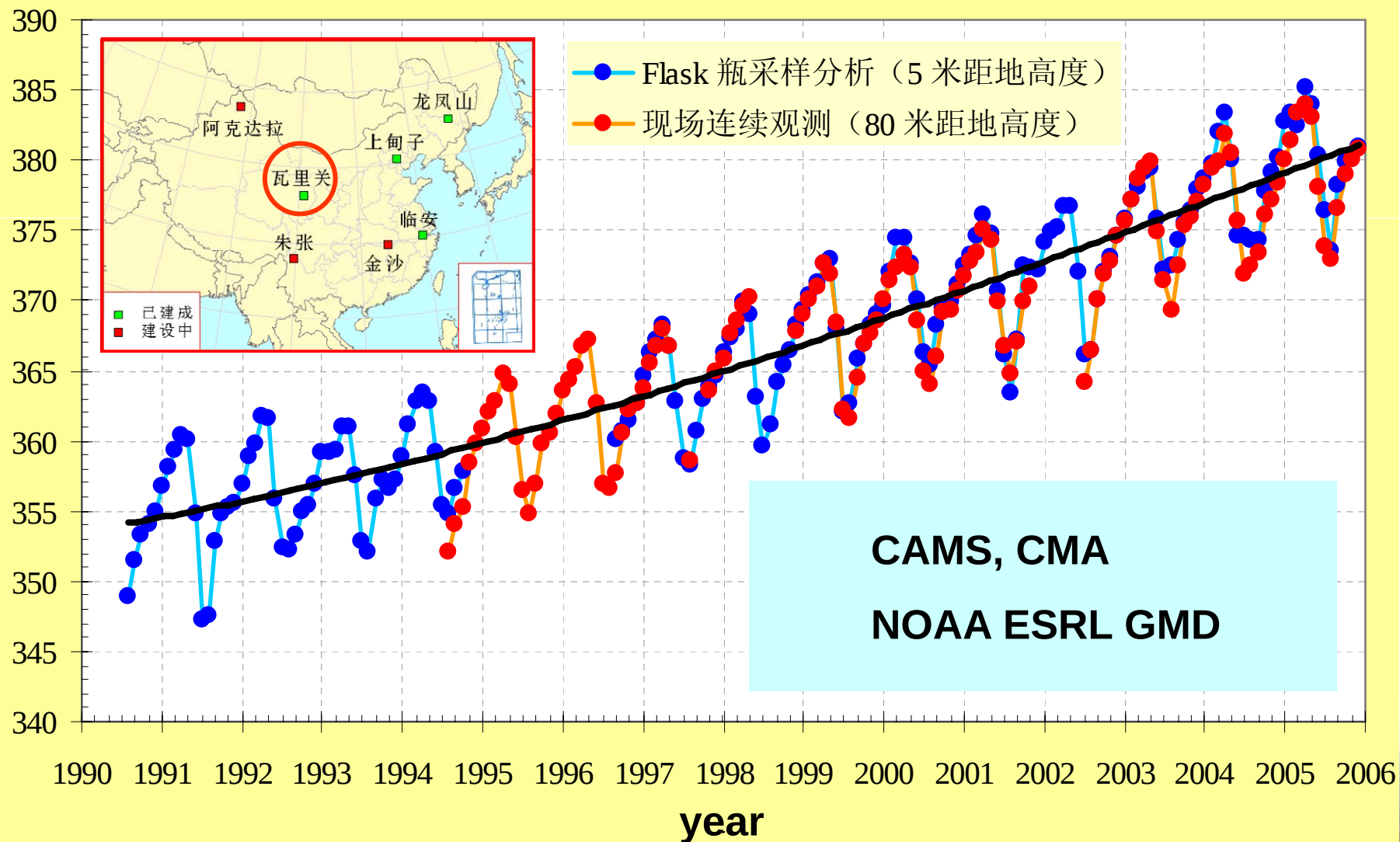
Aerosols

Land use

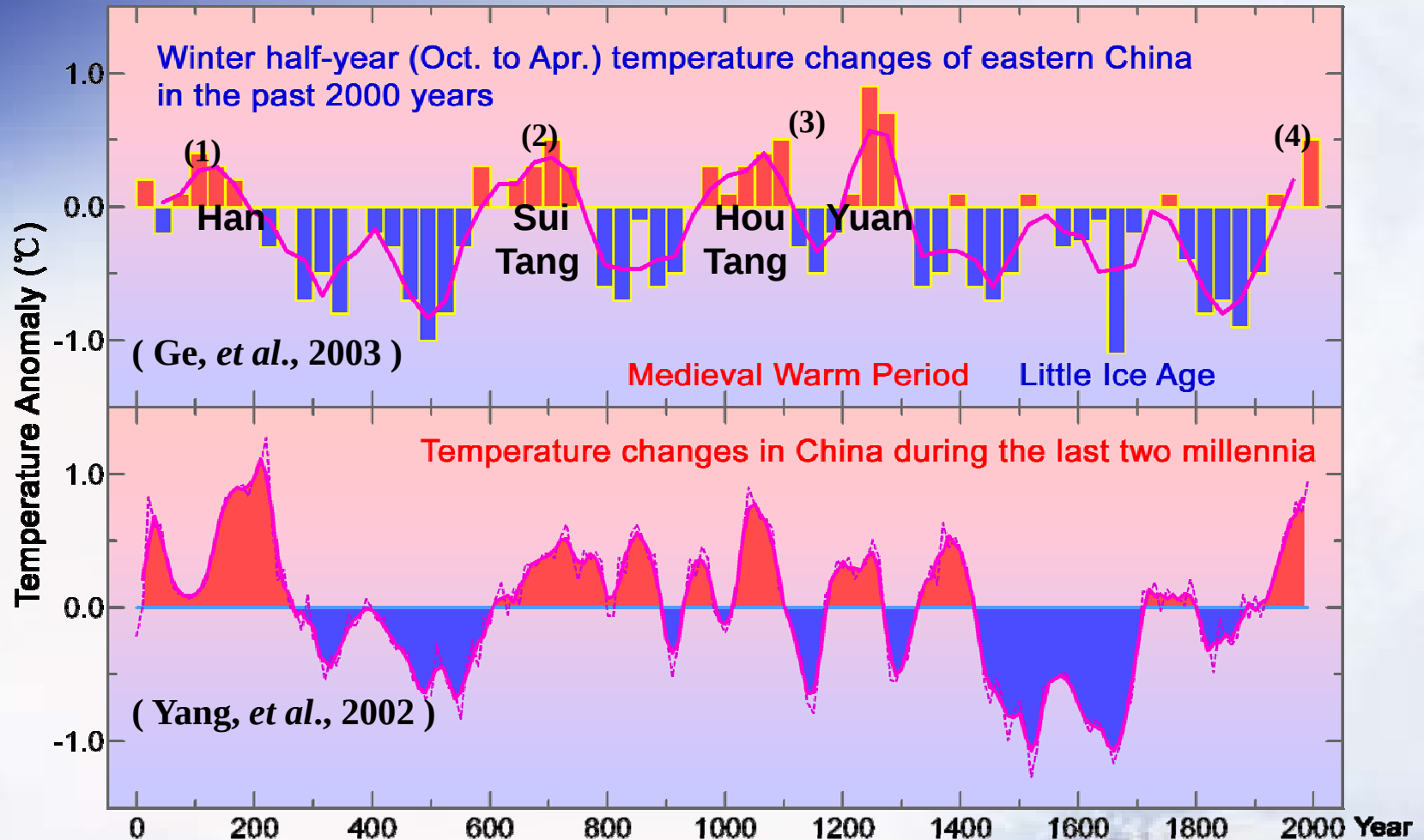
Urbanization

Atmospheric CO₂ concentration observed at Waliguan atmospheric baseline station of CMA

concentration of monthly mean CO₂



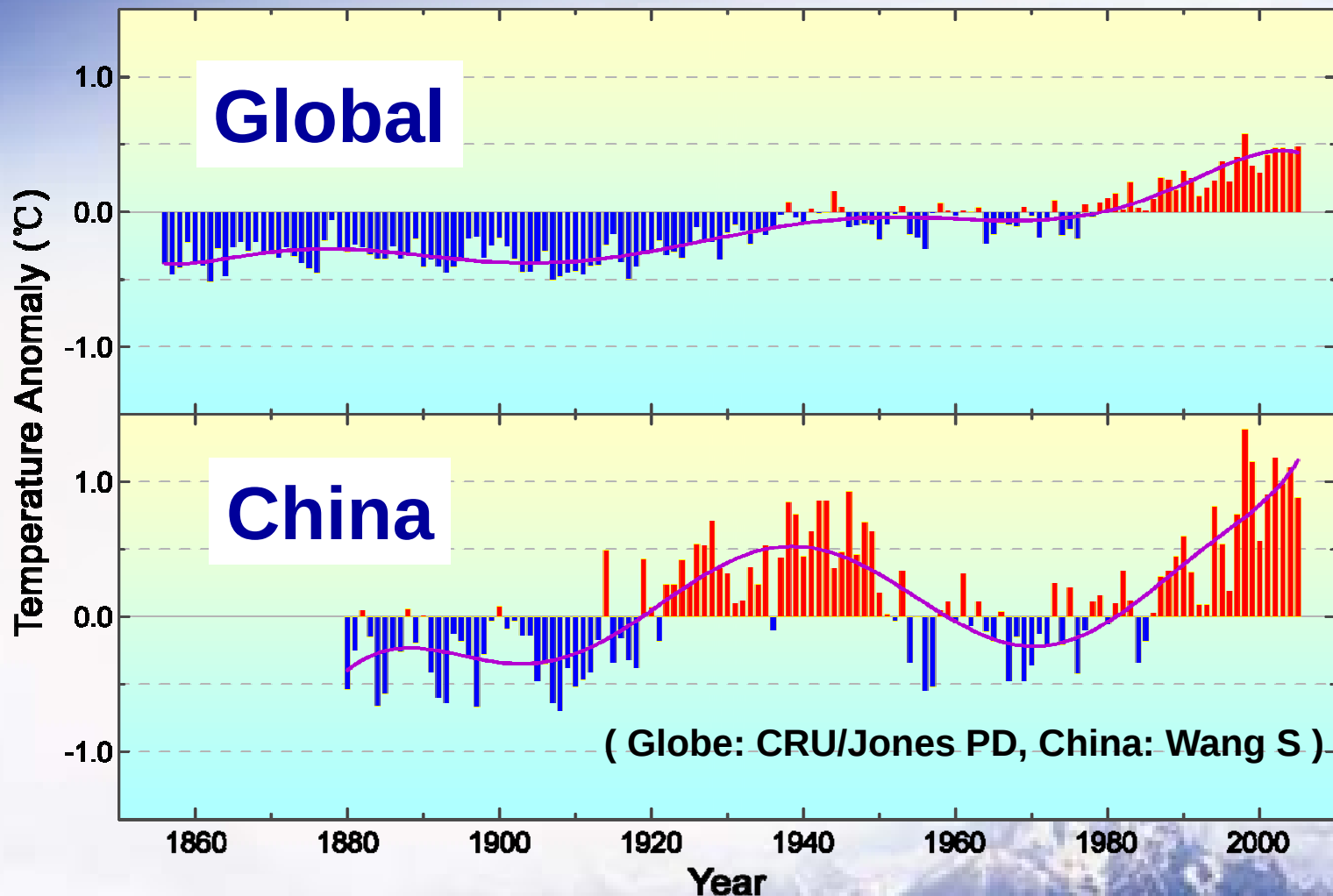
Temperature Variation at millennium scales



During the past 2000 years, there were at least four warm periods: (1) 1-200 AD; (2) 570-780 AD; (3) 930-1320 AD; and (4) 1920 AD-present

1. Climate Change in China

Global and China **annual temperature changes**
in the recent 100 years, relative to the period 1961-
1990

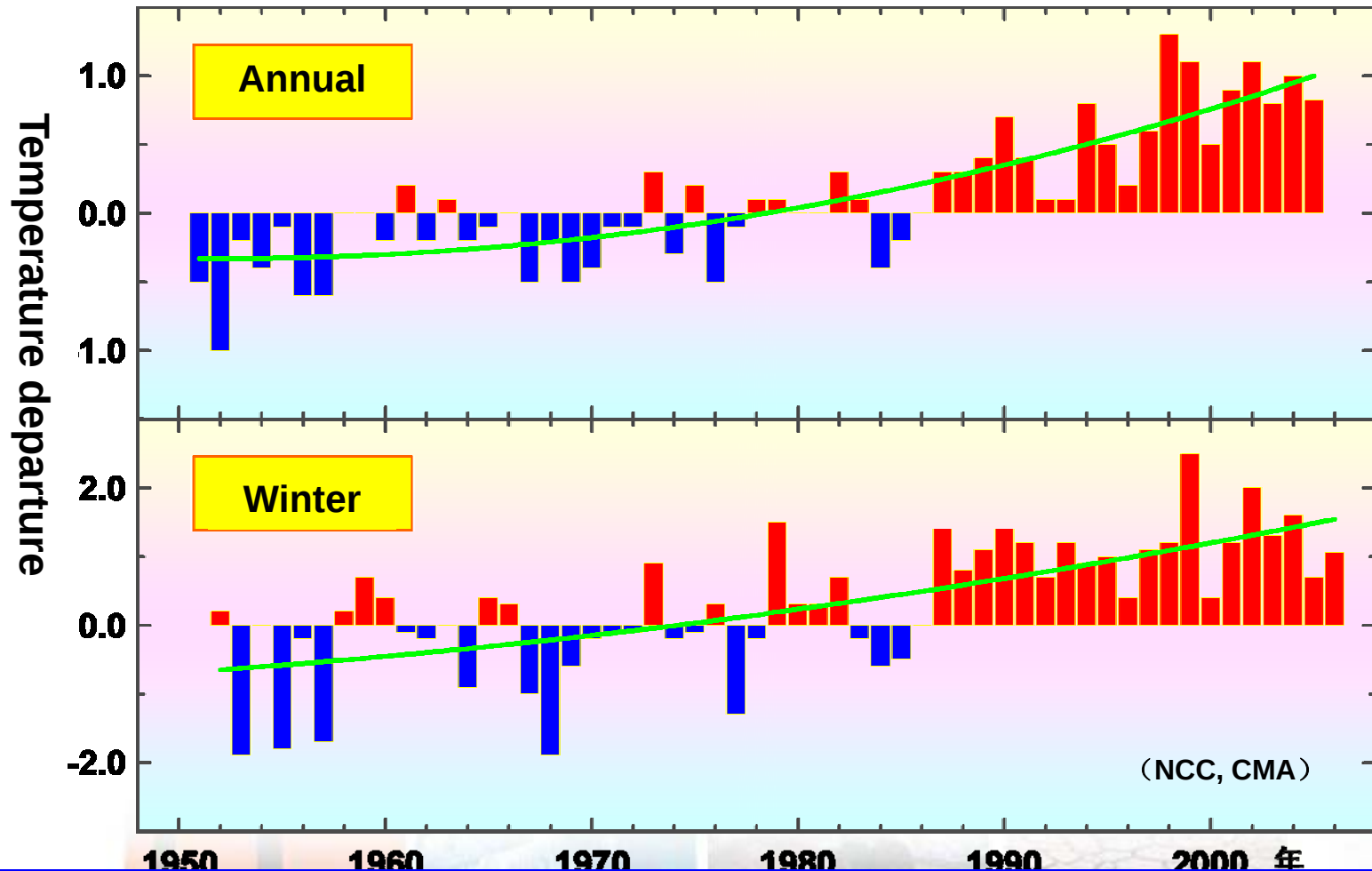


Warming trends for globe and China are significant in the past 100 years



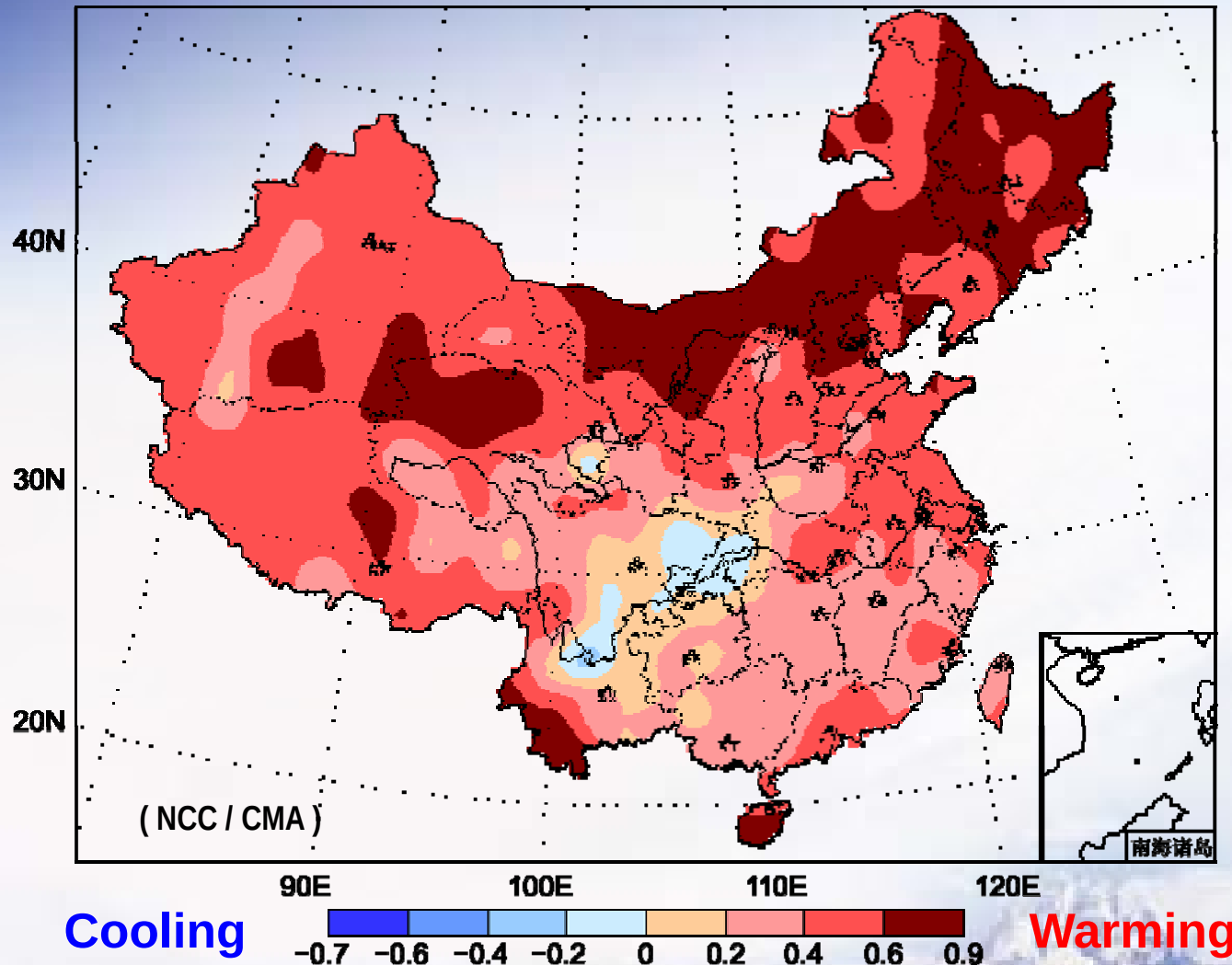
1. Climate Change in China

Temperature in recent 50 years of China Annual temperature variation of China since 1951



Since the winter of 1986/1987, 21 “warm winter” continuously occurred in China

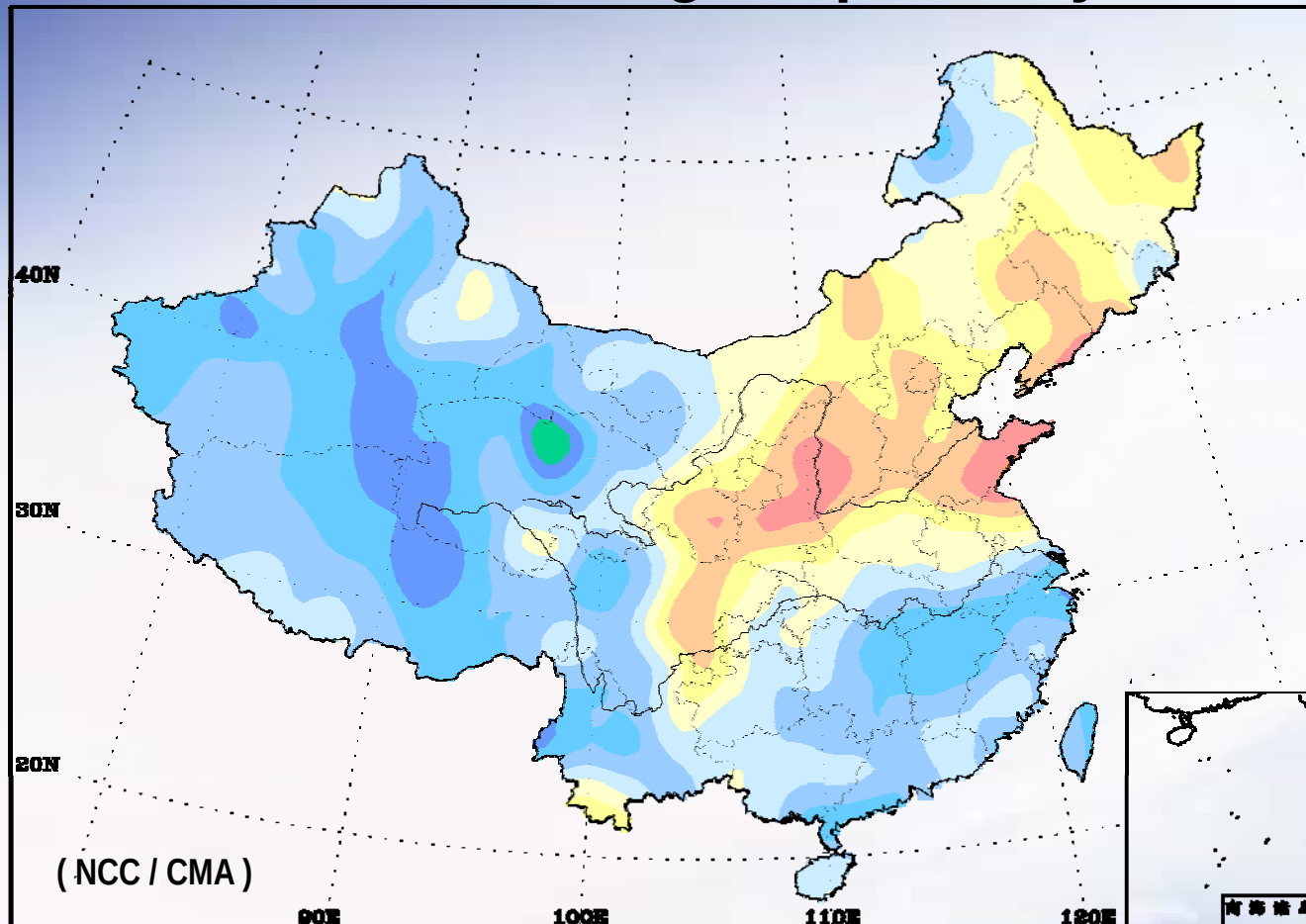
Spatial distribution of **temperature** changes over China during the past 50 years



Most regions turned to warmer, particularly in northern China

1. Climate Change in China

Spatial distribution of **precipitation** changes over China during the past 50 years



Decreasing -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 **Increasing**

More precipitation in western and southern, and much less in the North and northeast of China



2. Evolution of Ecology and Environment in China



Glacier

Sea ice

Sea level rise

Sand and dust storm

Lake area

Forest Coverage

Grassland degradation

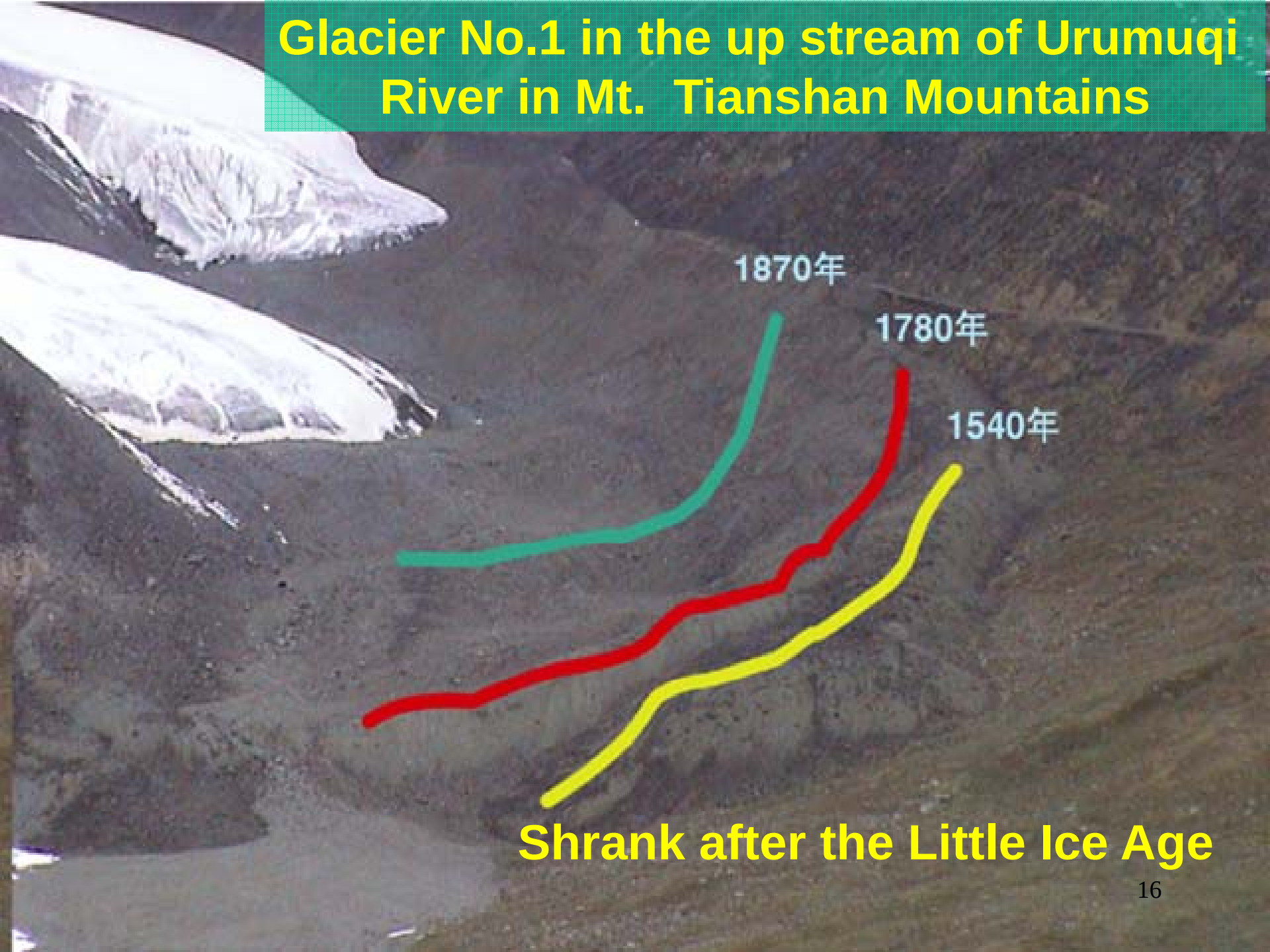
.....

Glacier in China

Glacier information in China (according to the result of Glacier Inventory):

- 46,342 glaciers (46,298)
- 59,414 km² (glacier area) (59,406)
- 5,601 km³ (ice value) (5,590)
- 0.4 % of the nature ice of world
- 0.6 % of the land territory of China

Glacier No.1 in the up stream of Urumuqi River in Mt. Tianshan Mountains



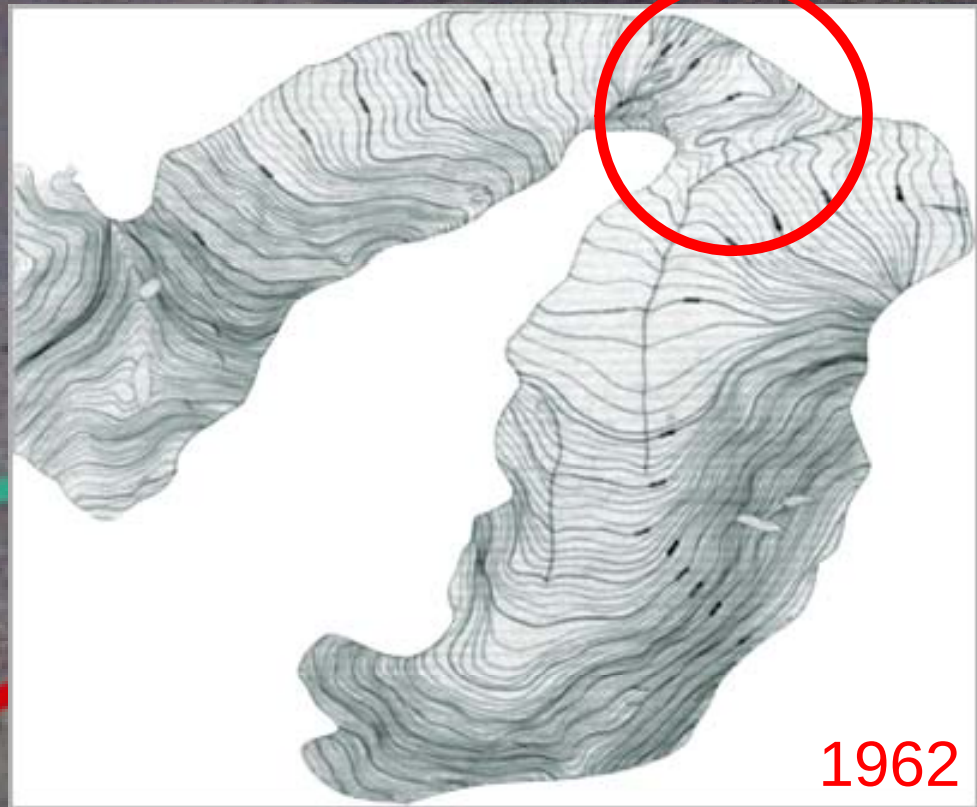
1870年

1780年

1540年

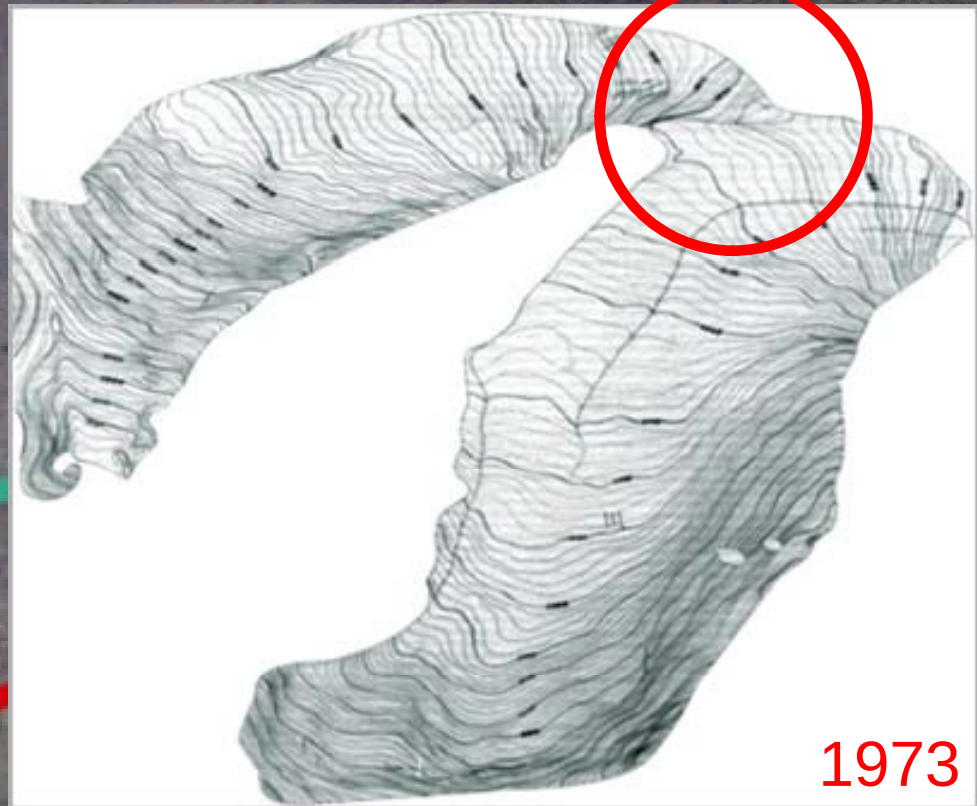
Shrank after the Little Ice Age

Glacier No.1 in the up stream of Urumuqi River in Mt. Tianshan Mountains



Continuingly shrank after 1962

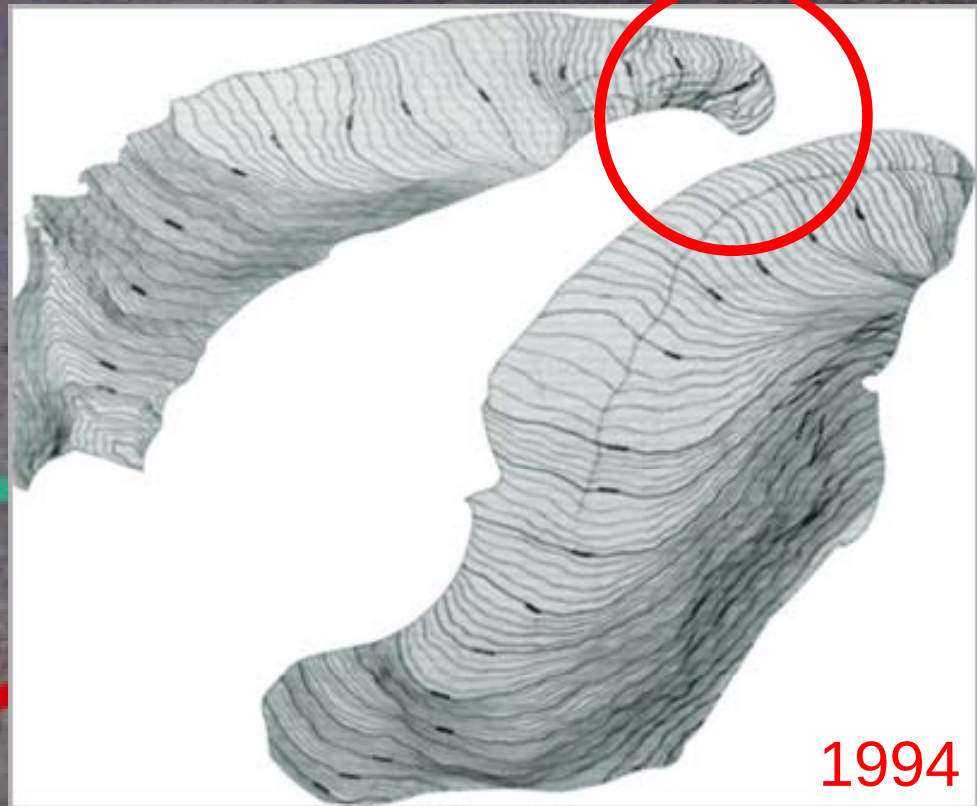
Glacier No.1 in the up stream of Urumuqi River in Mt. Tianshan Mountains



1973

Continuingly shrank after 1962

Glacier No.1 in the up stream of Urumuqi River in Mt. Tianshan Mountains



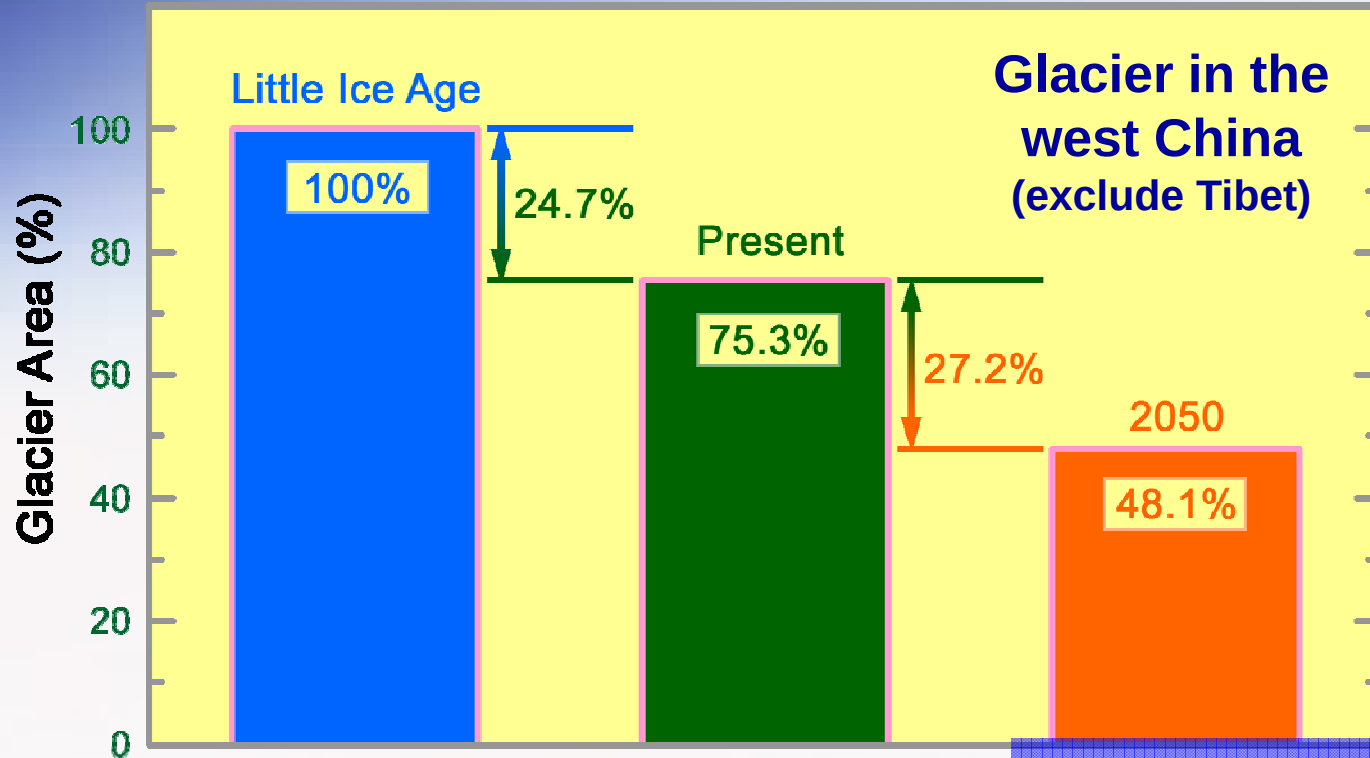
Continuingly shrank after 1962

今天面目！



Glacier retreated

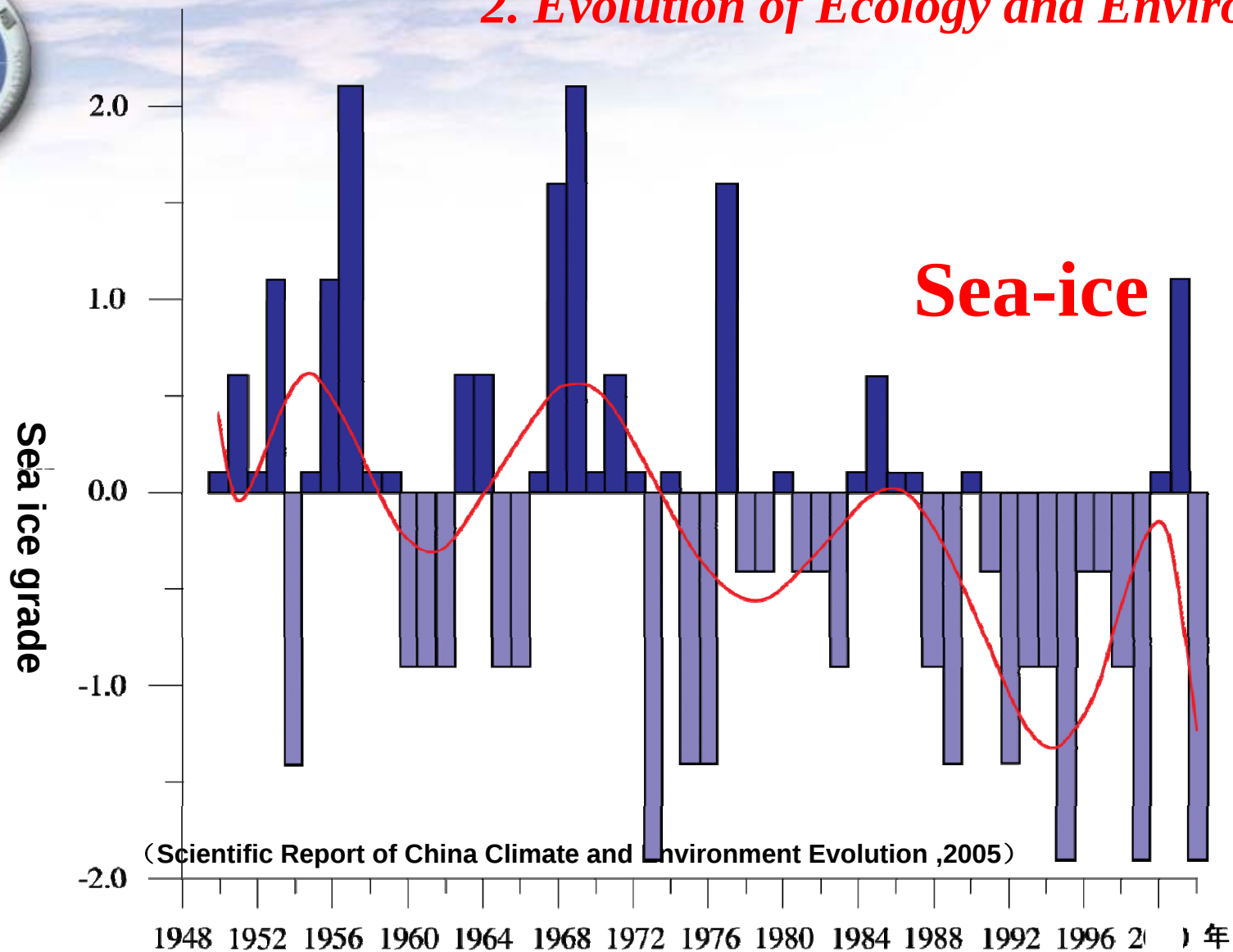
2. Evolution of Ecology and Environment



A half ice volume
of glaciers in
China would be
reduced by 2050s



2. Evolution of Ecology and Environment



Deviation change of sea ice grade in the Bohai Sea and the Yellow Sea from about last 50 years



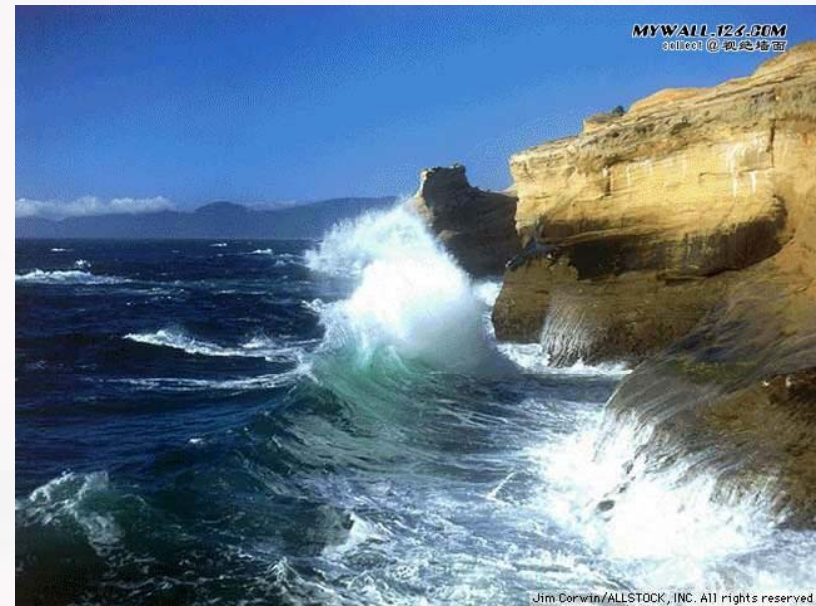
The sea level of China

- The mean sea level has risen by 160m in the past 15,000 yrs, similar to the global.
- In recent 50 years, the sea level rising rate is **1.0~2.5mm/year**.

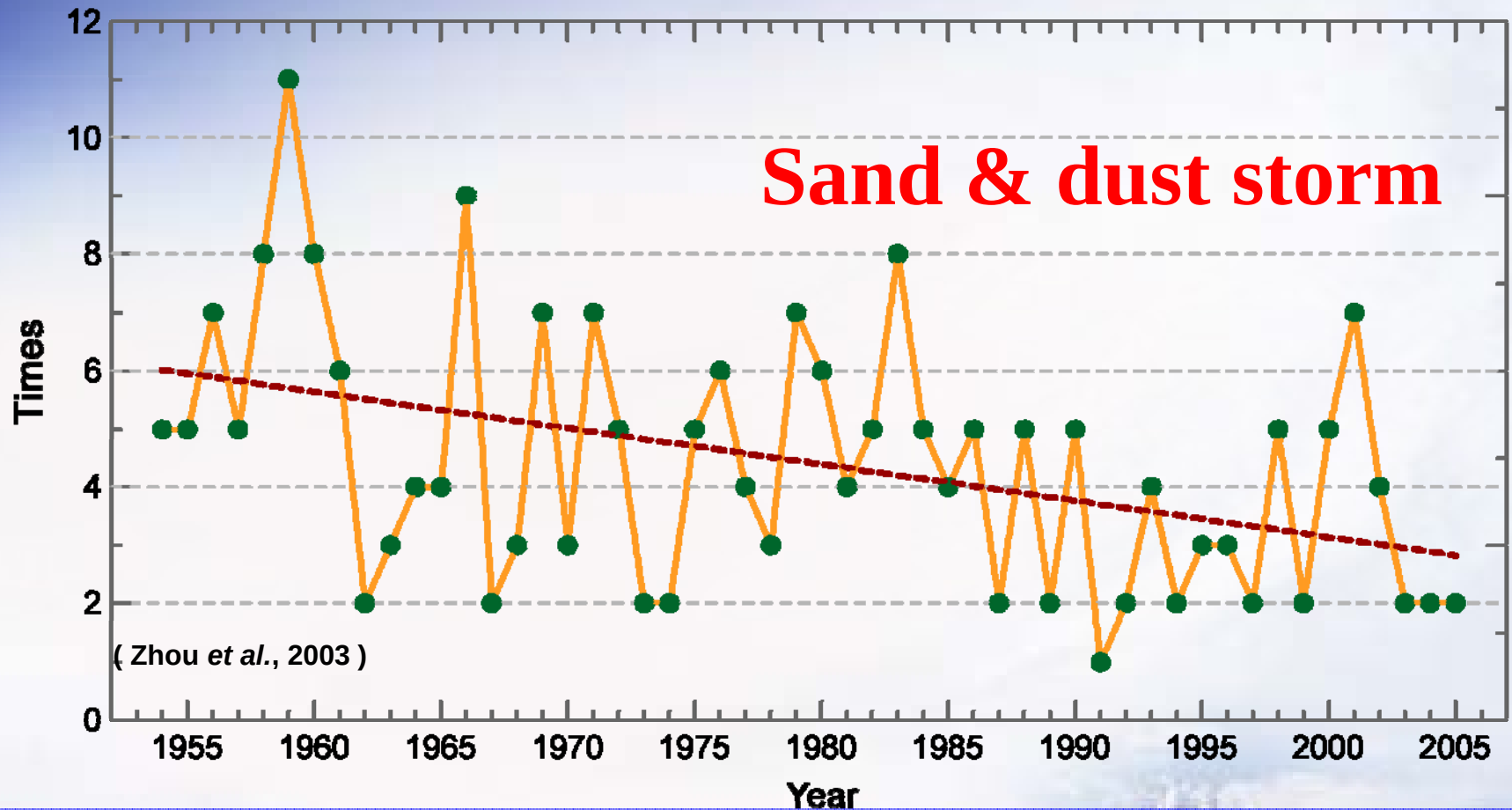
(IPCC TAR: 1- 2 mm/a)

(IPCC AR4: 1.2- 2.2 mm/a in 20th century)

Sea Level Rise



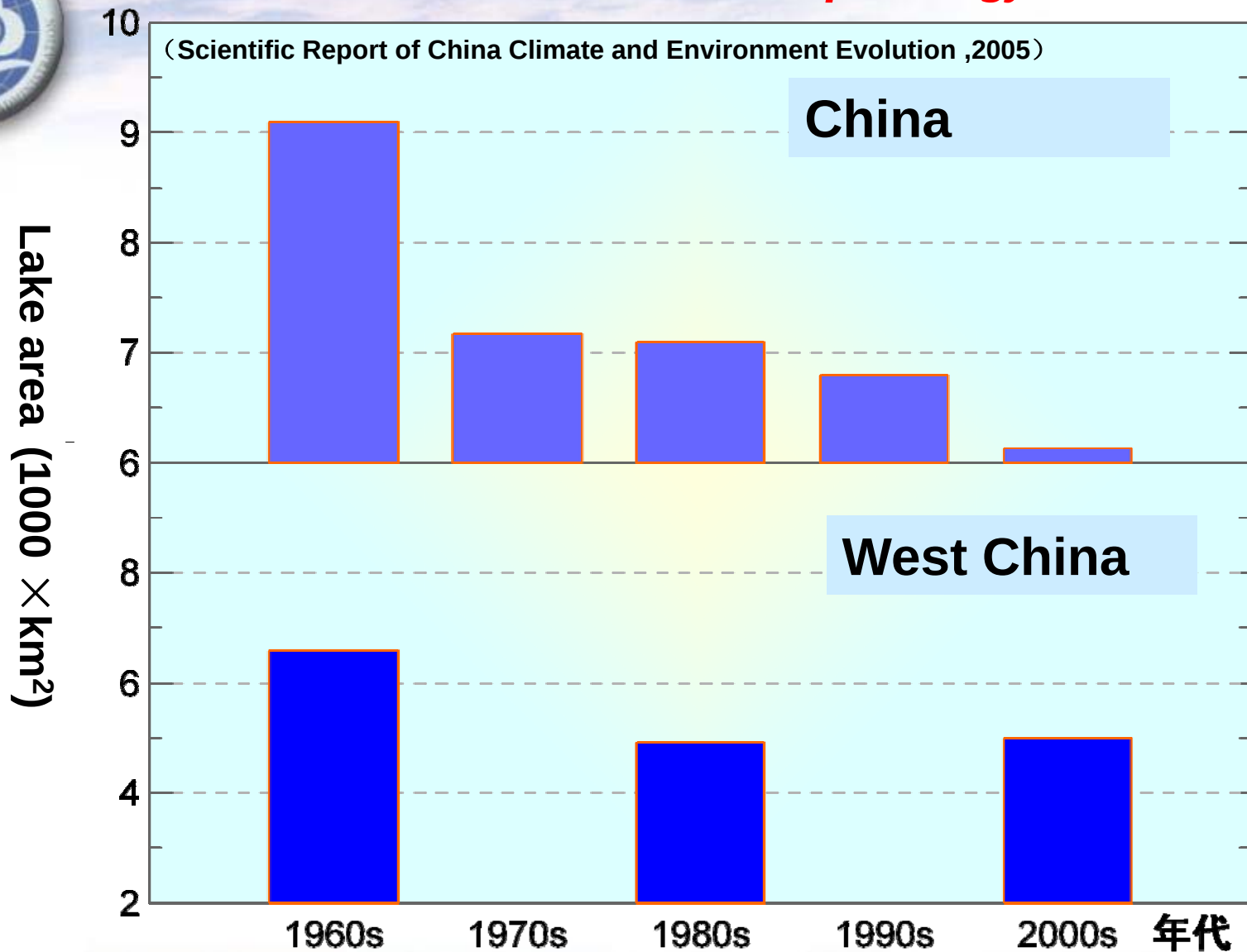
Occurrence of measured sand and dust storm in Northern China from 1954 to 2005



The sand and dust storm occurrence is gradually decreased in China during the recent 50 years



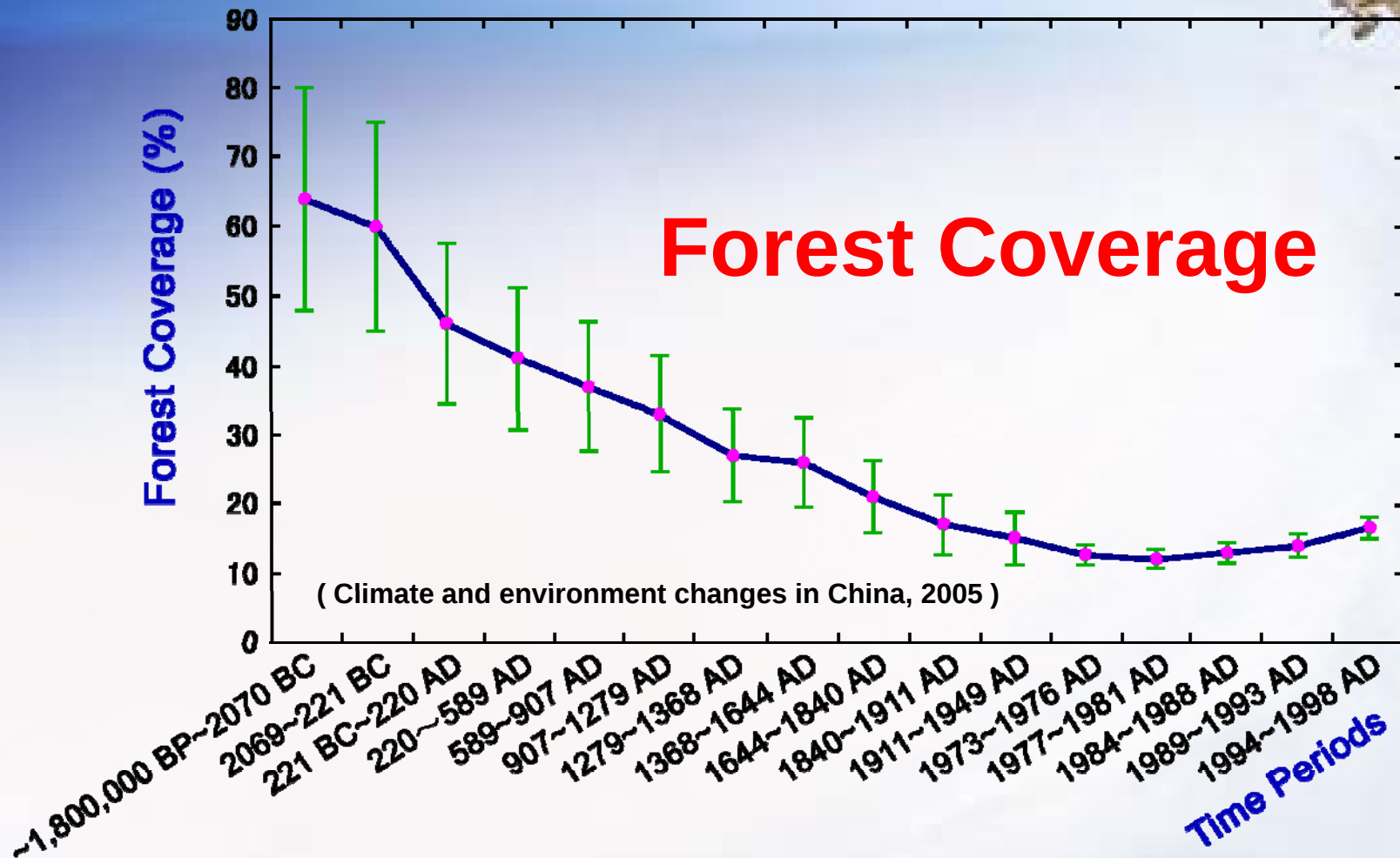
2. Evolution of Ecology and Environment



In recent 50 years, the lake areas in China shrank

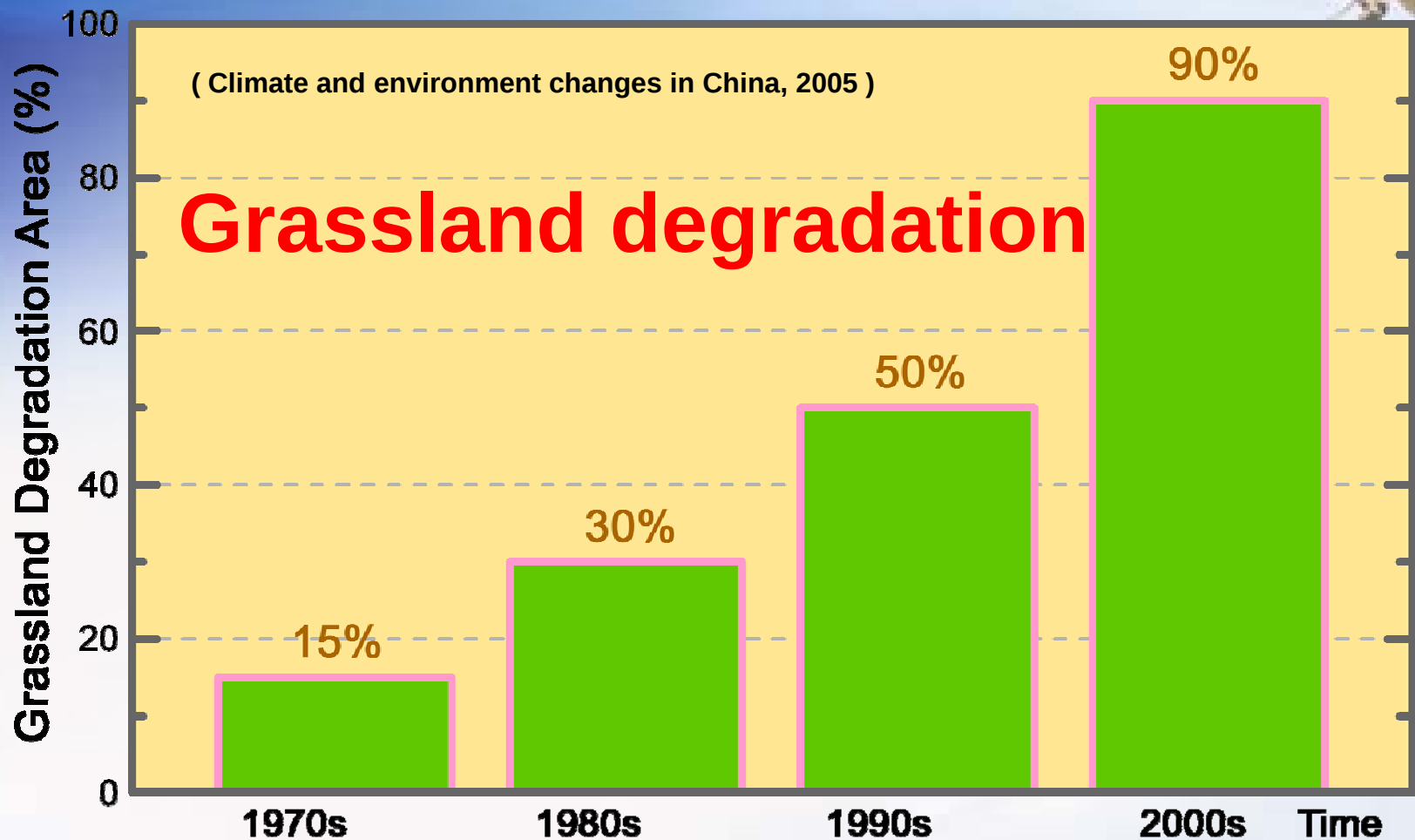


2. Evolution of Ecology and Environment



Four-thousand years before, the forest coverage in China was up to 60%, but by the end of 20th century was only 17%, equivalent to 61% of the world average.

2. Evolution of Ecology and Environment



The speed of grassland degradation increased in China

2. Evolution of Ecology and Environment



FinePix S5000 F5.0 1/480s ISO160

Mangrove

Mangrove and coral reef are degraded because of Global Warming.

The phenomenon of the **coral reef bleach and decease** was found in the ocean of Hainan and Guangxi.

Coral reef

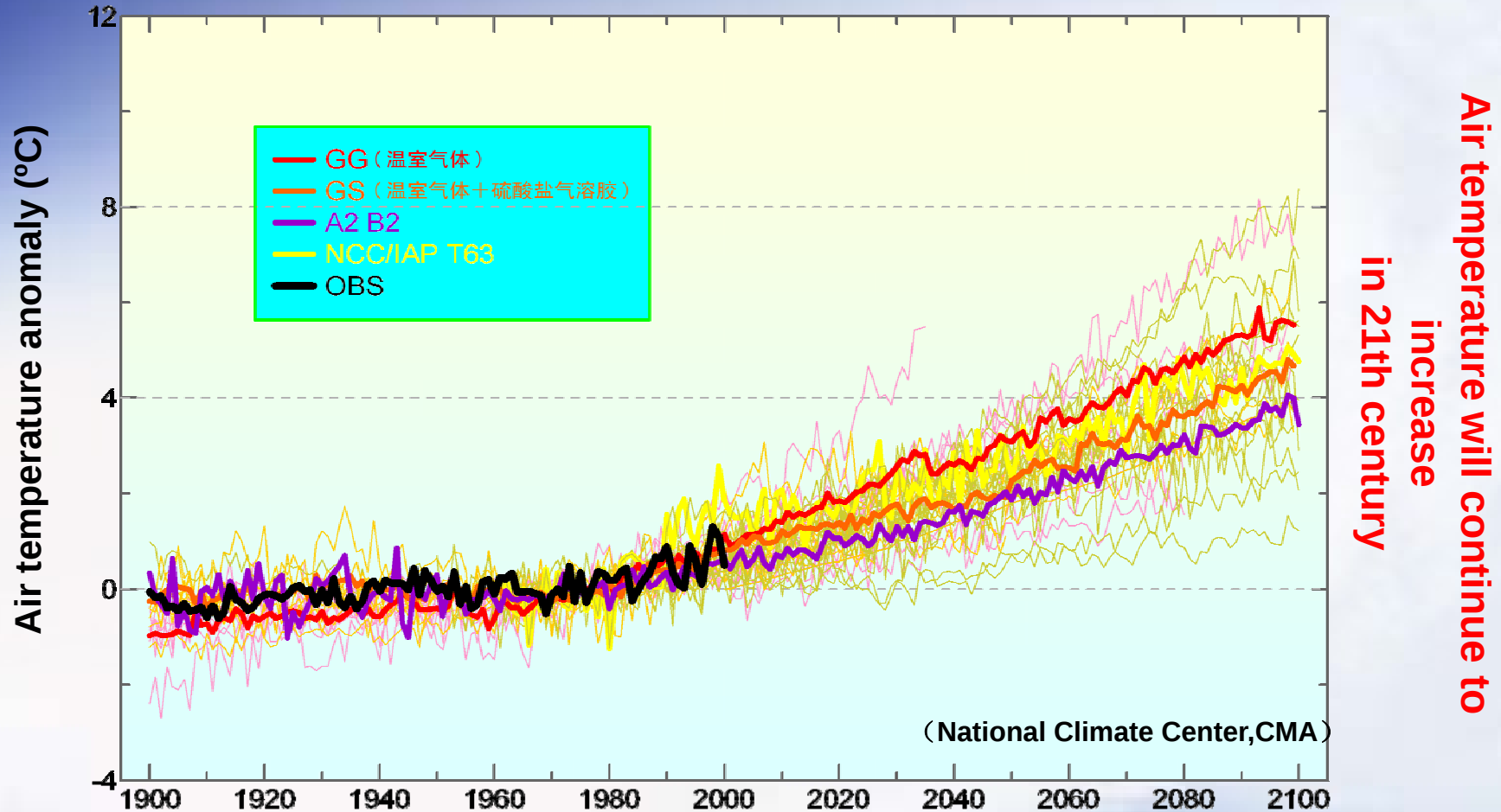


3. Future Changes and Impacts



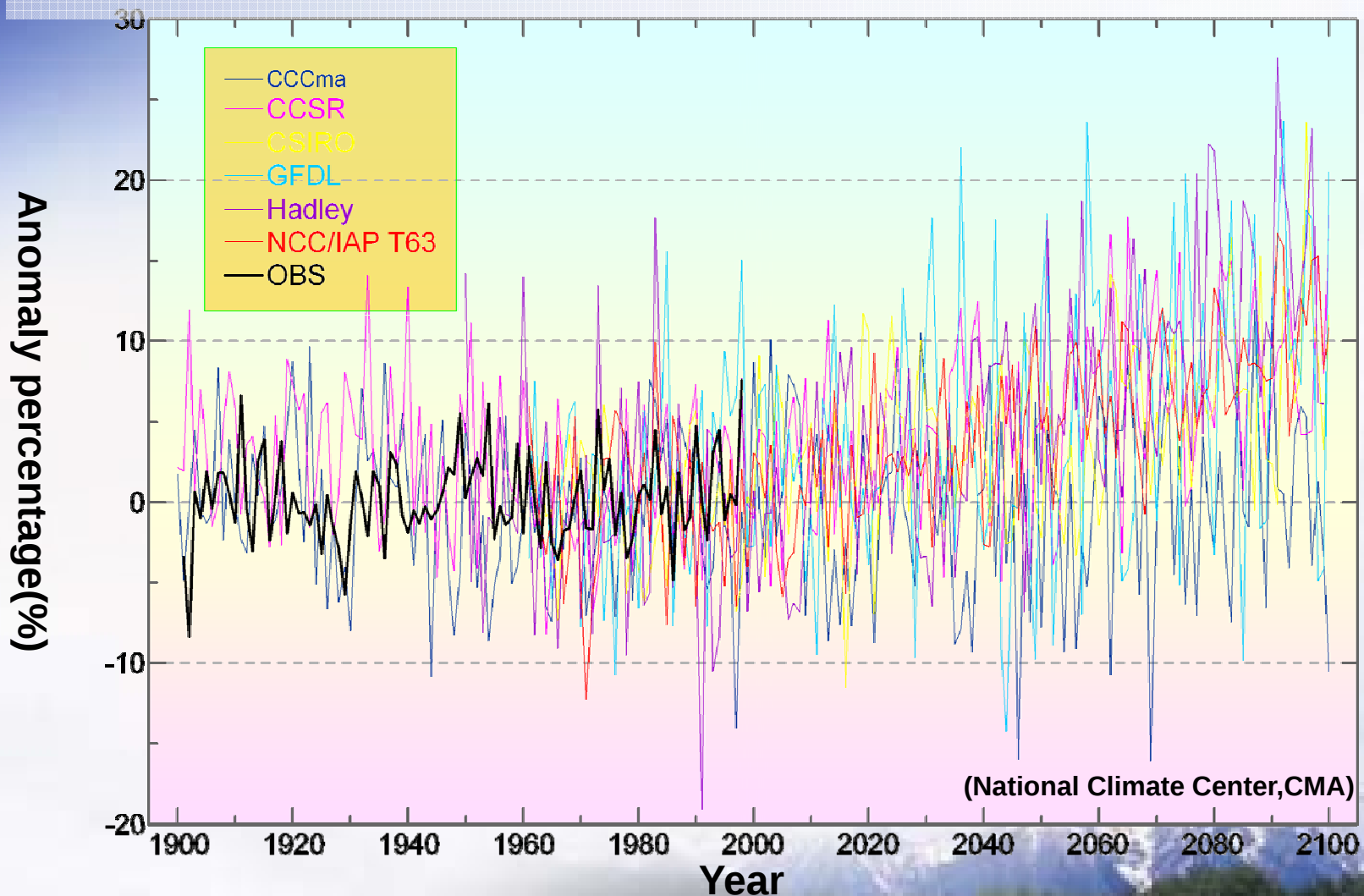
3. Future Changes and Impacts

Simulation and Projection on air **temperature** in 20th and 21th century in China by climate models based on different scenarios



(Thick black line denotes observation, provided by Wang Shaowu and Gong Daoyi; thick red line denotes multi-model average for GG(greenhouse gas only); thick apricot line denotes multi-model average for GS(greenhouse gas + sulfate aerosol); thick brown line denotes multi-model average for A2 and B2; thick yellow line denotes simulation by NCC/IAP T63.

Precipitation variation of 21th century in China simulated by several IPCC models based on 4 emission scenarios



Precipitation will increase in 21th century

3. Future Changes and Impacts

Future yearly **mean surface air temperature**
and **precipitation changes** in China
(compared with annually mean from 1961 to 1990)

2020	2030	2050	2100
1.3~2.1°C	1.5~2.8°C	2.3~3.3°C	3.9~6.0°C

- Precipitation **is likely to** increase by 2~3% in 2020;
- Precipitation **is likely to** increase by 5~7% in 2050;
- Precipitation **is likely to** increase by 11~17% in 2100.

(climate and environment changes in China, 2005)



Till 2050 in China

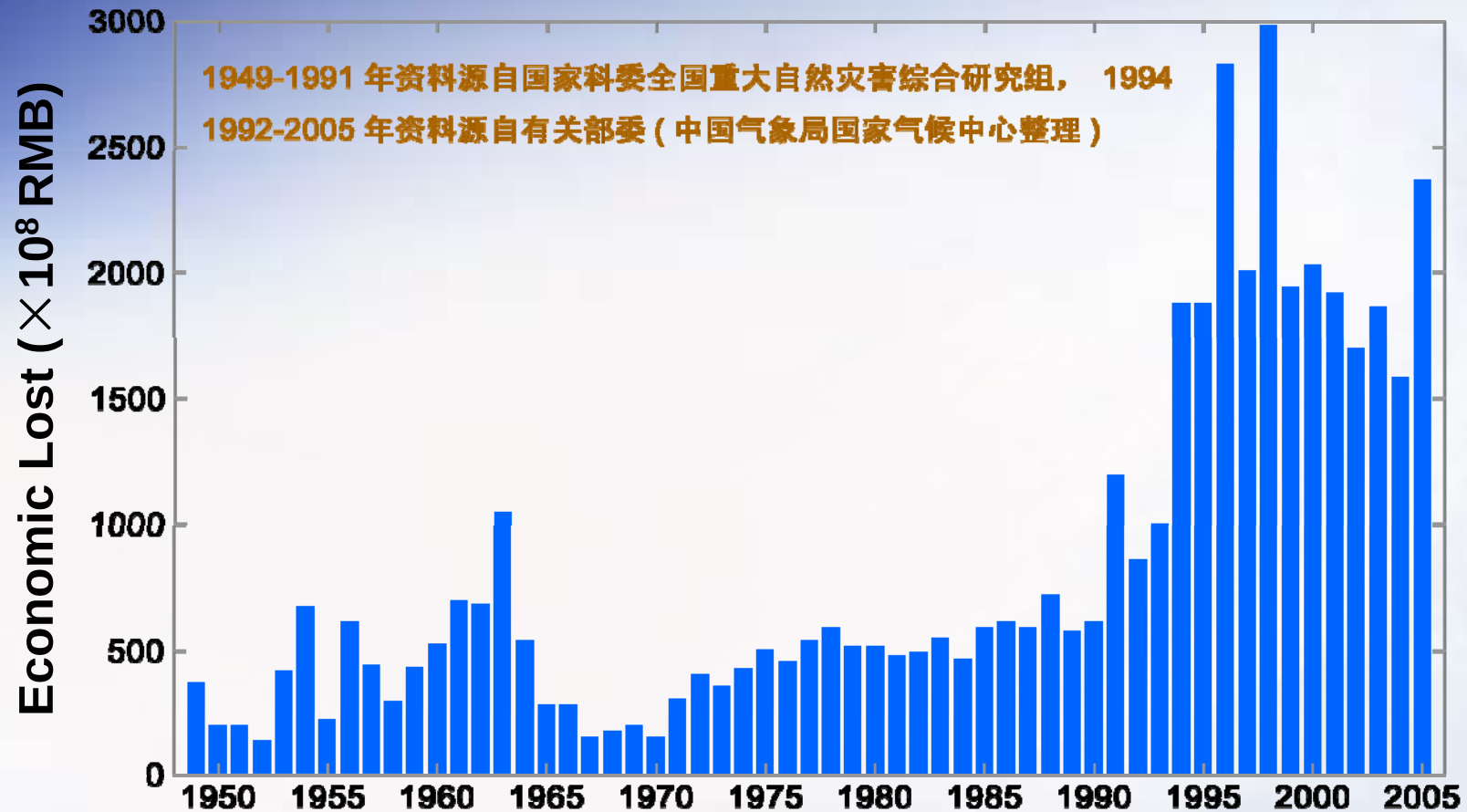
- **Glacier melting water** will show a continuous **increase** in most part of Northwest China, and run-off will increase.
- **Snowfall** will show an **increasing trend** in stable snow-covered regions of Inner Mongolia, North of Xinjiang, and Qinghai-Tibetan Plateau.
- **Degradation of frozen ground** will be full-scale and continuous.
- **Forest productivity** in China is likely to **increase** somewhat.
- **Sea level** rise will be 12-50cm in China, and 9-107cm in deltas of **Pearl River**, **Yangtze River** and **Yellow River**



Till 2100 in China

- **Precipitation days** is likely to increase in north of China
- **Heavy precipitation days** is likely to increase in south of China
- **Local heavy precipitation events** are likely to increase
- **Sea level** is likely to continue to rise

3. Future Changes and Impacts



**Economical losses due to meteorological disasters
continue to increase in China**

Impacts on agriculture



Global warming is **likely** to have the biggest effect on agriculture, and **crop yield** is likely to decrease in many regions. In China agriculture will be facing **three** outstanding problems:

Yield
fluctuation
is likely to
increase

5-10%
reduction
in output

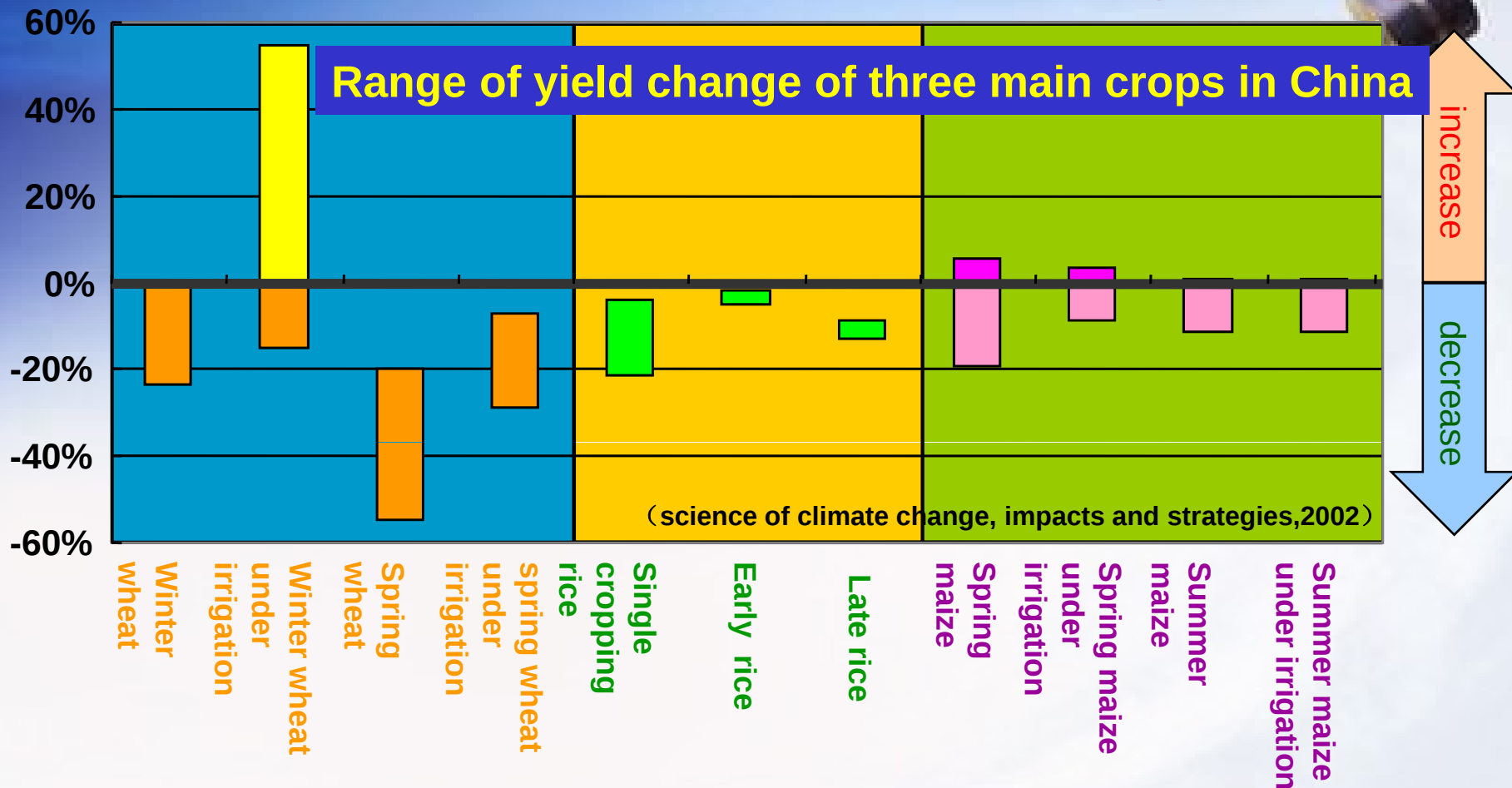
Layout
and
Structure
will change

Changes in
cropping system
and crop variety

Cost and
investment
will
increase

Increase in
fertilizer,
pesticide
and weedicide.

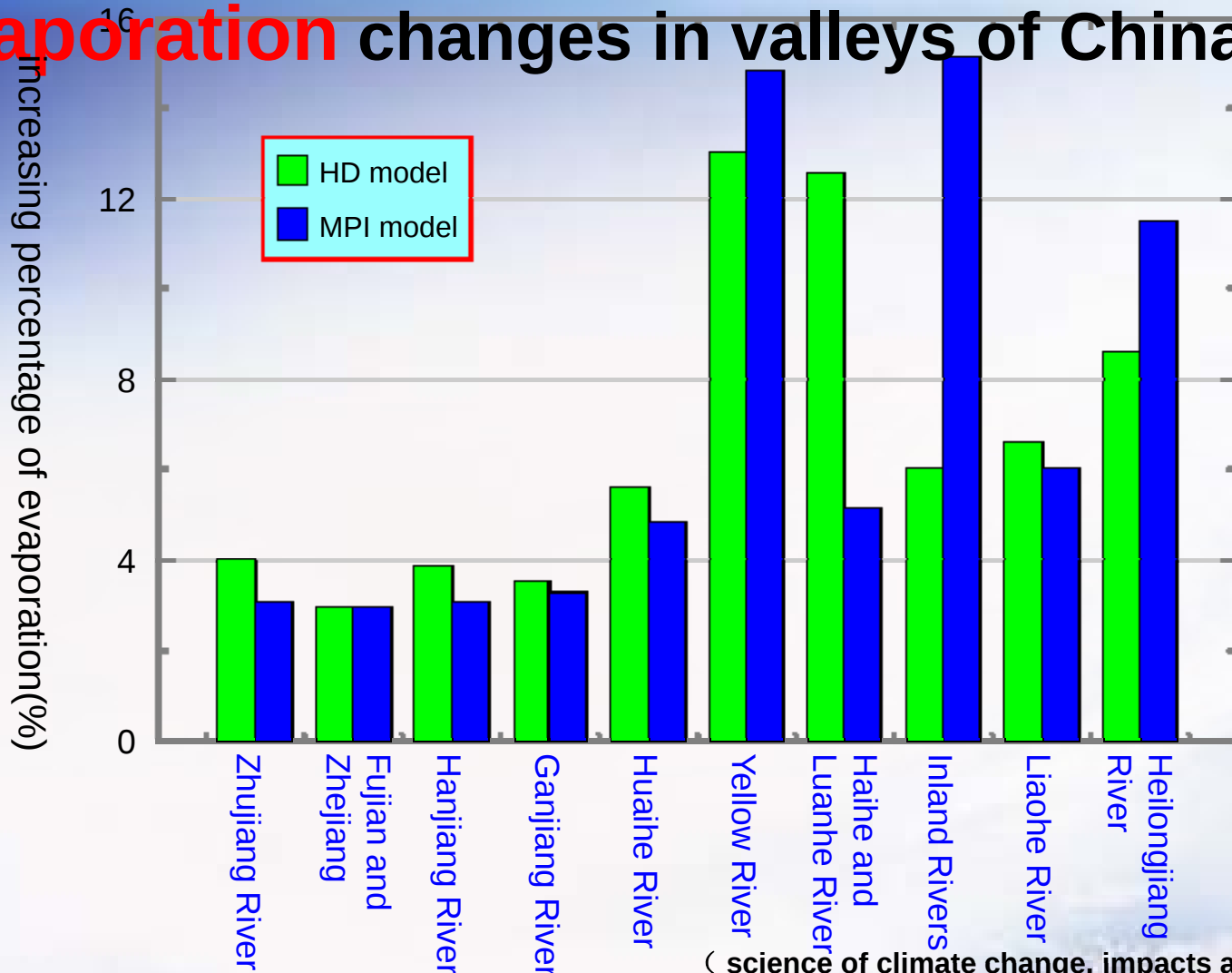
3. Future Changes and Impacts



Till **2030**, crop yield in China is likely to decrease by 5-10%, and three main crops all show a decrease in yield. (mainly due to temperature increase, intensification of **flood and drought, and water shortage** etc.)



Evaporation changes in valleys of China in 2030



(science of climate change, impacts and strategies,2002)

Yearly mean evaporation will increase in major valleys of China

3. Future Changes and Impacts

In **2050** in Qinghai-Tibetan Plateau:

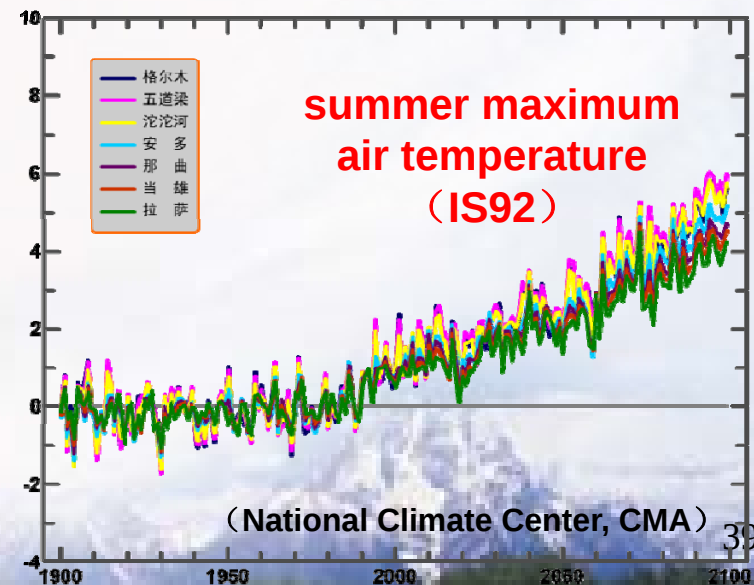
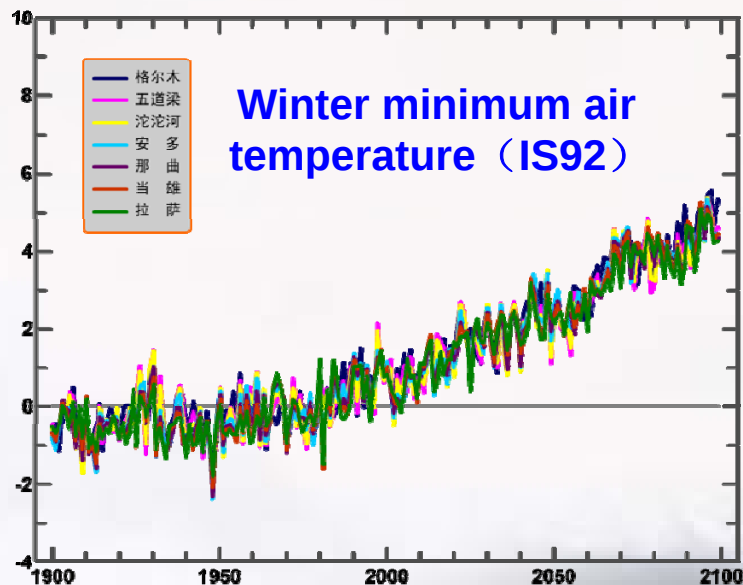
winter minimum air temperature is likely to increase by **3.1-3.4°C**;

summer maximum air temperature is likely to increase by **1.8-3.2°C**

Qinghai-Xizang's highway and railway will be threaten



Air temperature change along Qinghai-Tibet Railroad





4. Response Strategies



Adaptation Measures:

Agriculture : improve crop varieties, breed and select stress-resistance varieties, adjust the structure and layout of food industry.

Water resources: strength the management and conservancy of water resources, save water, and exploit cloud water resources and seawater desalination, etc.

Human living: improve public health infrastructure, and set up early warning system of diseases induced by climate change.

Coastal zone: intensify sea level rise monitoring, and build protective dam, etc.



Mitigation Measures:

- Development of **key technologies** for mitigating climate change;
- Adopt **preferential policy** for energy saving and energy efficiency improvement;
- Exploit **renewable energy resources** and technology;
- Optimize **land use** structure, and strength the protection and management of forest resources.

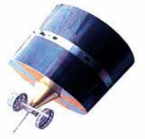


Mitigation Measures:

During the 11th five year plan period (2006-2010), the energy intensity in China will be reduced by 20%.

(1.2 t coal/10000 rmb---0.98 t coal/10000rmb in 5 years)

Conclusions



- Like other places in the world, **climate and environment in China** have changed and may continue to change in the future.
- Take active **adaptation and mitigation measures** within the framework of sustainable development.
- Keep a scientific eye on **uncertainties** in future climate change, strengthen the scientific research and monitoring, and continue to improve our knowledge of climate system.

Thanks

