Changes of Typhoon Hazards and Disaster Loss in China

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Outline

1. Overview

2. Change of Hazards
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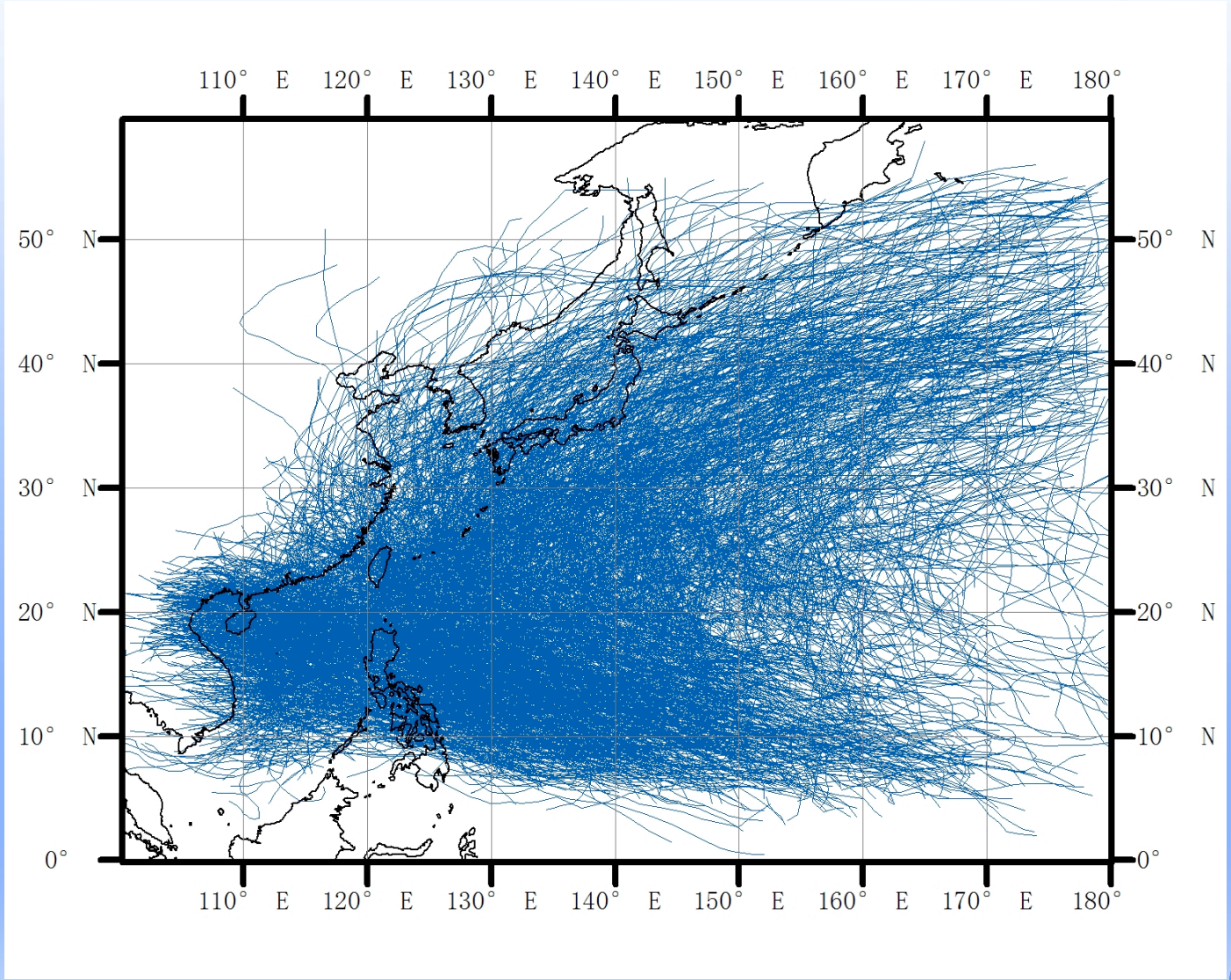
1. Overview

Categories of Tropical Cyclone Intensity over North-western Pacific

Tropical Cyclone Intensity Category	Beaufort Scale	2-min Mean Maximum Sustained Wind (m/s)
Tropical Depression	6~ 7	10.8~17.1
Tropical Storm	8~ 9	17.2~24.4
Severe Tropical Storm	10~11	24.5~32.6
Typhoon	12~13	32.7~41.4
Severe Typhoon	14~15	41.5~50.9
Super Typhoon	≥16	≥51.0

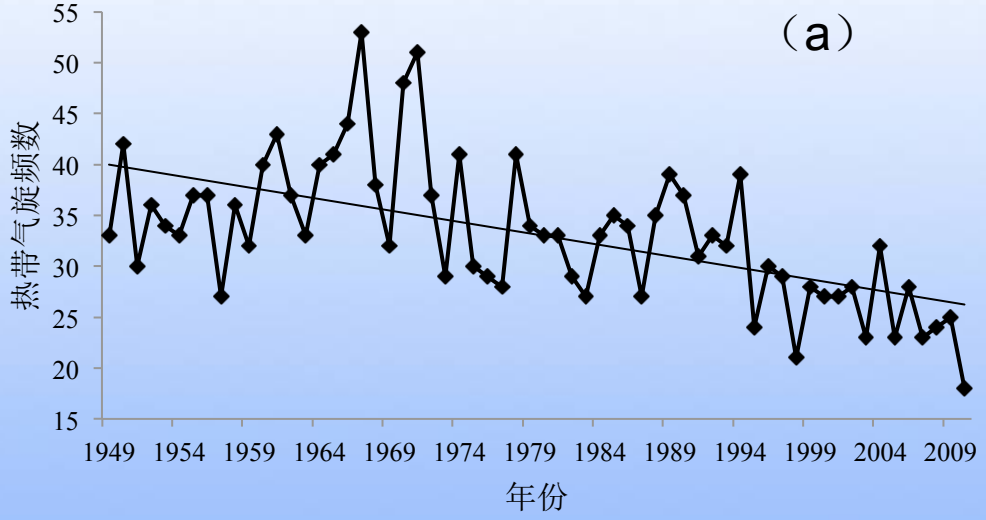
(Reference：GB/T 19201—2006)

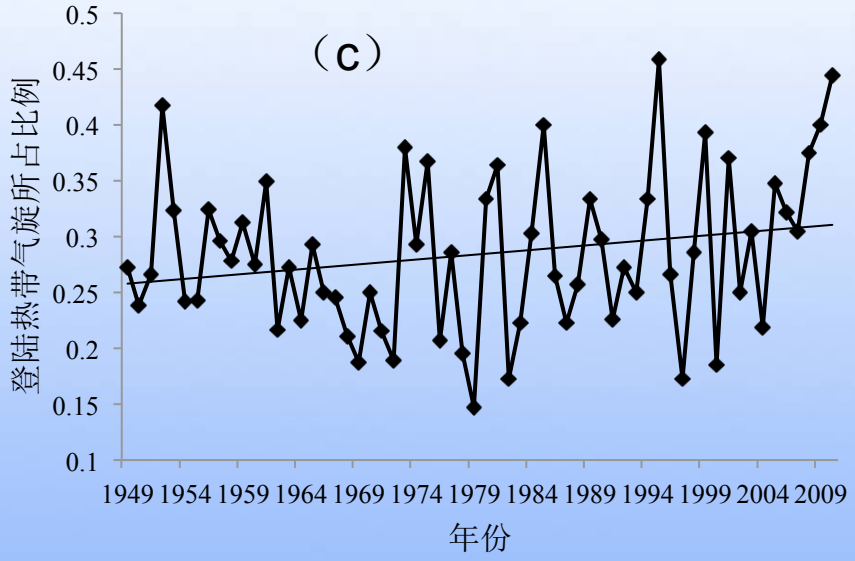
1. Overview

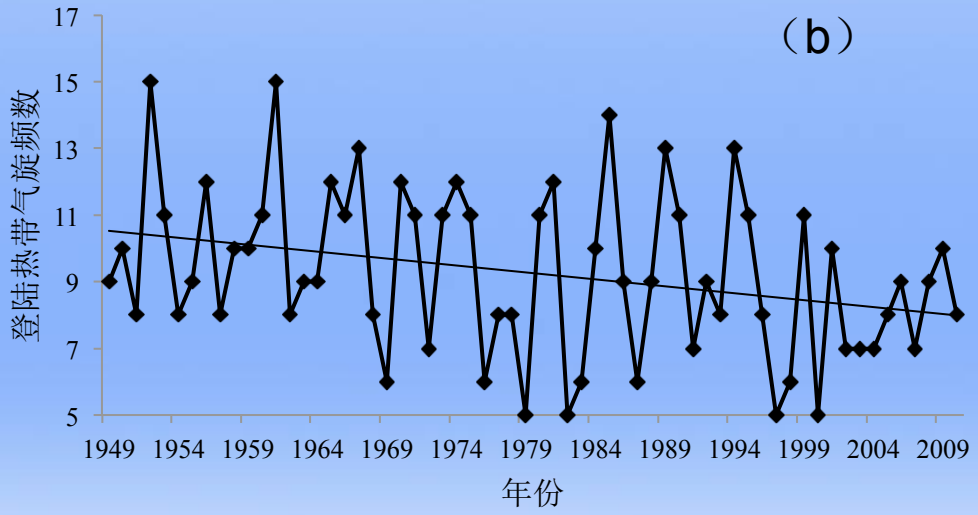


Best Tracks of Tropical Cyclone of North-western Pacific (1949-2010)

2.1 Frequency





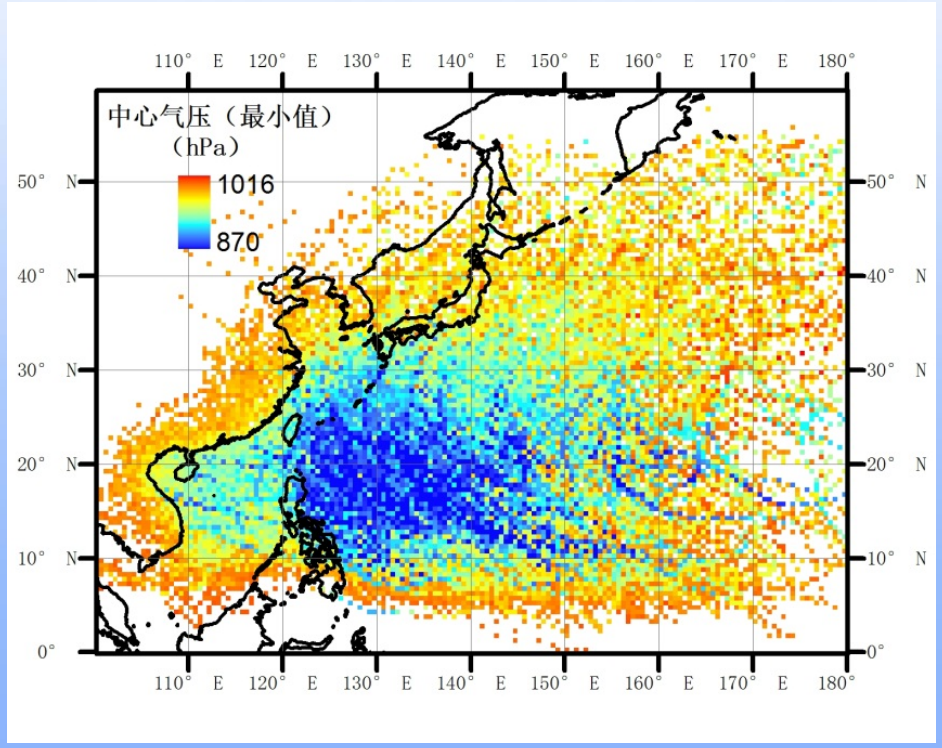


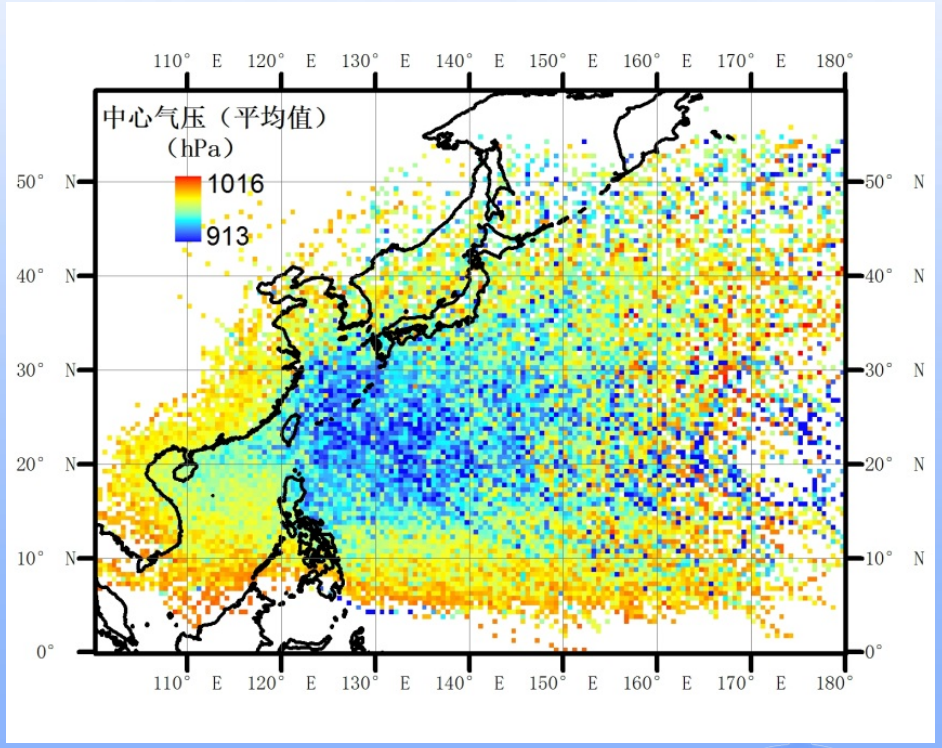
（a）Frequency of all TCs

（b）Frequency of Landing TCs

（c）Percentage of Landing TCs

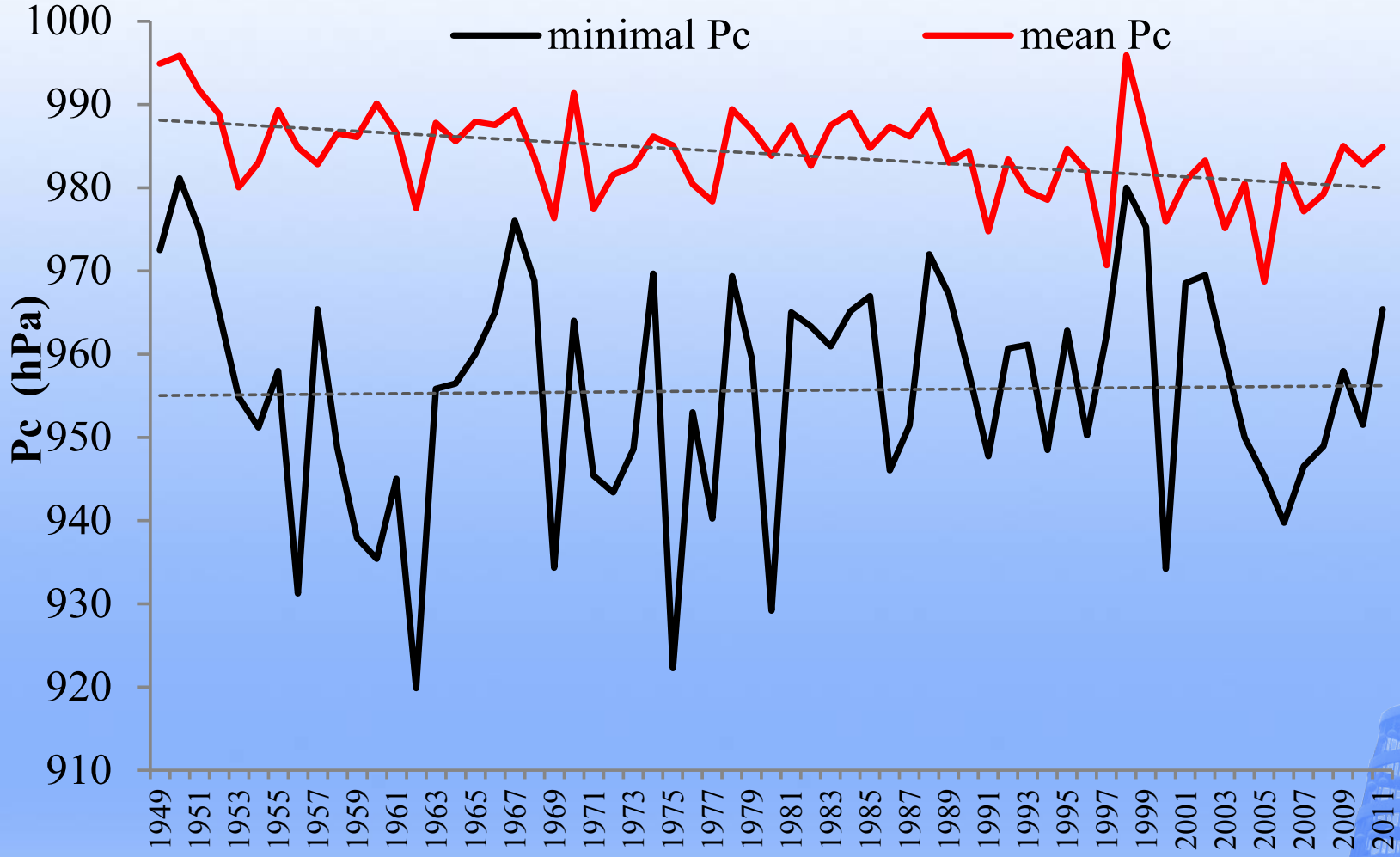
2.2 Central Pressure





Mean and Minimum of Historical Central Pressure (0.5°×0.5° degree grid)

2.2 Central Pressure



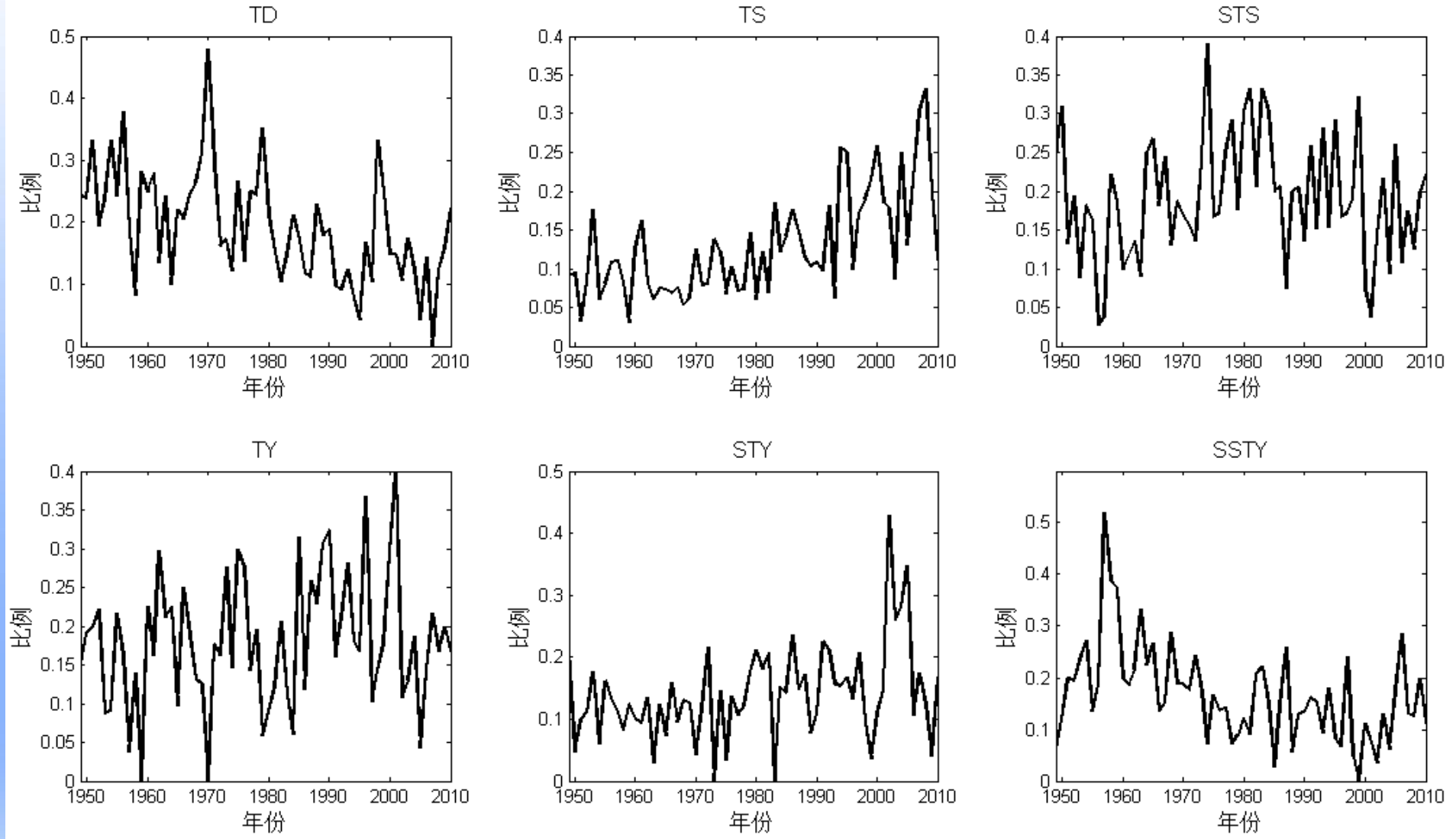
Mean and Minimal of Historical Central Pressure (0.5°×0.5° degree grid)

2.3 Intensity

Statistics of Tropical Cyclone of Different Categories (Landing and Total)

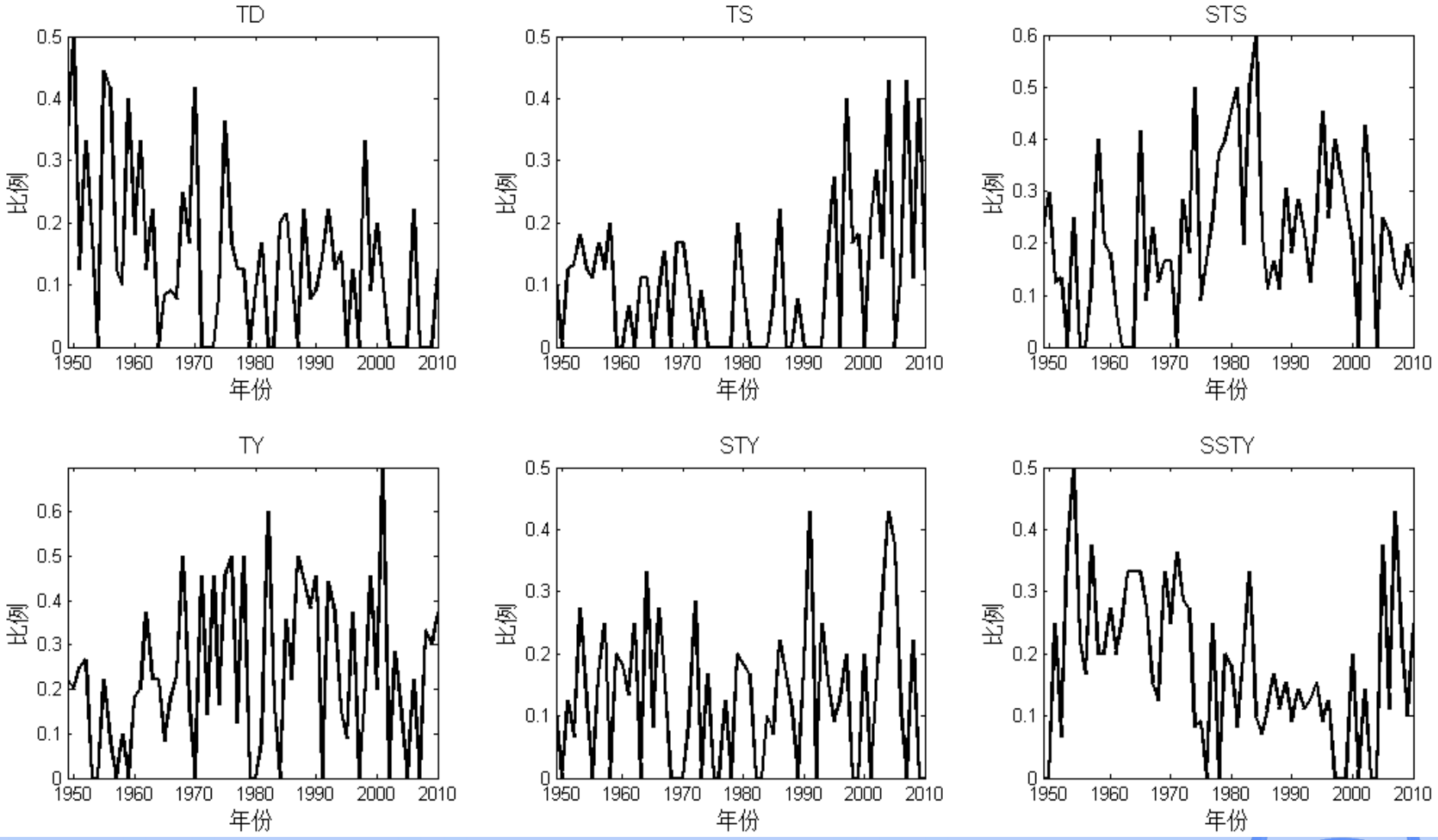
	TD	TS	STS	TY	STY	SSTY	Sum
Total	411	251	392	369	281	346	2050
Landing	88	58	122	133	70	100	571
Percentage	21.41%	23.11%	31.12%	36.04%	24.91%	28.90%	27.85%

2.3 Intensity



Percentage of Tropical Cyclone of Different Categories (NWP)

2.3 Intensity



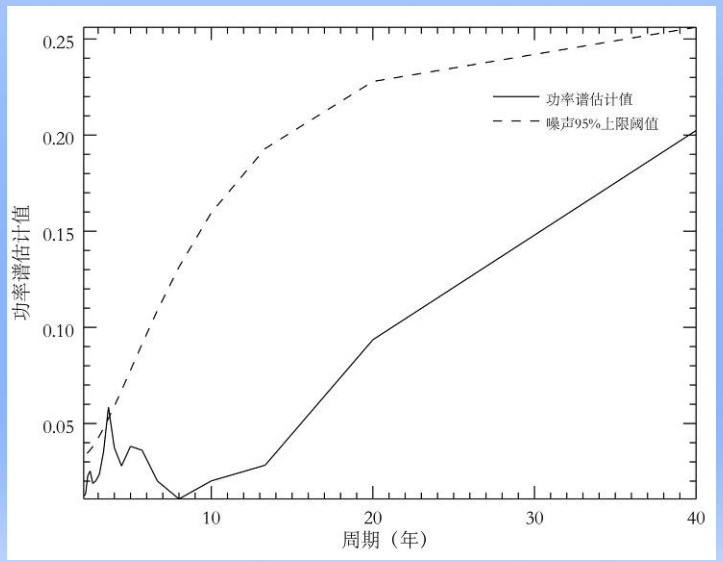
Percentage of Tropical Cyclone of Different Categories (Landing China)

2.3 Intensity

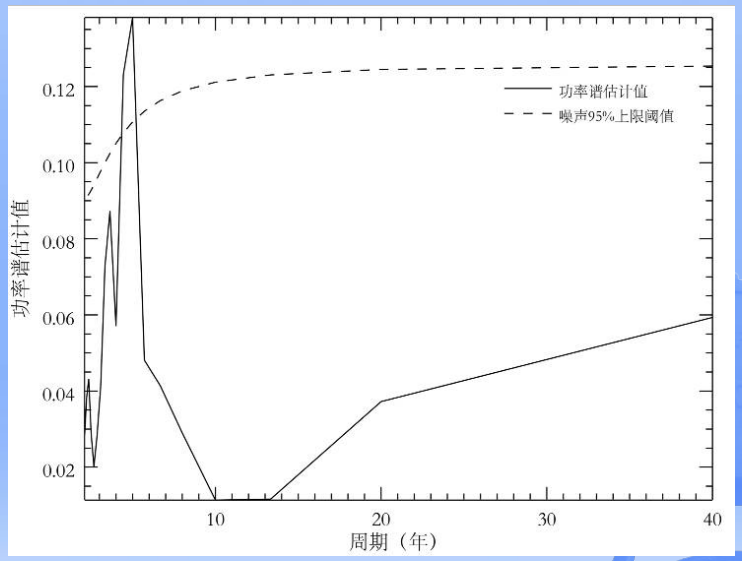
■Trend Analysis of Different Categories

$$r_{xt} = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)\left(i - \bar{t}\right)}{\sqrt{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2 \sum_{i=1}^{n}\left(i - \bar{t}\right)^2}}$$

	TD	TS	STS	TY	STY	SSTY	Total
Total	Decrease	Increase	Decrease	Stochastic	Stochastic	Decrease	Decrease
Landing	Decrease	Increase	Stochastic	Stochastic	Stochastic	Decrease	Decrease

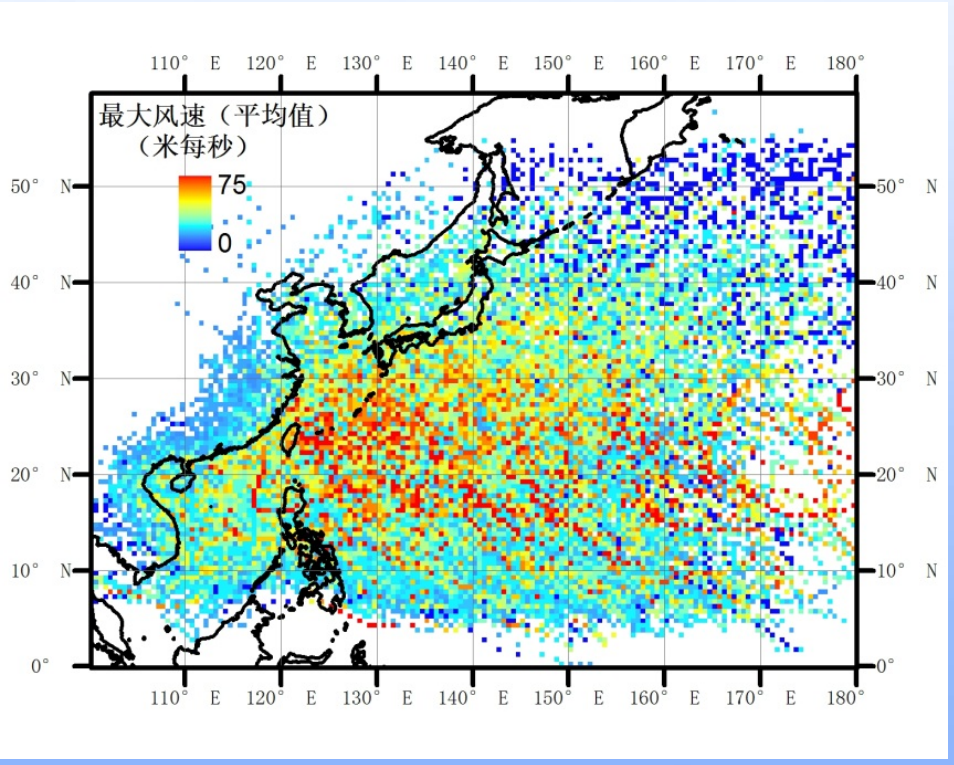


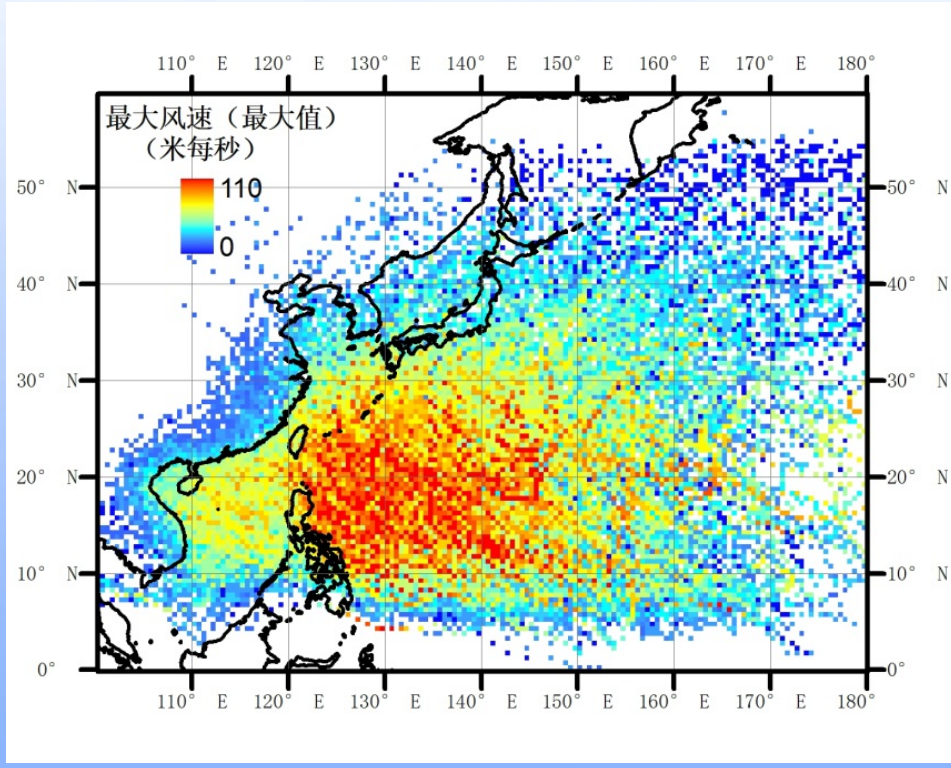
All Categories



Landing TC

2.4 Wind

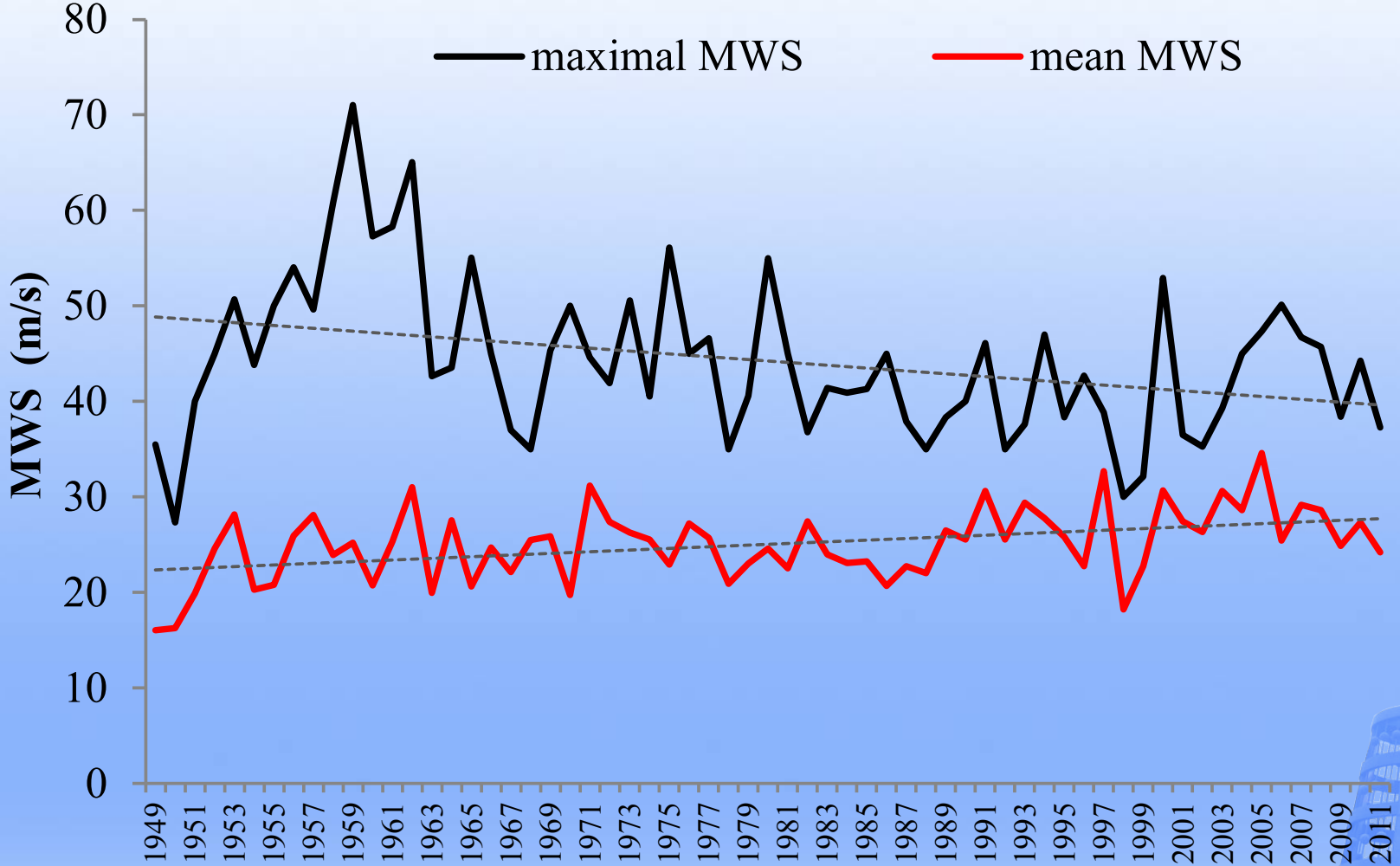




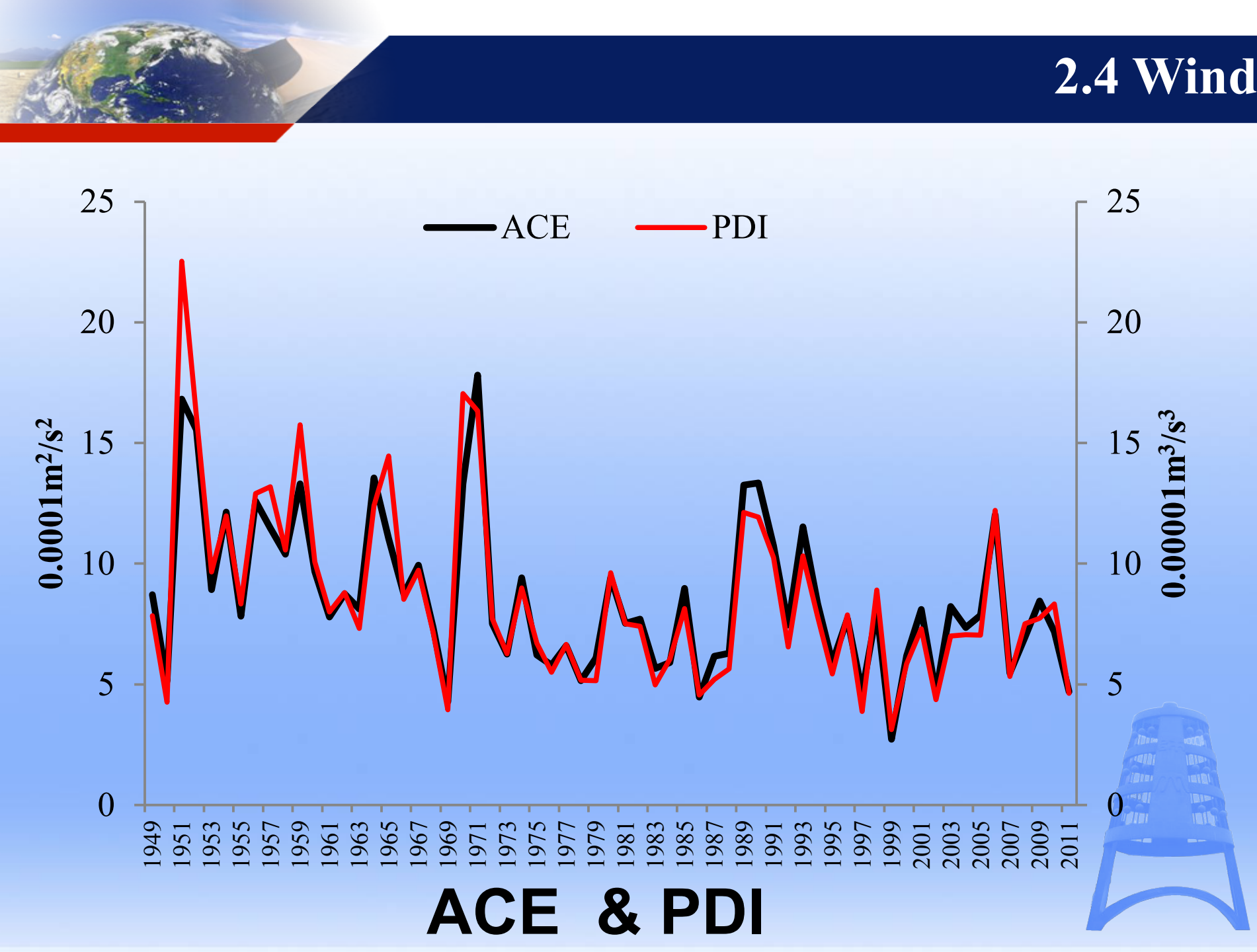
Mean and Minimum of Historical MWS(0.5°×0.5° degree grid)

MWS: maximum wind speed

2.4 Wind

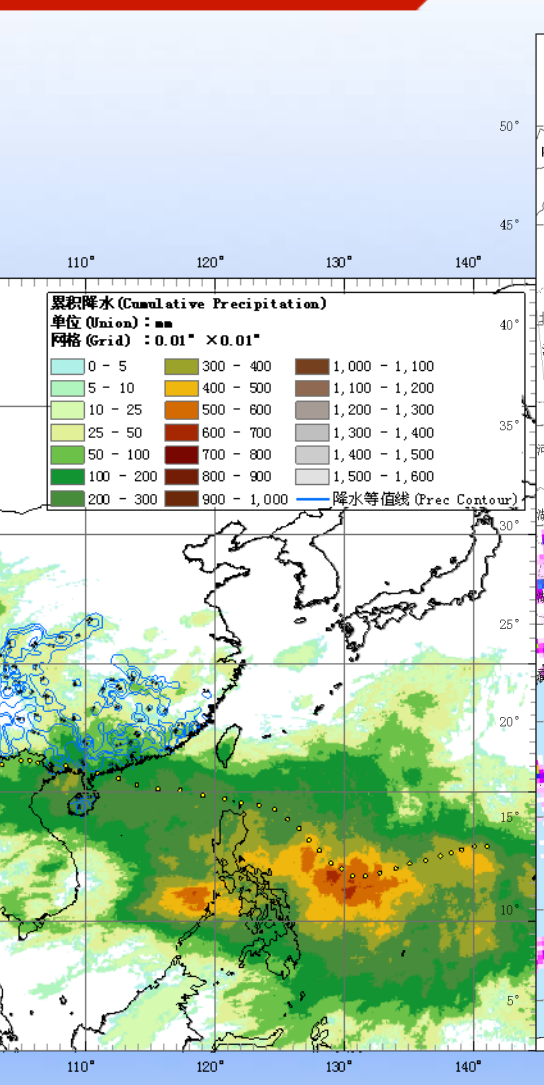


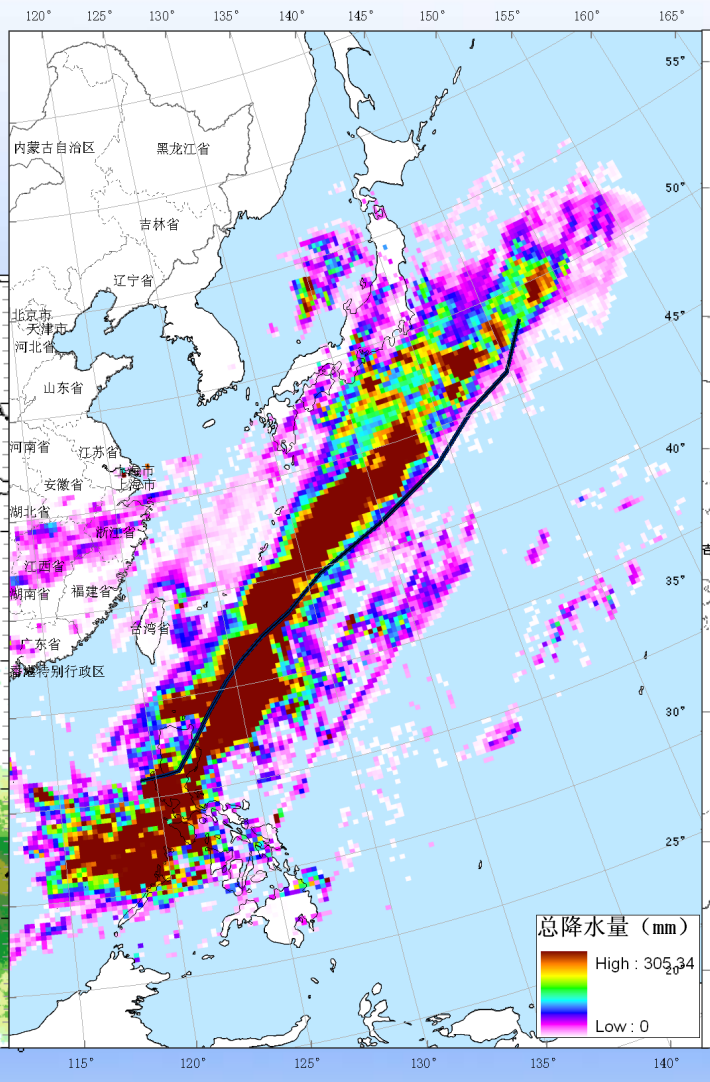
Mean and Minimum of Historical MWS (1949-2010)

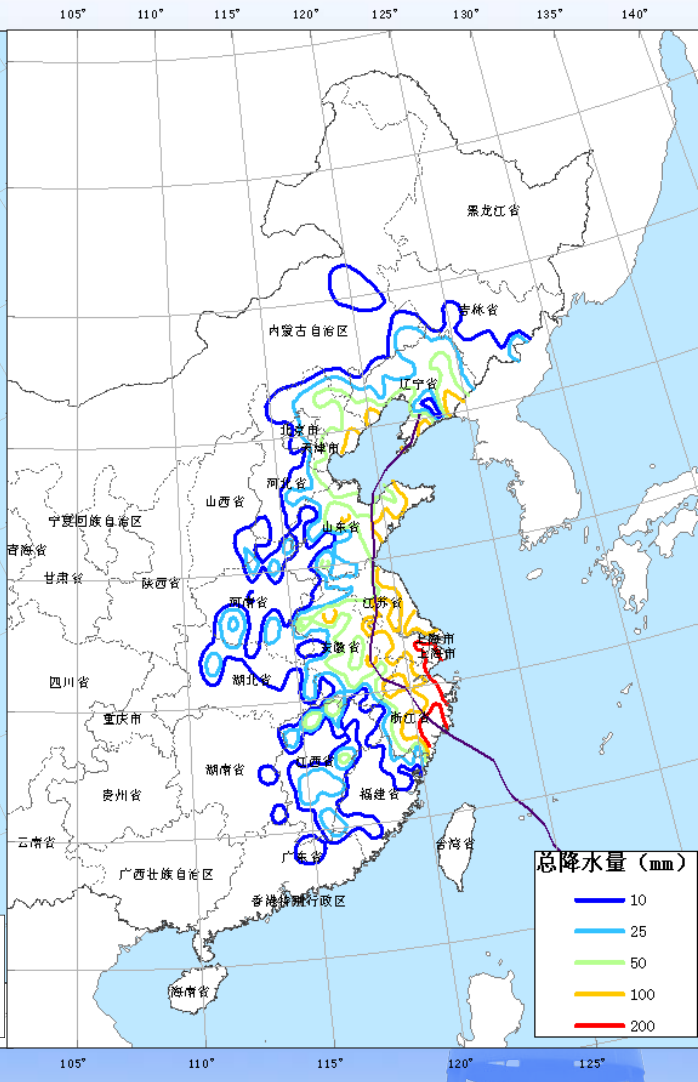

ACE
PDI
25
20
15
10
5
0
0.0001m²/s²
0.00001m³/s³
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011

ACE & PDI

2.5 Rainfall





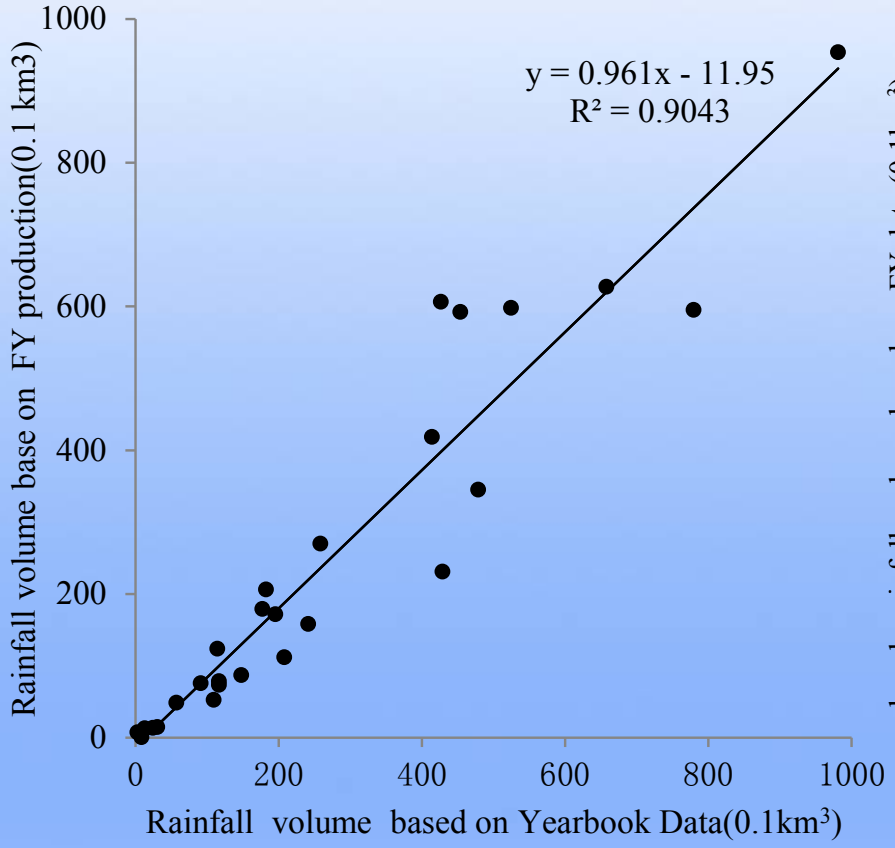


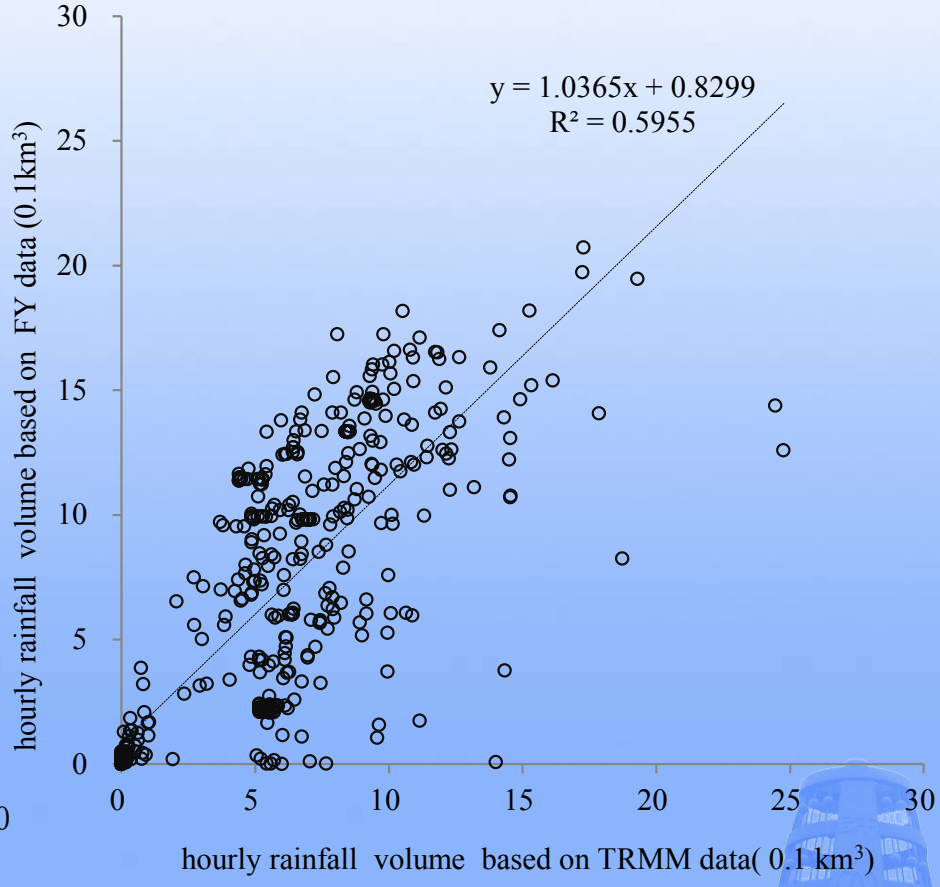
Rainfall extracted with FY

TRMM rainfall

Rainfall contour with ground obs. and other sources

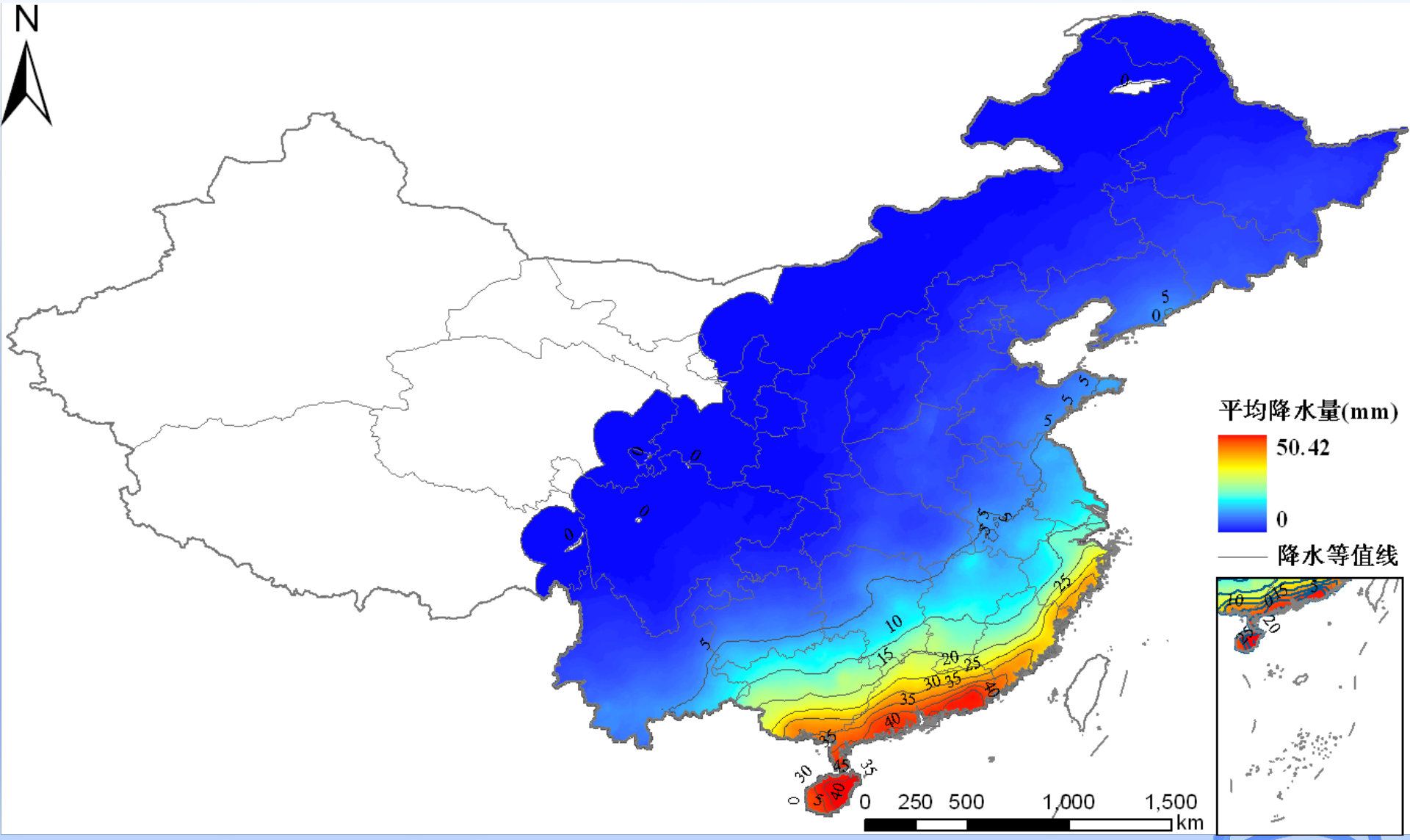
2.5 Rainfall





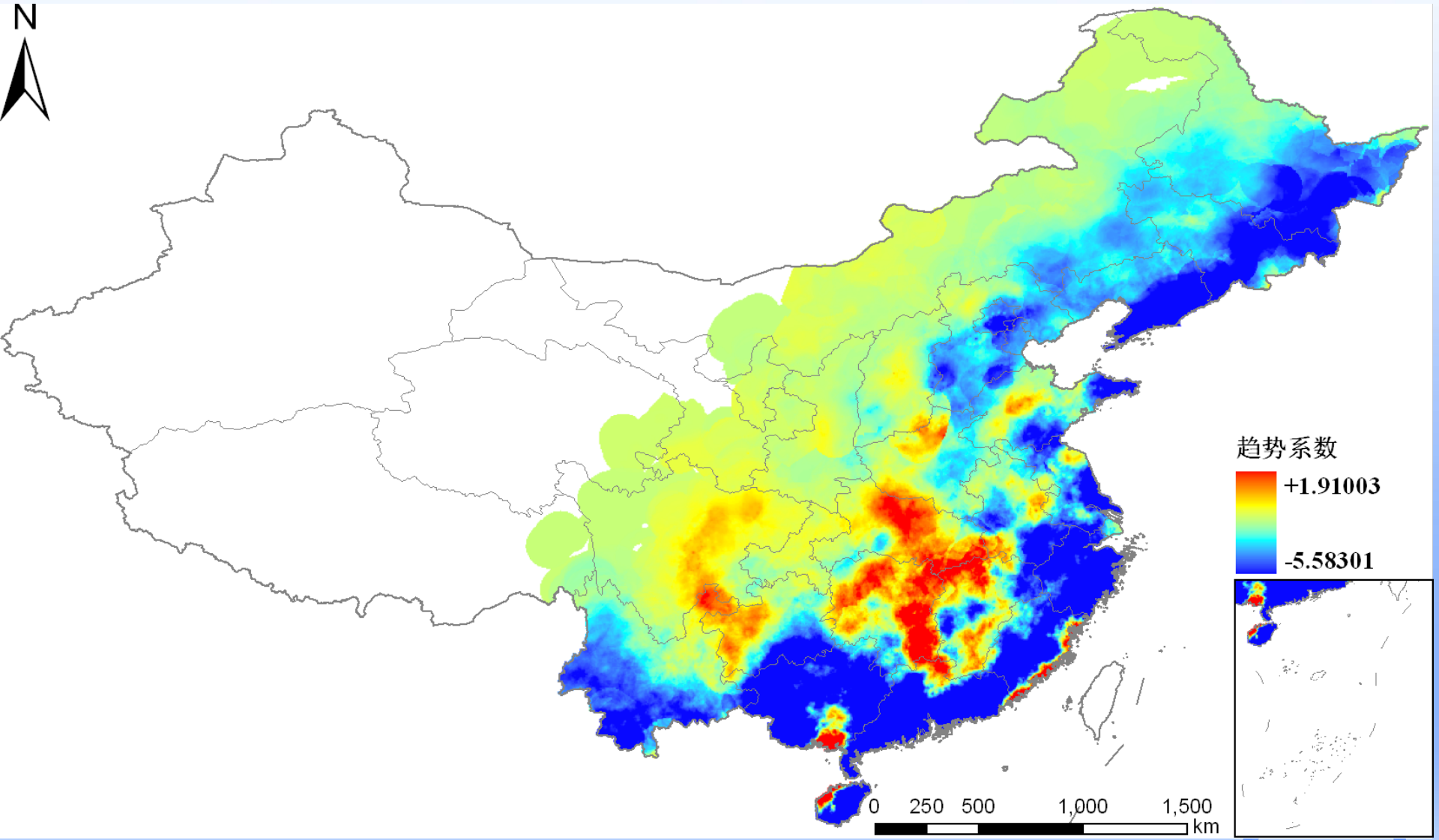
Comparison of rainfall with different sources

2.5 Rainfall



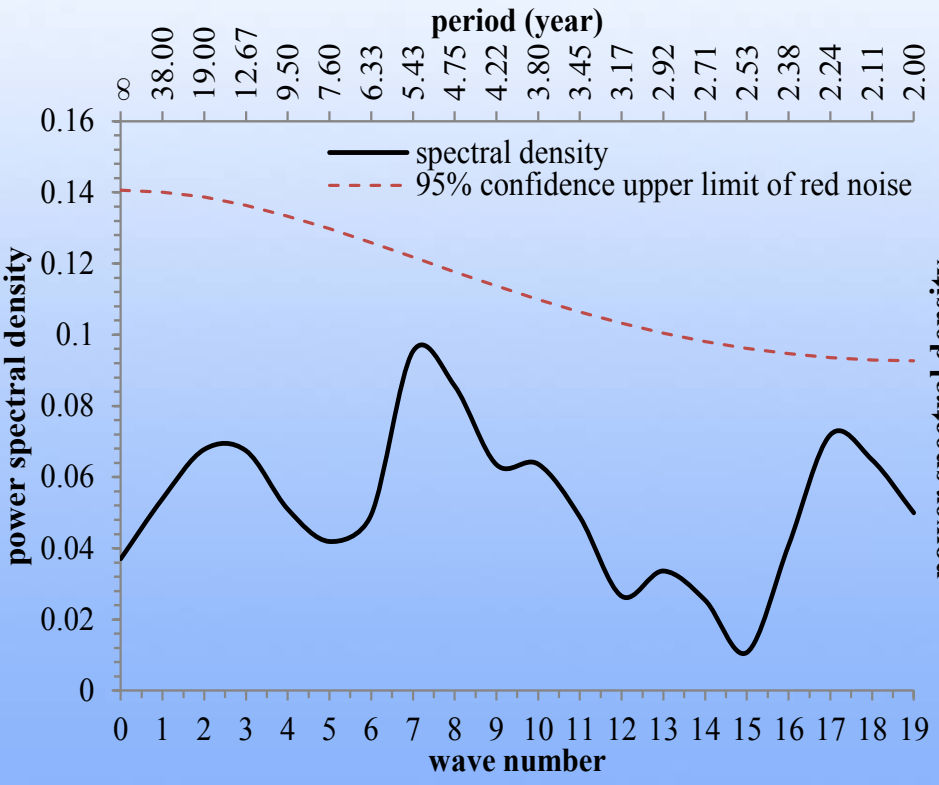
The mean rainfall per TC event during 1951~2009

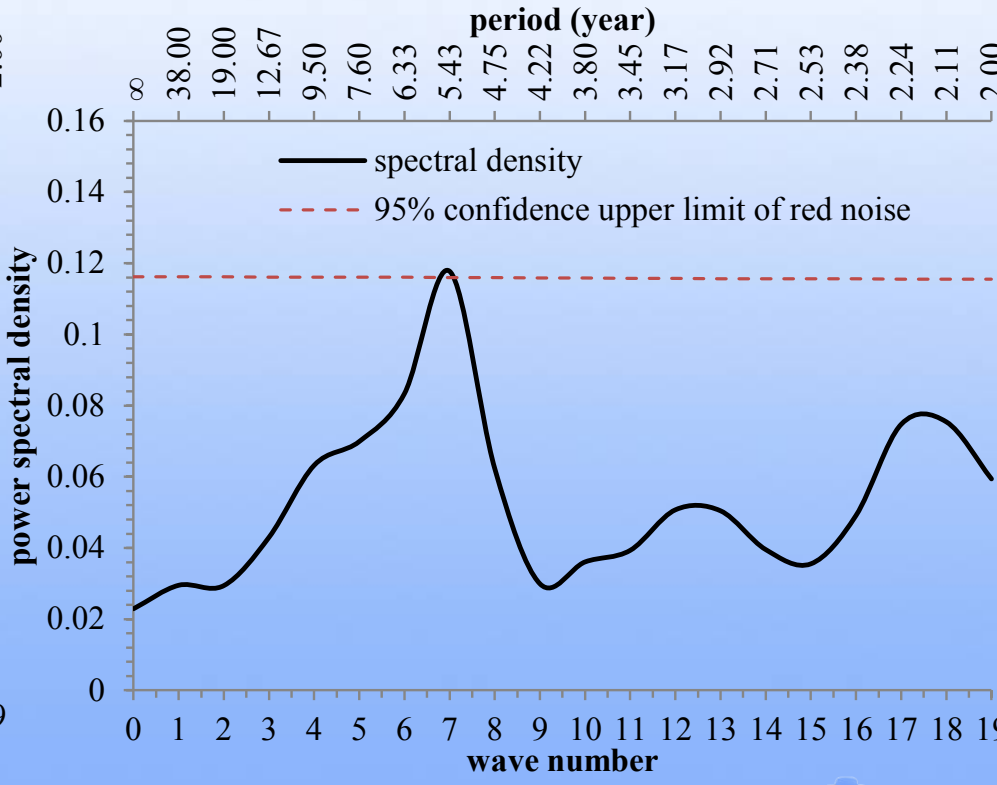
2.5 Rainfall



Trend (linear slope) of TC rainfall during 1951~2009

2.5 Rainfall

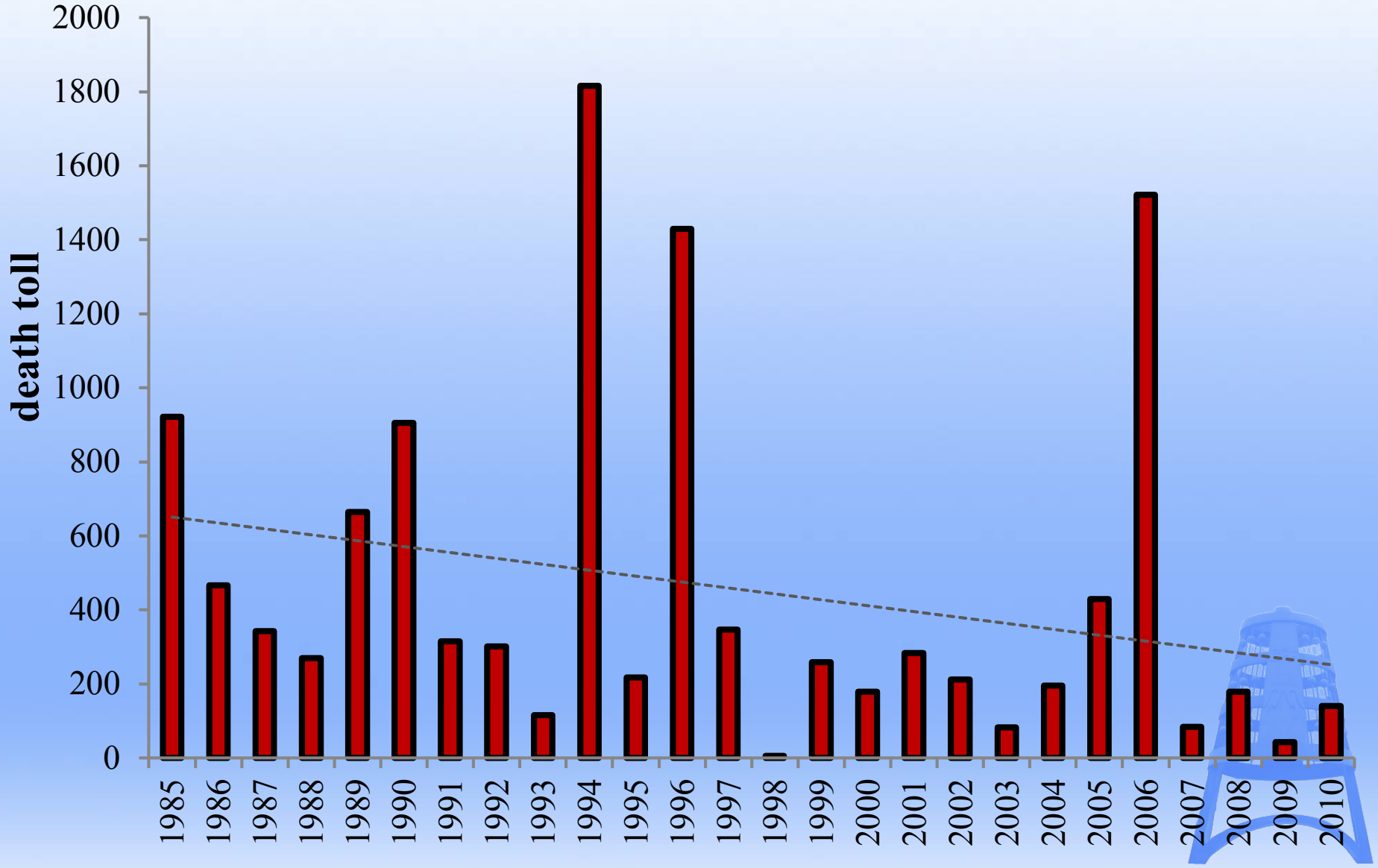




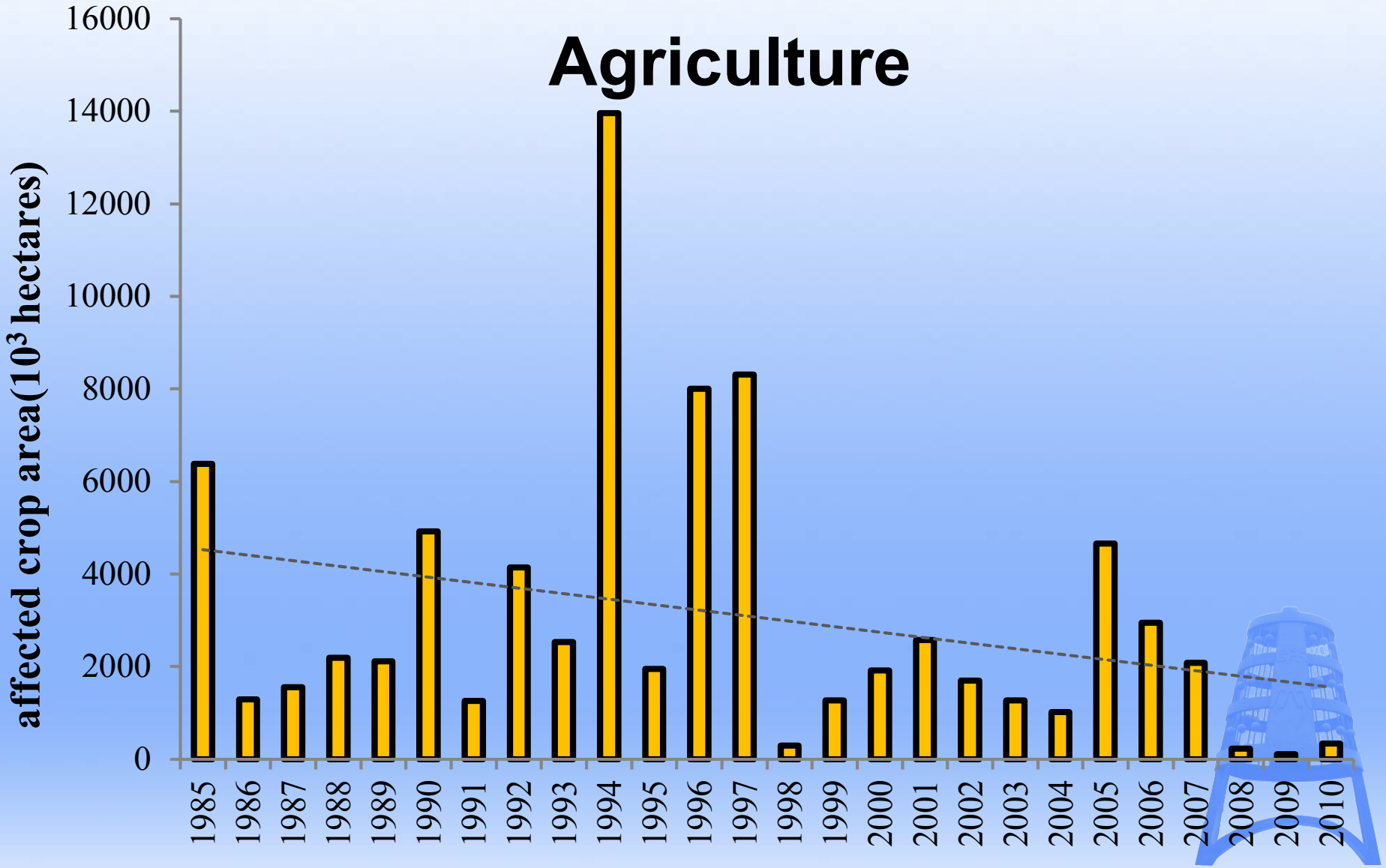
1) Total rainfall: no significant period

2) Maximum annual rainfall per event: weak period of 7 years

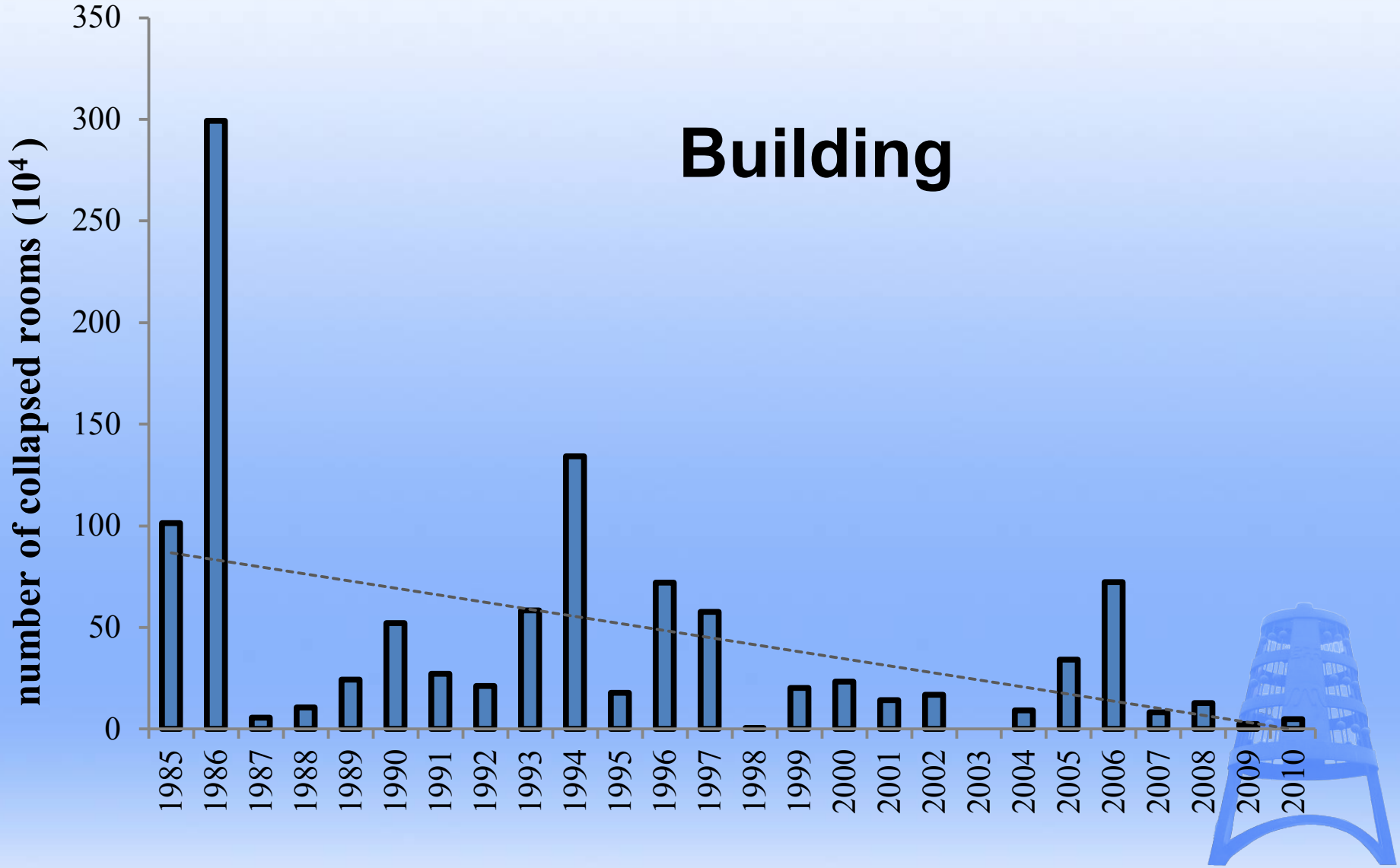
3.1 Loss of Life



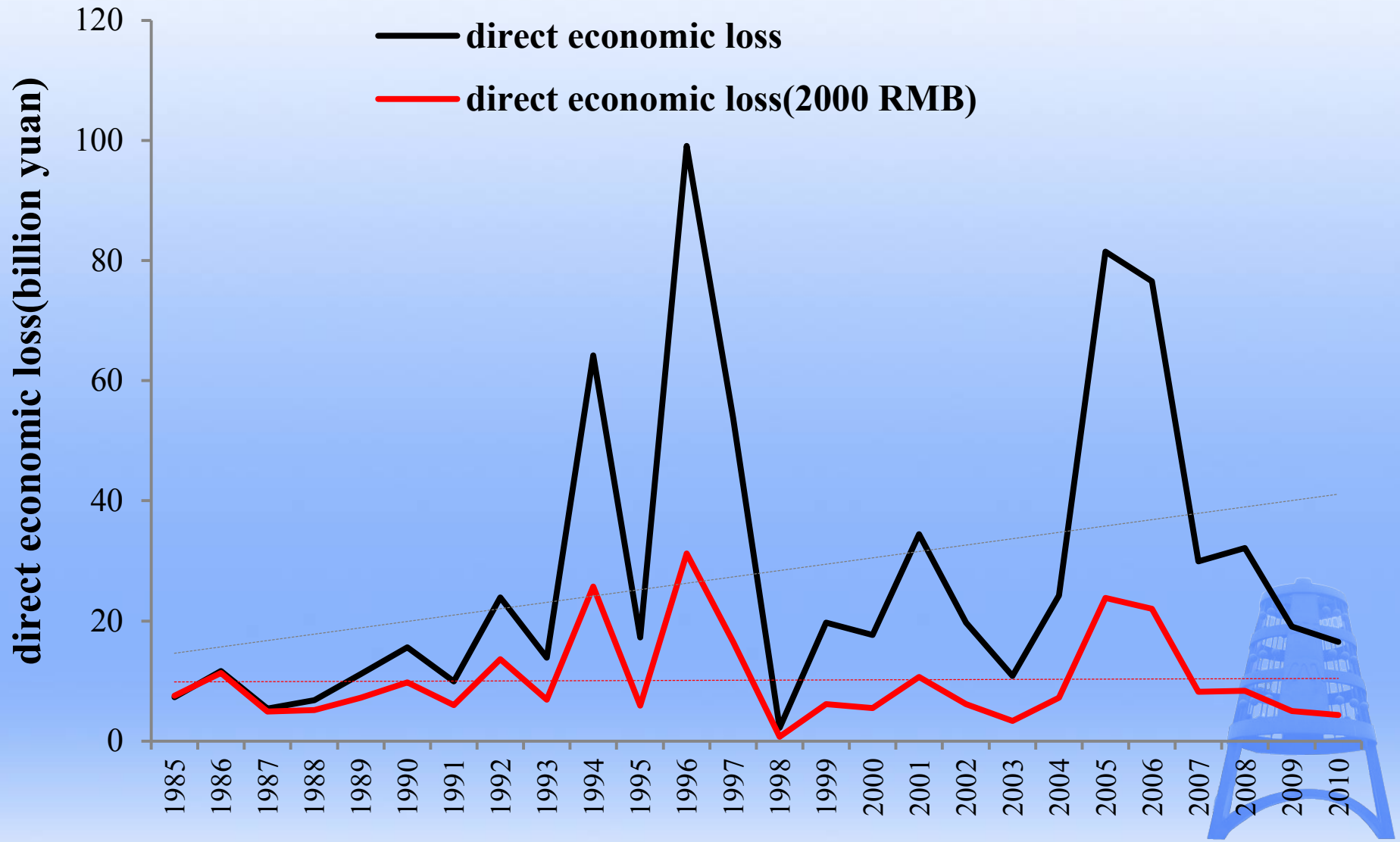
3.2 Economic Loss



3.2 Economic Loss



3.2 Economic Loss



4. Discussion

Change of Hazards?

----No significant change/increase

Change of Life Loss

---- Decrease

Change of Economic Loss

---- Increase? Decrease? Almost constant?

Change of Exposure

---- Great increase due to urbanization and industrialization

---- Vulnerability

---- Decrease, instead of popular “increasing” argument

The end.

- **Tropical Cyclone Systems Under Development**
  - CycloneWatcher
  - CycloneLoss
  - CycloneRisk
  - http://Github.com/OpenCyclone

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