Yale 耶鲁大学-南京信息工程大学大气环境中心

Yale-NUIST Center on Atmospheric Environment

Effects of drought on summer maize production and risk assessment in the Huang-Huai-Hai Region

Reporter： PAN Congcong

2018/4/13

Outline

- Introduction
- Materials and Methods
- Results
- Discussion and Conclusions

Introduction

ise in the future, the
des will fall, and droughts

account for about 85% of

Huang Huai Hai area is an im
in China, The trend of climate
in the region more severely a

Materials and Methods

- Observed data
- Drought indexes
- Drought frequency (Pi)
- Drought station ratio (Pj)

Materials and Methods

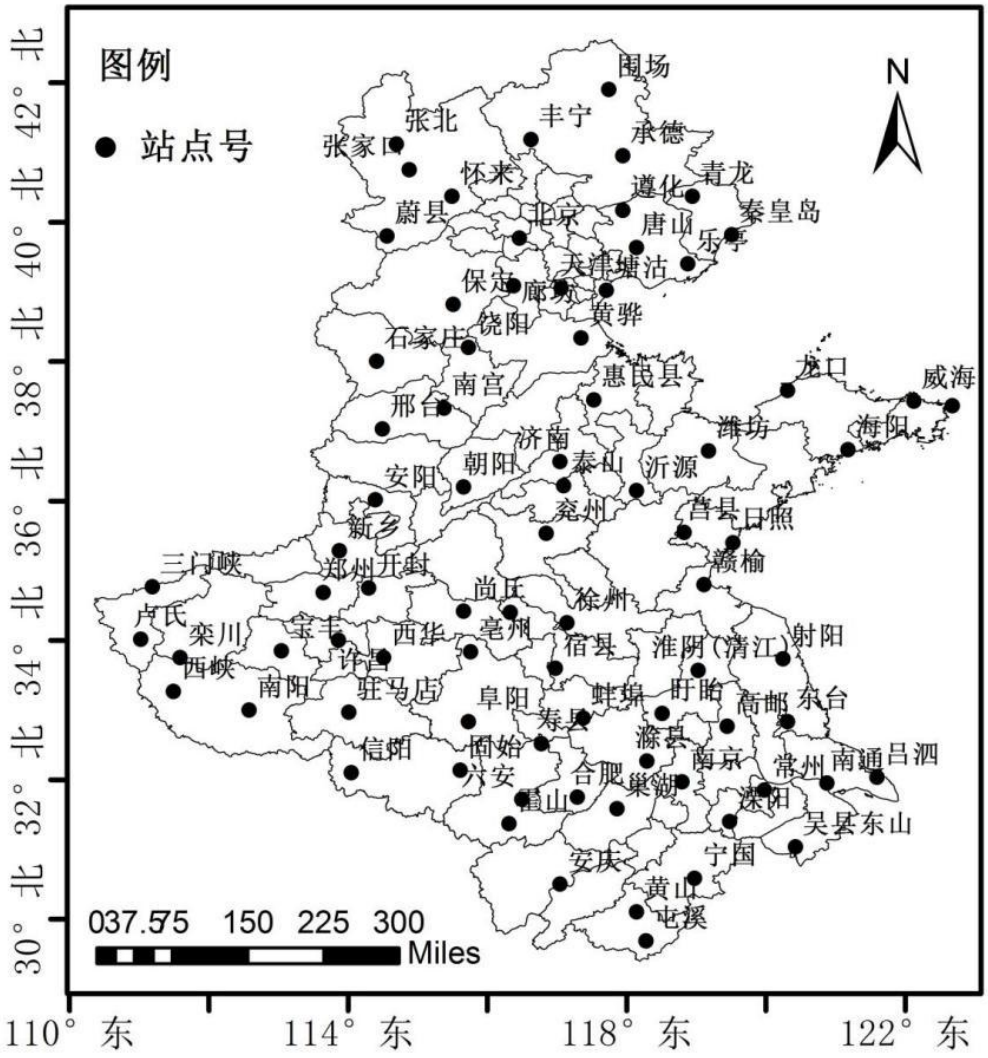
- **Observed data**

This study uses 79 weather stations meteorological data, from the China Meteorological Data Service Center(CMDC).

The dataset covers the period 1960–2015 .

The summer maize yield data from the Agricultural Meteorological Test Station

Socio-economic data from Statistical Yearbook and disaster ceremonies of 7 Provinces



Materials and Methods

- **Drought indexes**

SPEI (Standardized Precipitation Evapotranspiration Index)

$$\mathrm{Pej} = 16\mathrm{K}\left(10\mathrm{Tj}/\mathrm{H}\right)^{\mathrm{m}} \qquad K = \left(N/12\right)\left(Ndm/30\right)$$

$$f(x) = \beta/\alpha\left(\frac{x-\gamma}{\alpha}\right)^{\beta-1}\left[1+\left(\frac{x-\gamma}{\alpha}\right)^{\beta}\right]^{-2}$$

$$\mathrm{F}(x) = \left[1+\left(\frac{\alpha}{x-\gamma}\right)^{\beta}\right]^{-1}$$

Materials and Methods

令P=1-F(x)，当 p≤0.5 时 $W = \sqrt{-2\ln(P)}$

$$SPEI = W - \frac{c_0 + c_1 W + c_2 W^2}{1 - d_1 W + d_2 W^2 + d_3 W^3}$$

当 0.5<P 时 $W = \sqrt{-2\ln(1-P)}$

$$SPEI = \frac{c_0 + c_1 W + c_2 W^2}{1 - d_1 W + d_2 W^2 + d_3 W^3} - W$$

c0=2.515517；c1=0.802853；c2=0.010328；
d1=1.432788；d2=0.189269；d3=0.001308。

Materials and Methods

- Drought classification according to SPI Values

Drought grade	Type	SPEI Index
1	No drought	(-0.5, 0)
2	Mild drought	(-1, -0.5]
3	Moderate drought	(-1.5, -1]
4	Severe drought	(-2, -1.5]
5	Extreme drought	(-∞, -2]

Materials and Methods

- Drought frequency (Pi)

Representation site has a frequent occurrence of drought in the year of data

$$Pi = (\mathrm{n} / N) \times 100 \ \%$$

- Drought station ratio (Pj)

Pj is the size of the drought affected by the proportion of the number of stations in the area to the total number of stations

$$P\mathrm{j} = (m / M) \times 100 \ \%$$

Materials and Methods

- Comparative value Index (Z)

A statistic for quantifying the differences between two groups of data

$$z = \left(k_d / D - k_f / F\right) / \left(k_d / D\right)$$

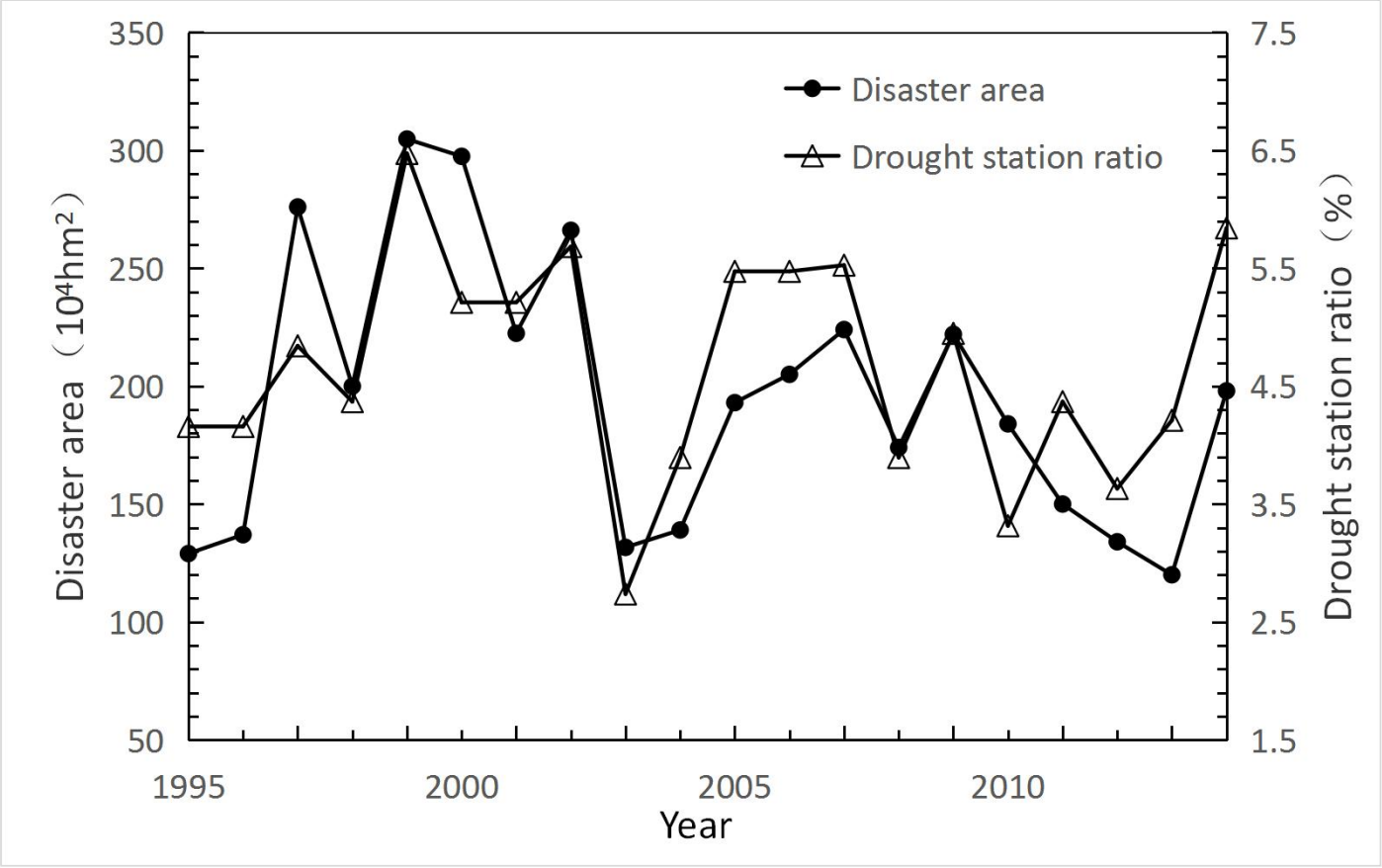
- The principle of disaster risk assessment

Hazard、Exposure、Vulnerability、Disaster prevention and mitigation ability

$$Rd = f(h, e, v, p) = f_1(h) f_2(e) f_3(v) f_4(p)$$

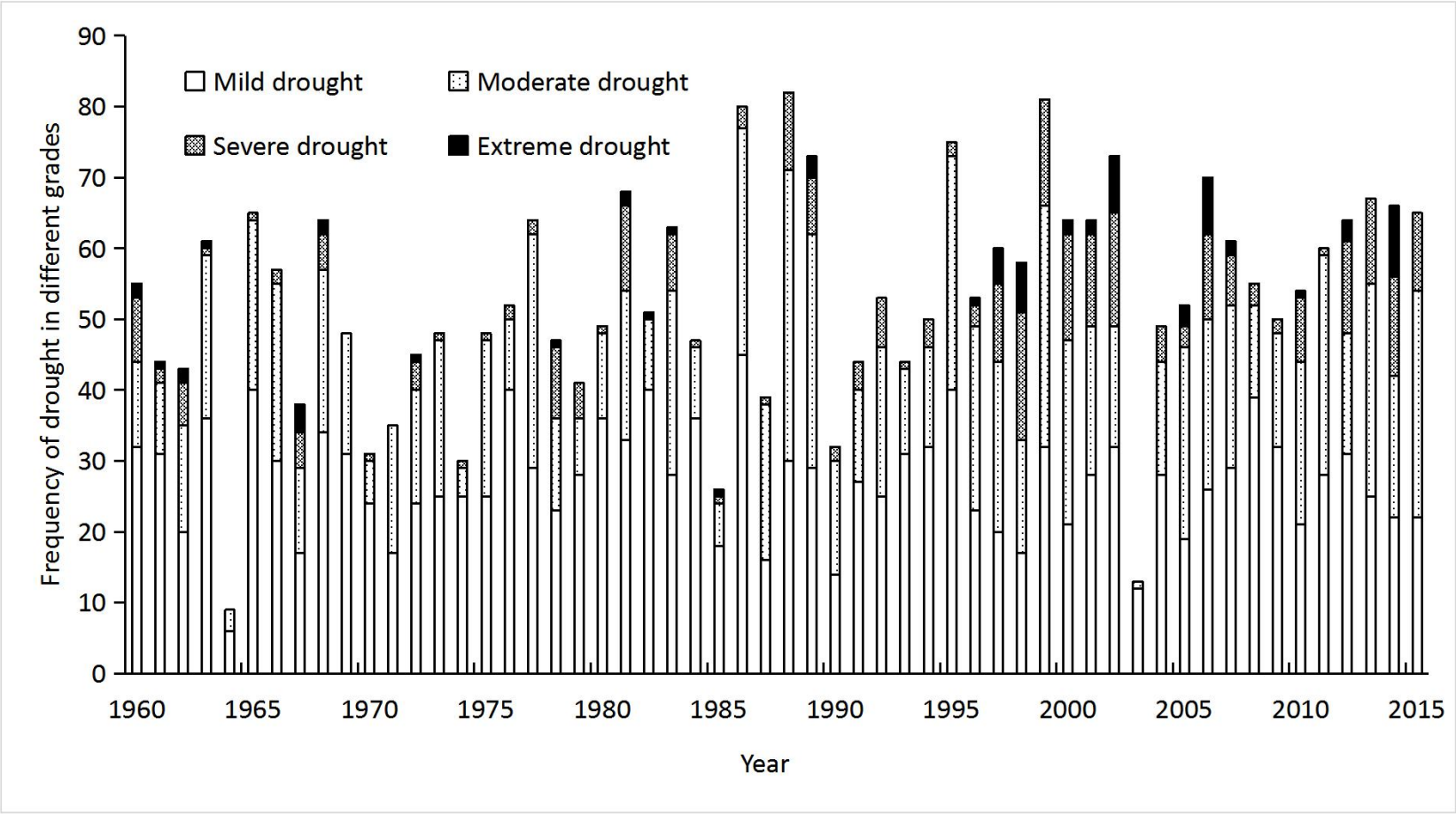
Results

- Comparison of Drought Disaster Area and Drought Station Ratio in Hebei Province over Time



Results

- Temporal variation of drought occurrence times in different grades in Shandong Province



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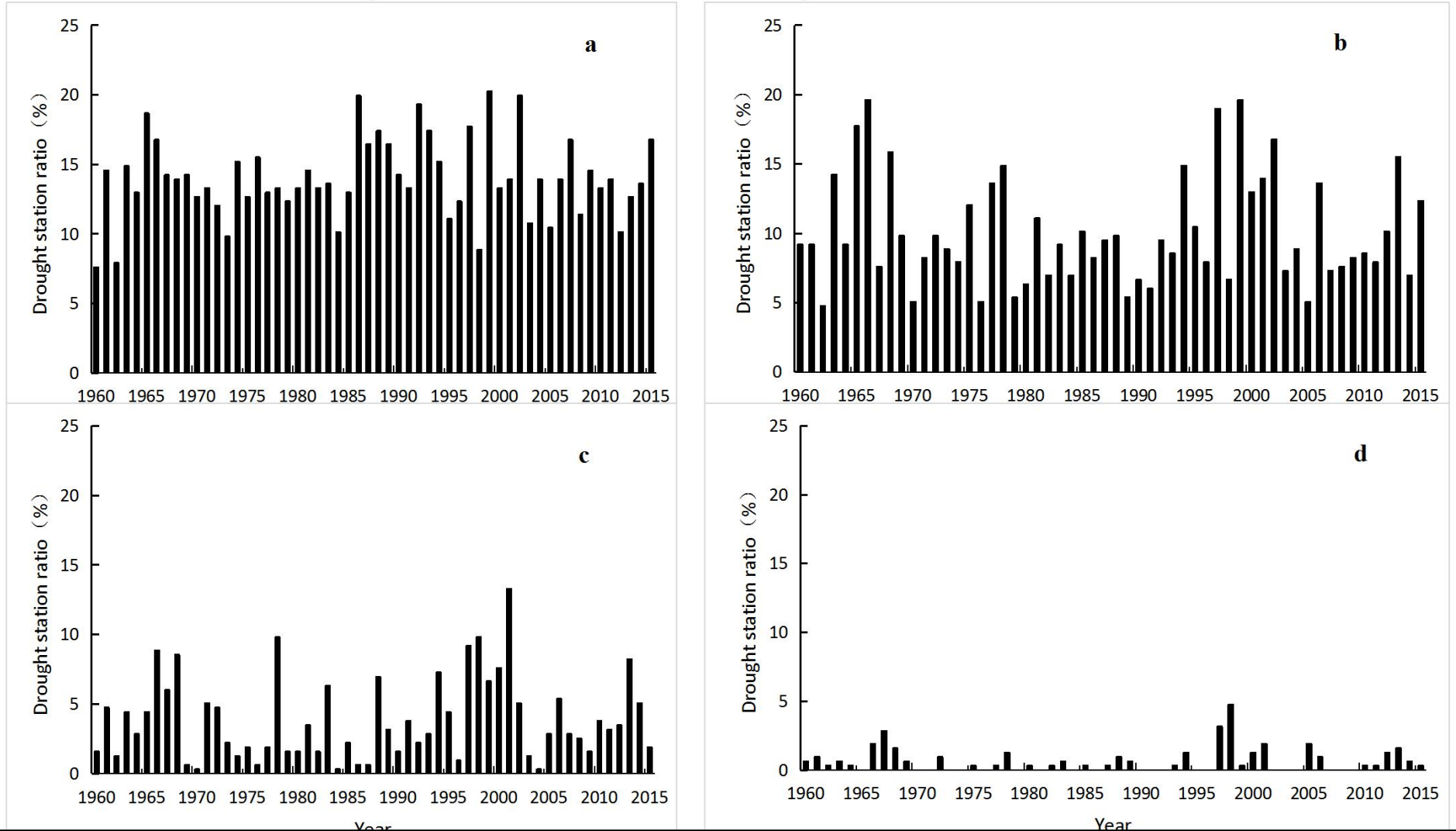
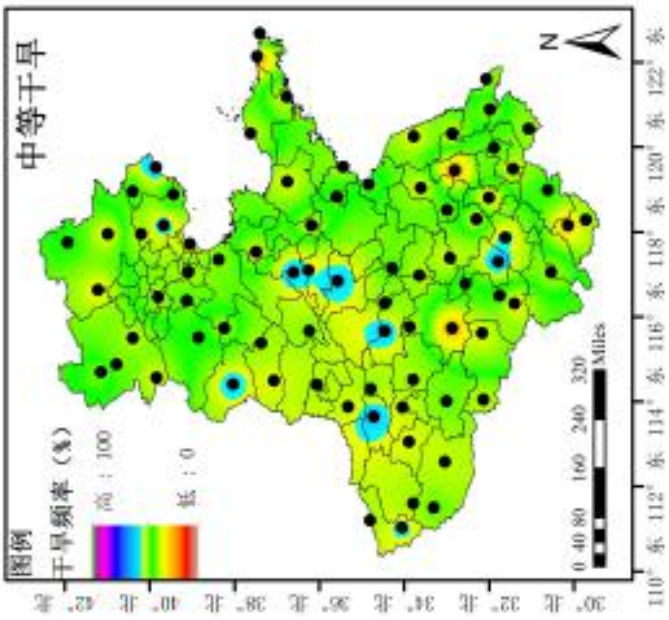
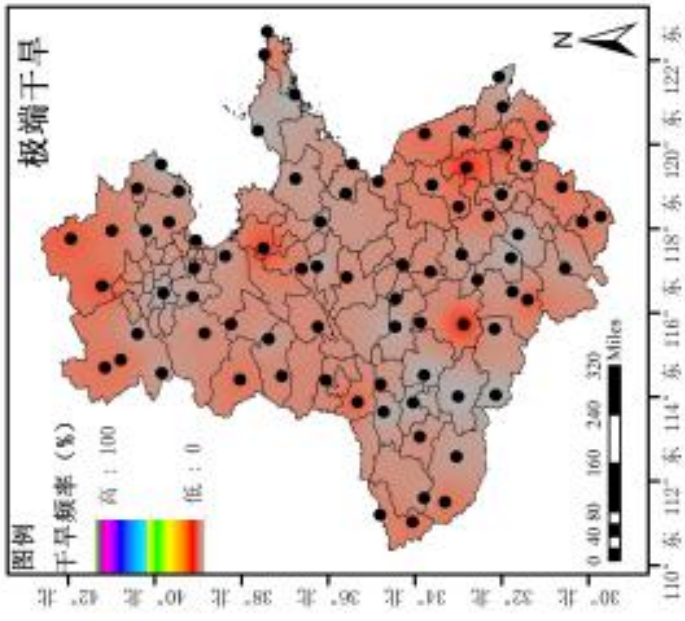
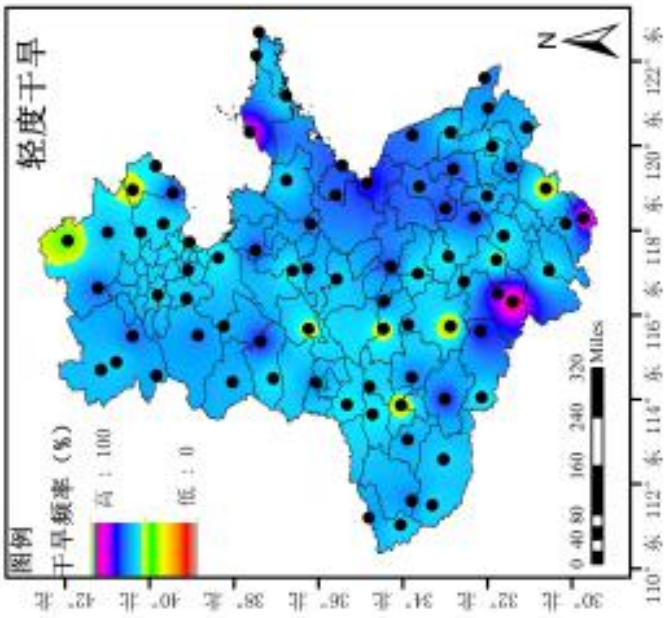
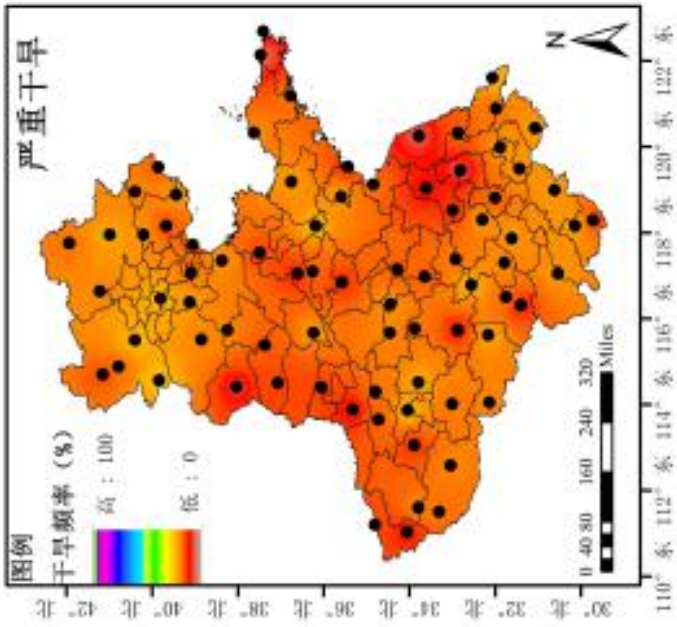




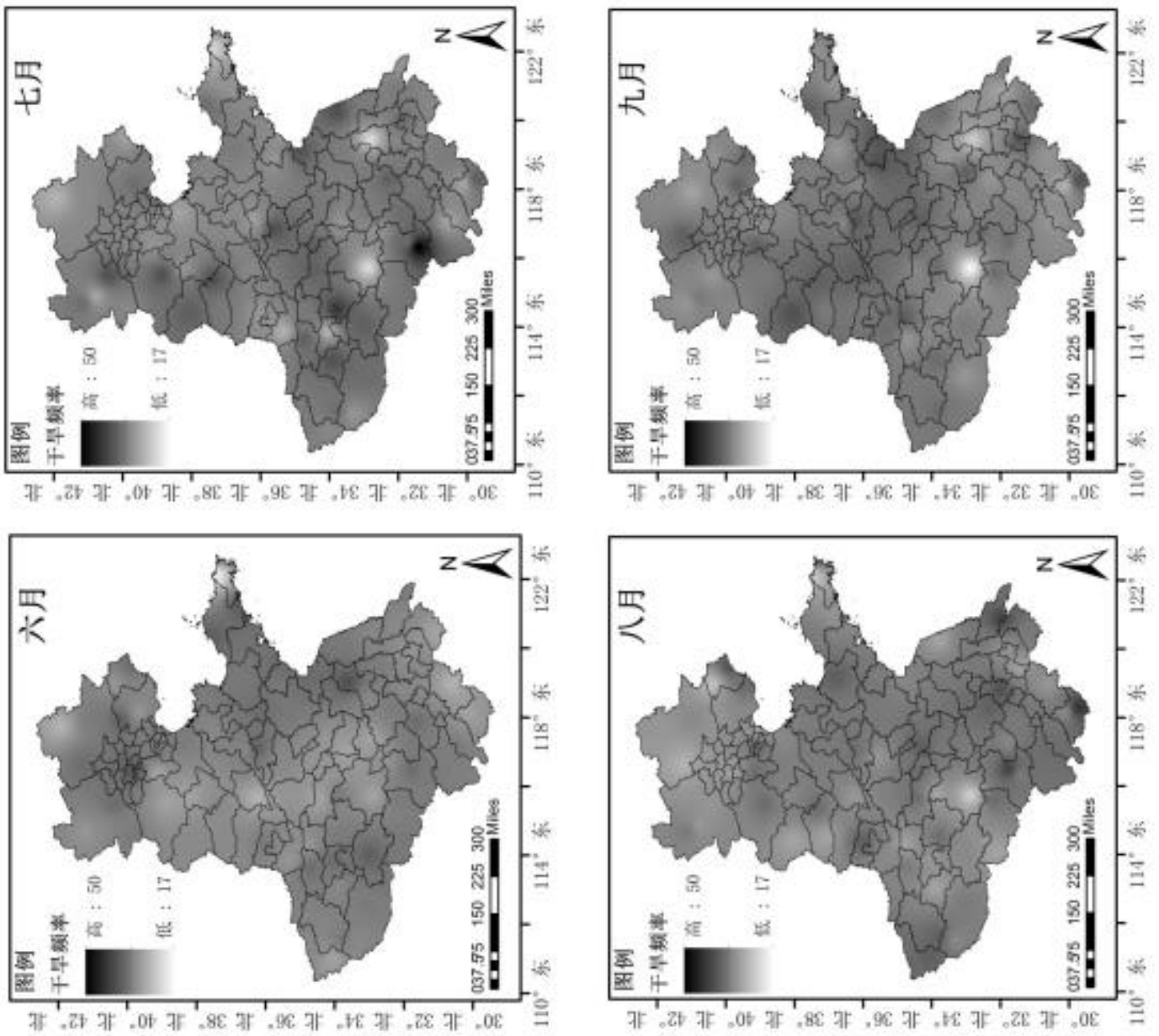






Spatial distribution of frequency of drought
in summer maize growing period in the Huang-Huai-Hai Region

Results

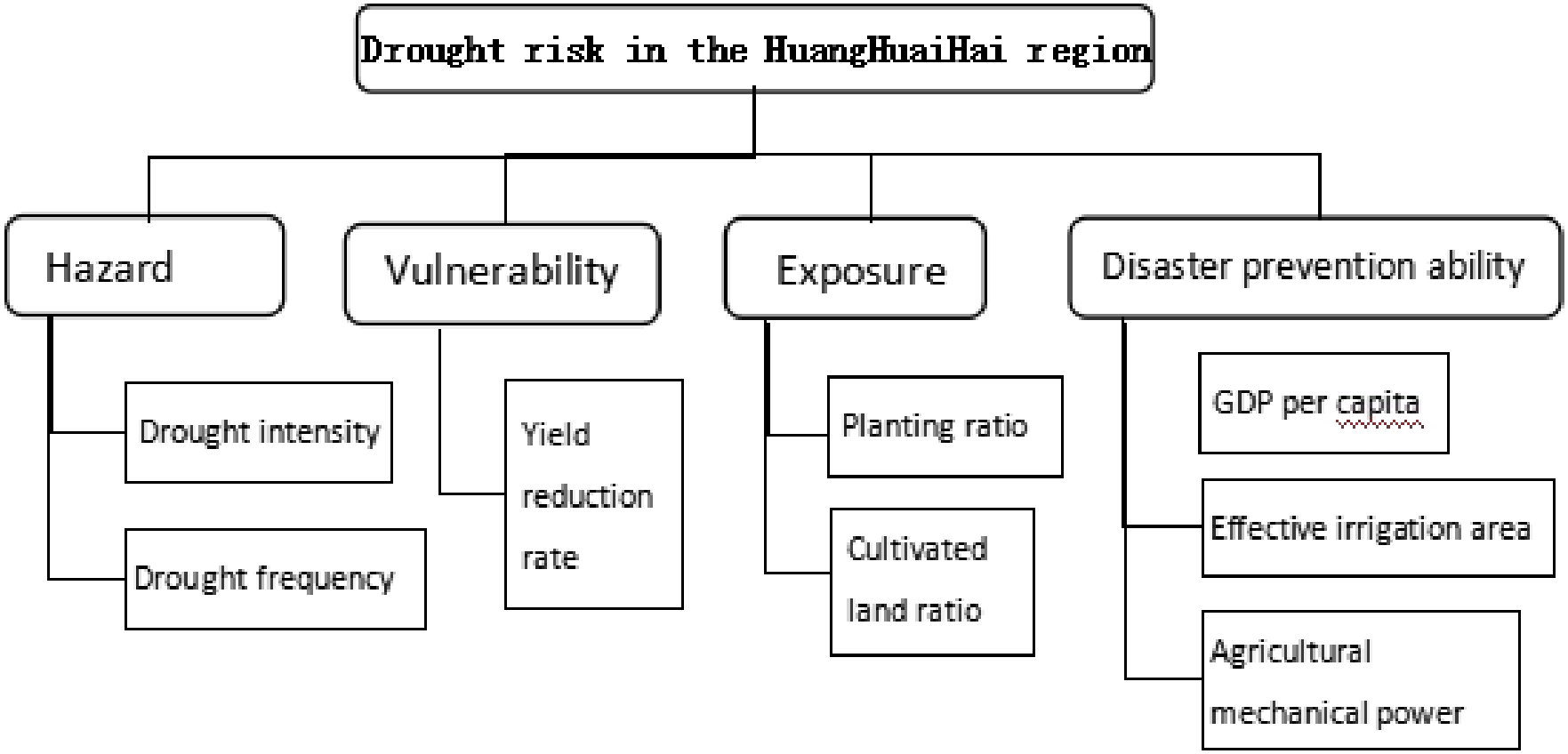


Spatial distribution of drought frequency
in the Huang-Huai-Hai Region in June-September

Results

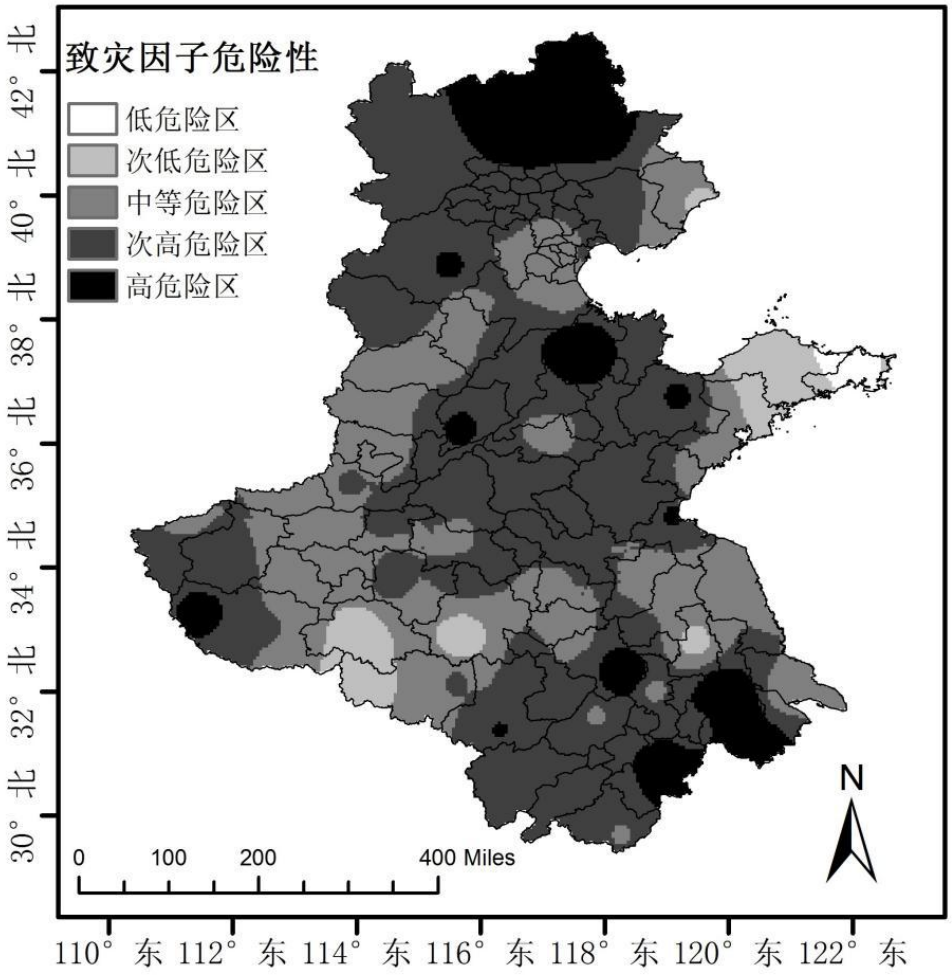
Results

- Indicator system for drought disaster risk assessment in the Huang-Huai-Hai Region



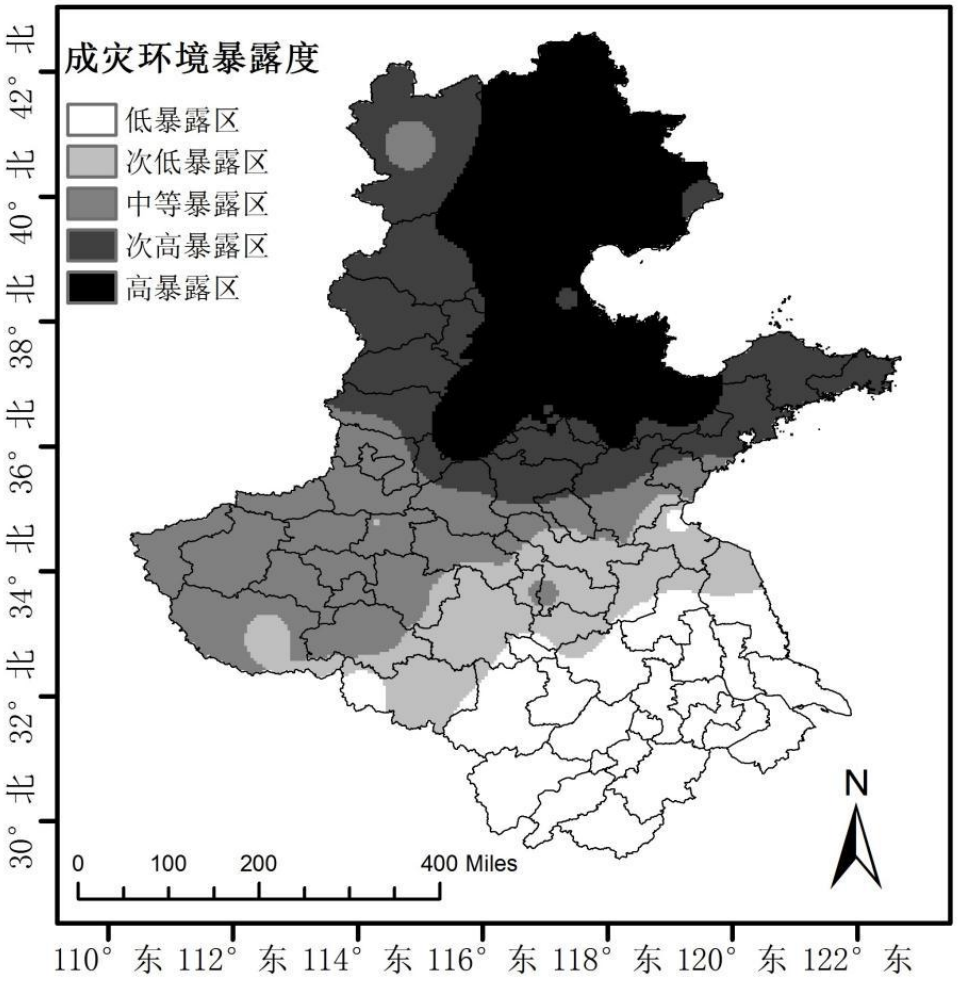
Results

- Risk assessment zonation of drought disaster factors



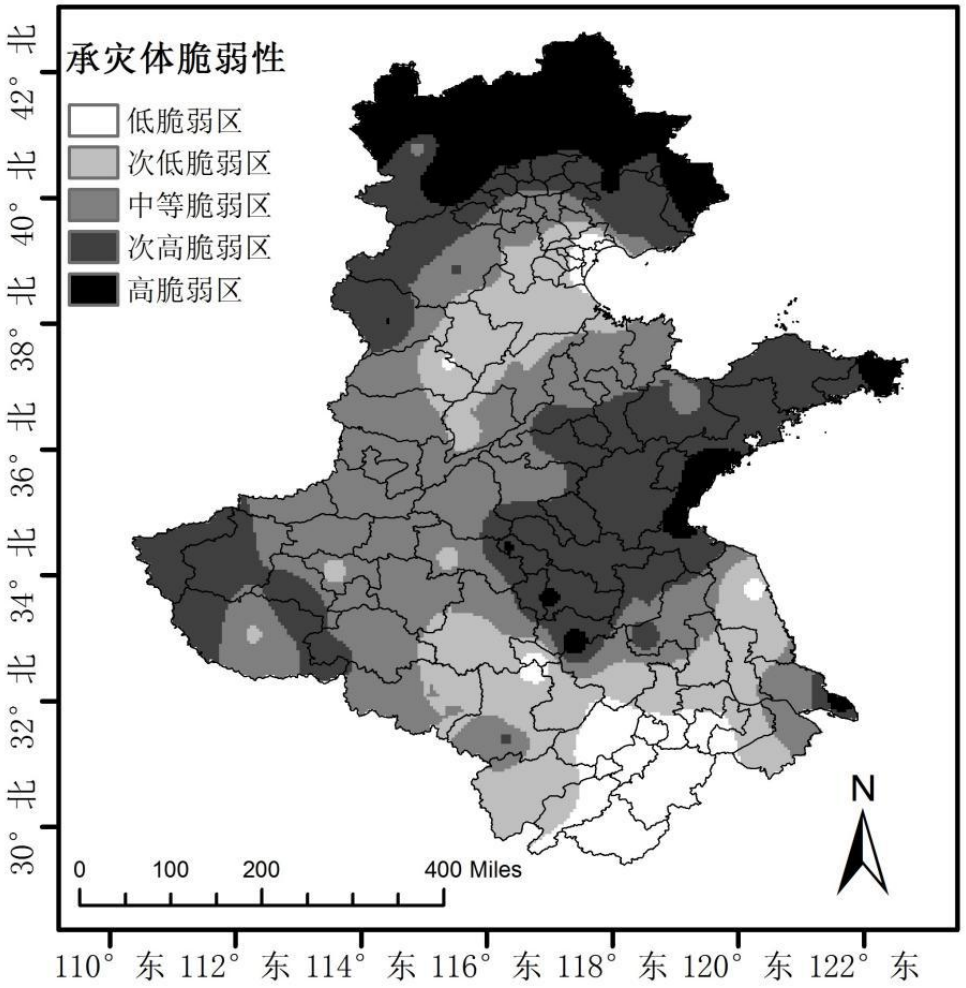
Results

- Assessment of environmental exposure to drought hazards



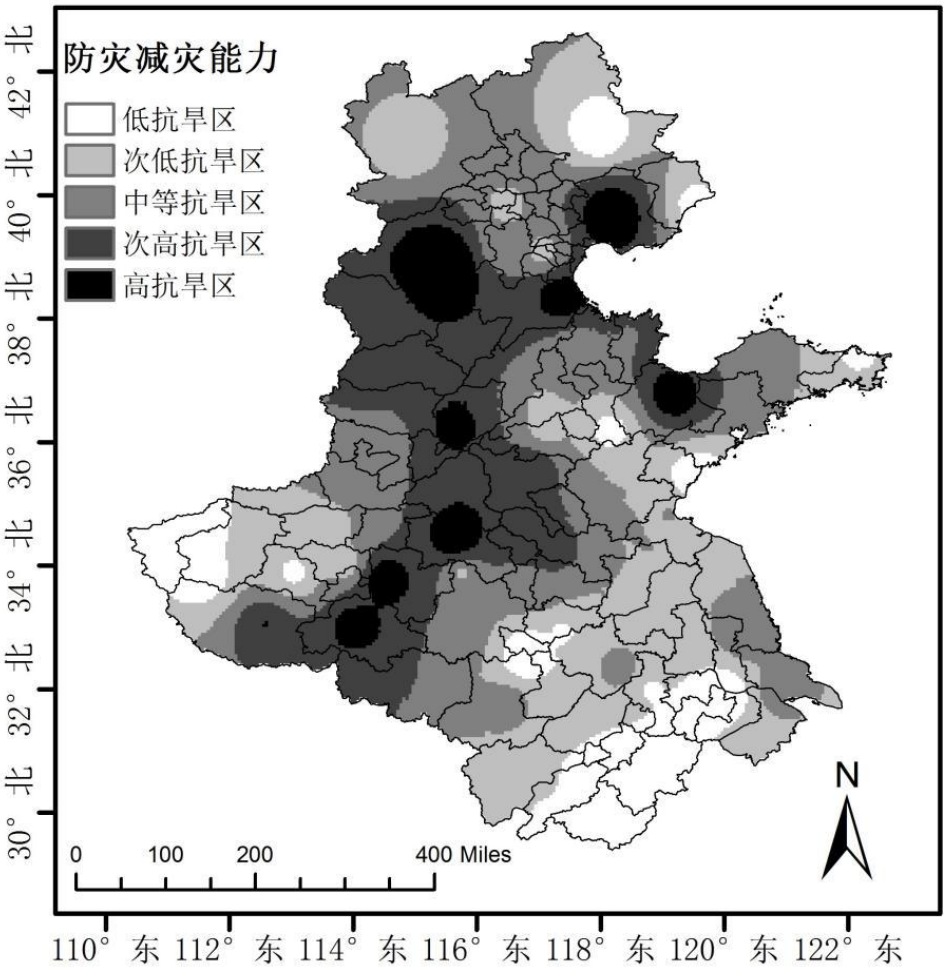
Results

- Vulnerability assessment zonation of drought disaster bearer



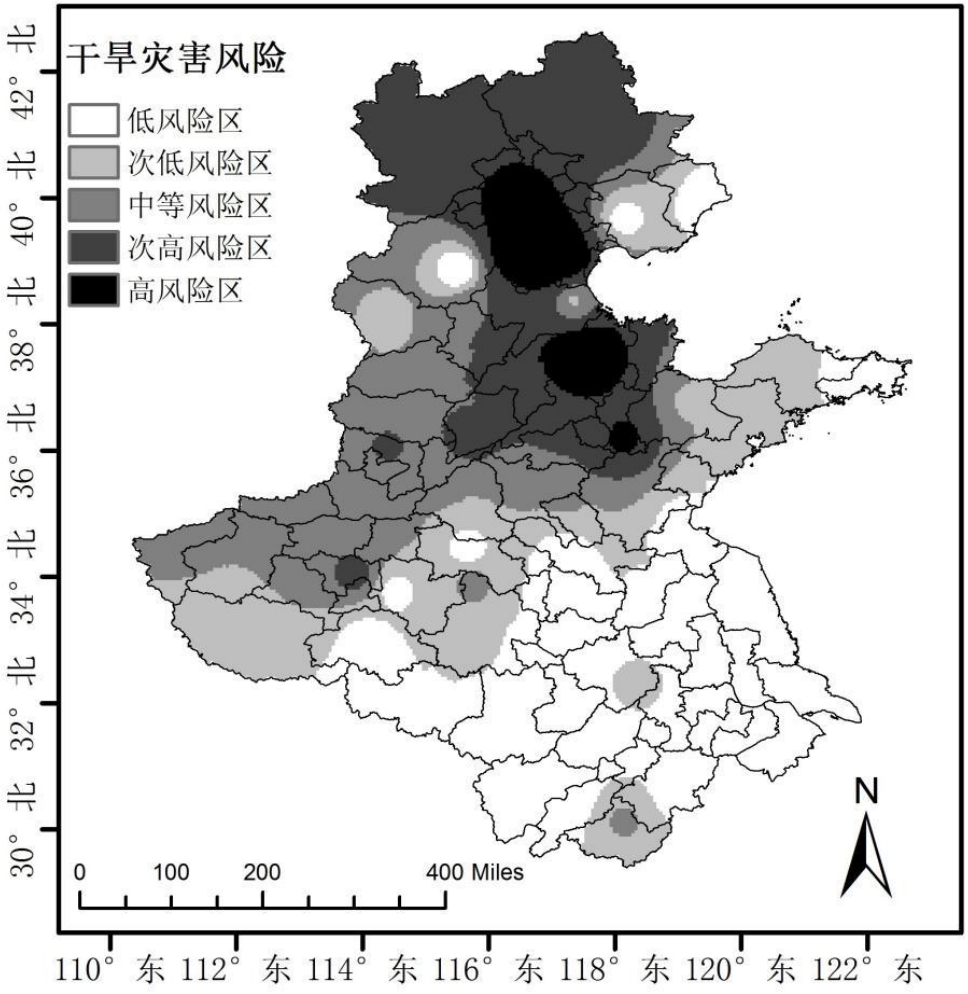
Results

- Assessment division of drought disaster prevention and reduction ability



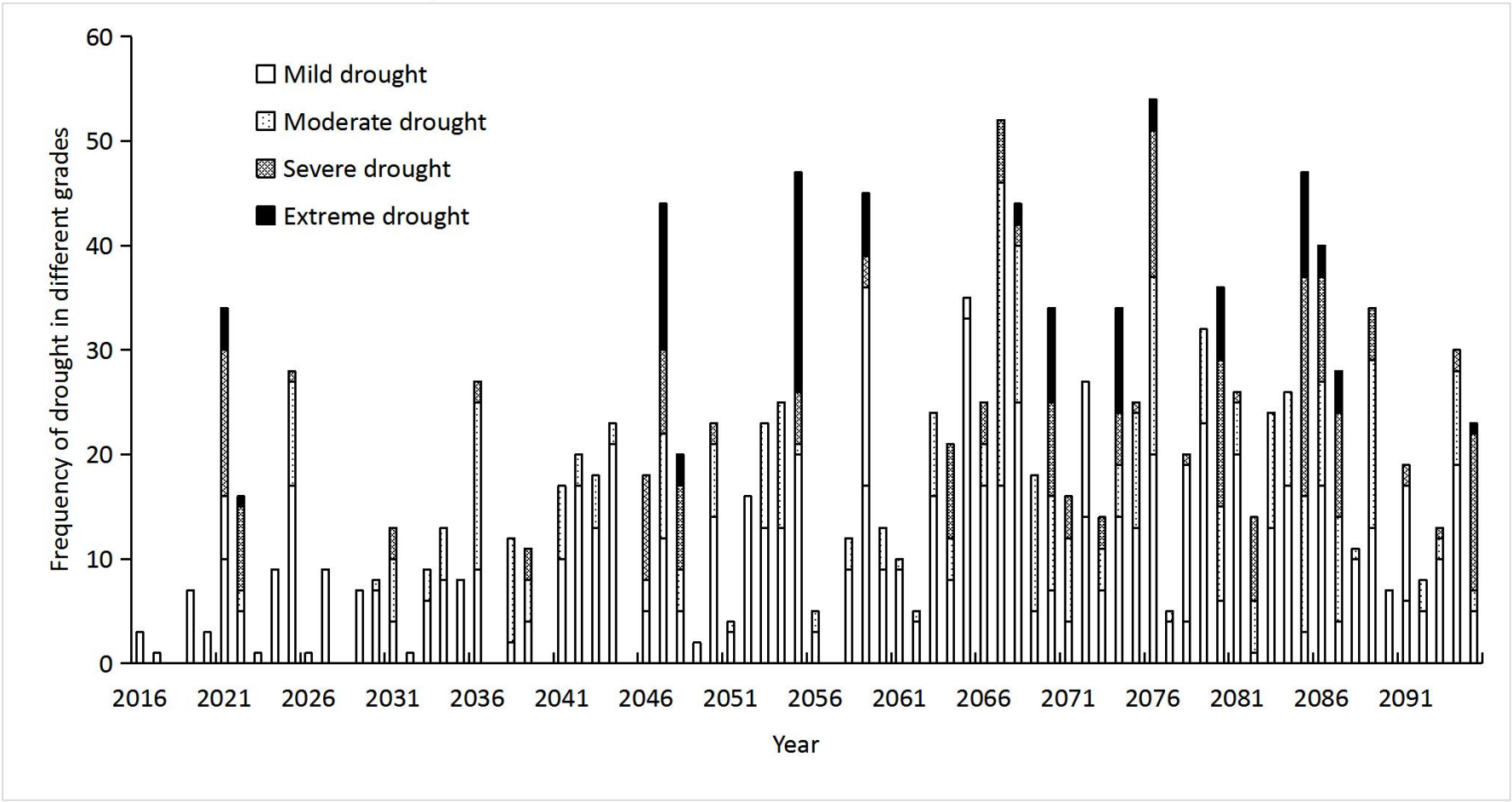
Results

- Regionalization of drought disaster risk assessment



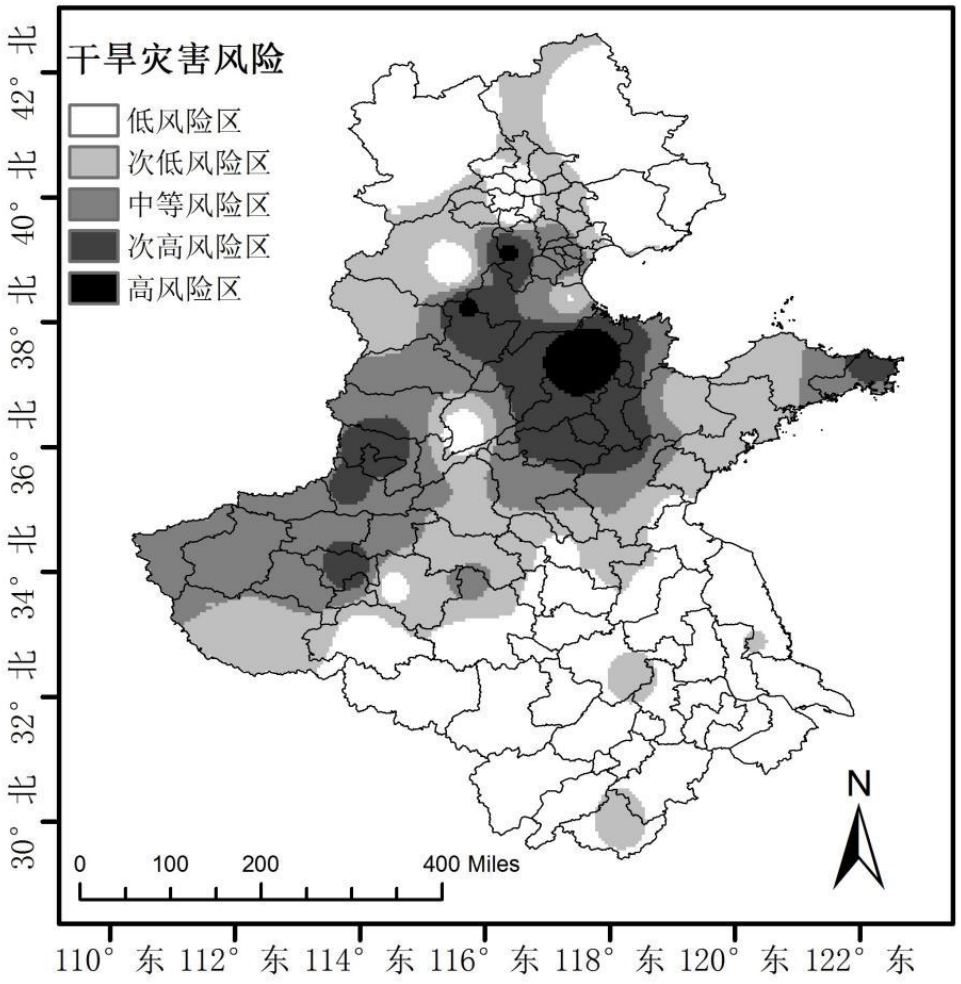
Results

- Temporal changes of the occurrence times of drought of different grades in Shandong Province in the next 80 year



Results

- Regionalization of drought disaster risk assessment in future scenarios



Discussion and Conclusions

Analysis of temporal characteristics of drought in Huang-Huai-Hai Region for the period 1960–2015

(1) The monthly scale SPEI index is applicable in Huang-Huai-Hai Region.

(2) Drought disasters are common in Shangdong Province, and the severity of drought, the number of occurrence has a rising trend.

(3) The situation of drought in Huang-Huai-Hai Region is more and more serious in 60s and 80s.

Discussion and Conclusions

Analysis of spatial characteristics of drought in Huang-Huai-Hai Region for the period 1960–2015

(1) The frequency of drought were between 27% -37%, the drought situation is still more serious.

(2) The maximum precipitation was in September, and the frequency of drought was only 33.48%. Most sites in June have a low frequency of drought, except for individual sites. Drought occurred more frequently in July and August.

Discussion and Conclusions

Drought disaster assessment in Huang-Huai-Hai Region

(1) The risk distribution of drought disaster in summer is decreasing from north to south. The low risk area is more than half of the total area, mainly in the south of the study area.

Discussion and Conclusions

In the future climate scenario, Drought situation and risk prediction

(1) The drought stations in Shandong have a trend to increase over time, reaching a peak in 2080 and falling from 2090.

(2)The risk prediction of drought disaster in the next 80 years in the Huang-Huai-Hai region is over 50% of the whole research area.

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THANK YOU