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A dataset of agro-meteorological disaster-affected area and grain loss in China (1949 – 2015)

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Abstract: As a big agricultural country, the People's Republic of China has experienced a series of natural disasters since its founding, such as the 1959 – 1961 Great Famine, the 1998 floods and the 2008 snowstorm. Here we present a dataset summarizing four categories of meteorological disaster-affected area at provincial level in China from 1949 to 2015: mildly-affected area, moderately-affected area, heavily-affected area, and total affected area. Based on crop-planting data and natural disaster data, grain losses are also evaluated by using a grain loss assessment model. The dataset plays an important role in the future prediction, prevention, and reduction of agro-meteorological disasters.

Keywords: natural disasters; grain loss; provincial; China; 1949 – 2015

Dataset Profile

Title	A dataset of agro-meteorological disaster-affected area and grain loss in China (1949 – 2015)
Data corresponding authors	Mao Kebiao (maokebiao@caas.cn); Zhao Yinghui (zhaoyhneau@163.com)
Data authors	Guo Jingpeng, Chen Huiqian, Zhang Xiaorong, Zhao Yinghui, Mao Kebiao, Li Ning, Zhu Liang
Time range	1949 – 2015
Geographical scope	China
Spatial resolution	Provincial
Data volume	0.7 MB
Data format	*.xlsx
Data service system	< http://www.sciencedb.cn/dataSet/handle/540 >
Sources of funding	National Natural Science Foundation of China (No. 41571427); Innovation Group Program of the Chinese Academy of Agricultural Sciences (Grant No. Y2017JC33)

Dataset composition	This dataset consists of two data files: Natural_disaster.zip stores data of disaster-affected area and Grain_loss.zip stores evaluated data of grain losses. (1) Natural_disaster.zip is a 0.45 MB disaster data set made up of three files: • Mildly-affected area.xlsx presents the areas with less than 100% of the yield that would be expected under long-term average temperature and precipitation due to natural disasters; • Moderately-affected area.xlsx presents the areas with less than 70% of the expected yield due to natural disasters; • Heavily-affected area.xlsx presents the areas with less than 30% of the expected yield due to natural disasters. (2) Grain_loss.zip is a 0.25 MB grain loss data set made up of two .xlsx files: • Grain_loss_amount.xlsx; • Grain_loss_ratio.xlsx.
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1. Introduction

With a vast territory, diverse climatic types, fragile ecosystems and varied types of disasters, China is a country that suffered from the most serious natural disasters in the world. Agricultural disasters constitute the main natural disasters in China, mainly including flood, drought, low temperature, hail, and typhoon, with flood and drought being the most prominent.¹⁻³ In June and July 2017, 11 provinces in southern China suffered from floods, which affected more than 11 million people, including 78 people who died or disappeared and 27 thousand houses that collapsed. Direct economic losses reached 25.27 billion yuan, leading to a government supply of up to 1.88 billion yuan for disaster relief. Research on the temporal-spatial laws, driving mechanism, risk assessment, regional regularity, and control measures of natural disasters needs the support of historical disaster datasets.³⁻⁴ Here we sorted, summarized and evaluated the data of major meteorological disasters in China at provincial level from 1949 to 2015, as well as the data of grain losses caused by these disasters.

Firstly, we summarized mildly-, moderately-, and heavily-affected area, as well as total affected area by meteorological disasters from 1949 to 2015 (i.e., flood, drought, low temperature, hail, typhoon). Secondly, based on the crop planting dataset, we estimated grain losses caused by these disasters at provincial level by means of grain loss assessment model. The dataset, which includes information on agro-meteorological disasters and grain losses, can provide a scientific basis for investigating the spatiotemporal pattern of agro-meteorological disasters.

2. Data acquisition and processing

2.1 Overview

It should be noted that, due to limited data availability, statistics of Hong Kong, Macao, and Taiwan were not included in this dataset. This study covers five main disaster types that took place in 31 provinces/municipalities in China: flood, drought, hail, low temperature, and typhoon. The raw data were collected over the period 1949 – 2015 via Python scripts (Figure 1) from the website of the Ministry of Agriculture of China (MAC) and China Statistical Yearbooks Database (CSYD), as listed in Table 1. Python scripts 1, 2, and 3 (Figure 1) are Web-based data mining techniques.

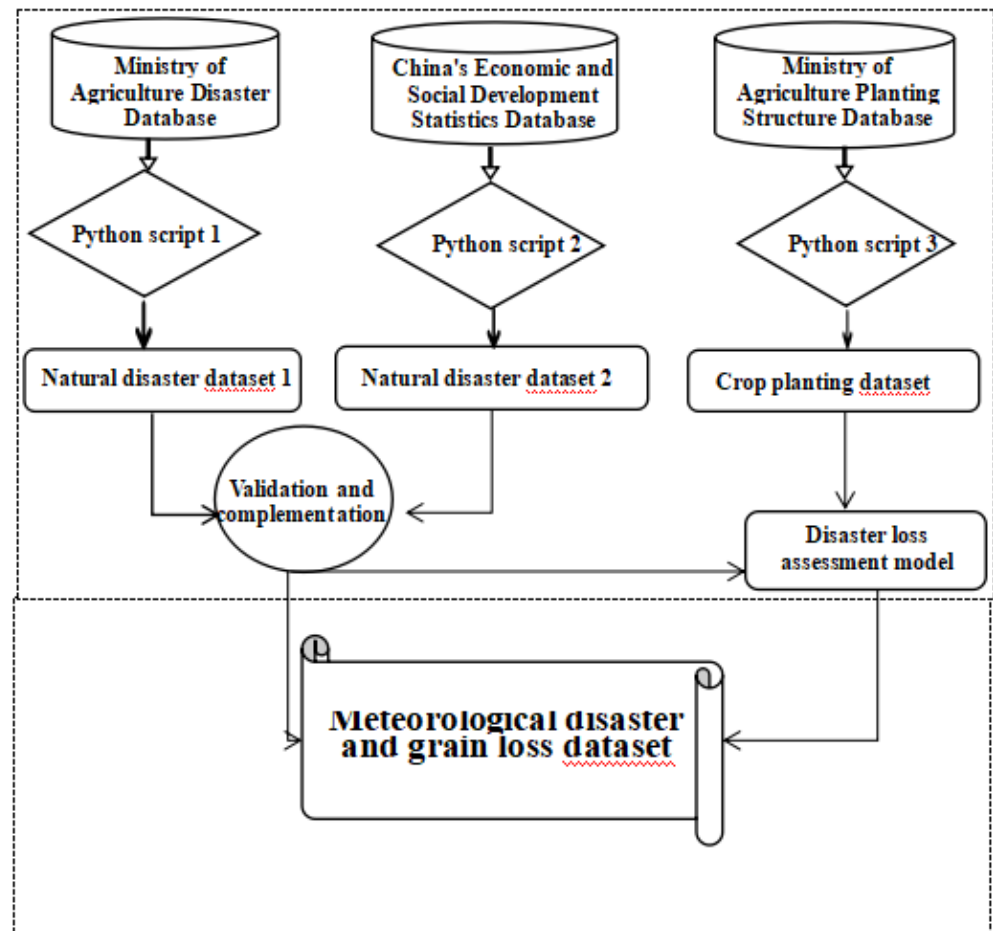


Figure 1 Flowchart illustrating the dataset formation

Table 1 Description of the raw data

Database	Variable	Time span	Geographical scope	Sources
Raw data on meteorological disasters	Mildly-affected area (10 ⁴ ha)	1949 – 2015	31 provinces / municipalities in China	Website of the Ministry of Agriculture of China (MAC) and China Statistical
	Moderately-affected area (10 ⁴ ha)	1949 – 2015	31 provinces / municipalities in China	

	Heavily-affected area (10 ⁴ ha)	1949 – 2015	31 provinces / municipalities in China (CSYD)	Yearbooks	Database
	Grain yield (kg*ha ⁻¹)	1949 – 2015	31 provinces / municipalities in China		
Crop planting dataset	Crop-sown area (10 ⁴ ha)	1949 – 2015	31 provinces / municipalities in China	Website of the Ministry of Agriculture of China (MAC)	
	Grain-sown area (10 ⁴ ha)	1949 – 2015	31 provinces / municipalities in China		

Firstly, we cleaned, sorted and replenished the raw meteorological disaster data drawn from the above two sources. Secondly, the final meteorological disaster dataset and the planting dataset were used to generate grain loss data via grain loss assessment model. A detailed description of the final dataset is given in Table 2.

Table 2 Description of the data of meteorological disaster-affected area and grain loss

Dataset	Variable	Disaster type	Time span	Geographical scope
Meteorological disaster data set	mildly-affected area (10 ⁴ ha)	Five major disaster types	1949 – 2015	31 provinces/municipalities in China
	moderately-affected area (10 ⁴ ha)	Five major disaster types	1949 – 2015	31 provinces/municipalities in China
	heavily-affected area (10 ⁴ ha)	Five major disaster types	1949 – 2015	31 provinces/municipalities in China
Grain loss data set	Grain loss amount (10 ⁴ kg)	Five major disaster types	1949 – 2015	31 provinces/municipalities in China
	Grain loss rate (%)	Five major disaster types	1949 – 2015	31 provinces/municipalities in China

2.2 Methods

Li et al. (2010) constructed a statistical model for estimating the amount of grain loss based on grain yield and disaster-affected area. Researchers (Shi et al., 2014; Guan et al., 2015) in China mainly used the statistical model to estimate the amount of grain loss in recent years.⁴⁻⁶ This section uses the model to estimate the amount of grain loss based on the following formula:

$$G_q = R_i \times A_{i1} \times y_i \times P_1 \quad (1)$$

$$G_m = R_i \times A_{i2} \times y_i \times P_2 \quad (2)$$

$$G_z = R_i \times A_{i3} \times y_i \times P_3 \quad (3)$$

$$S_{ci} = G_q + G_m + G_z \quad (4)$$

$$S_c = \sum_{i=1}^n S_{ci} \quad (5)$$

where S_c is the amount of grain loss in China; n is the number of provinces and municipalities; S_{ci} is the grain loss in Province i ; G_q is the grain loss caused by mild disaster; G_m is the grain loss caused by moderate disaster; G_z is the grain loss caused by severe disaster; R_i is the ratio of grain-sown area to crop-sown area; A_{i1} , A_{i2} , and A_{i3} designate the amount of crop area affected by mild, moderate and severe disasters, respectively (mild disaster: 10 – 30% grain losses; moderate disaster: 30% – 70% grain losses; severe disaster: over 70% grain losses); and y_i is the grain yield per ha of Province i in the same year. P_1 , P_2 , and P_3 assume a value of 20%, 50%, and 85%, respectively, assigned based on the median method in tandem with the definitions of crop affected area and crop failure area.

The ratio of grain losses to total grain output in the same year was defined as the rate of grain losses.⁸ It is expressed by:

$$R = \frac{S_c}{G_a} * 100\% \quad (6)$$

where R is the ratio of grain loss; S_c is the amount of grain loss; G_a is the amount of total grain output.

3. Sample description

Moderately-affected area.xls includes six worksheets (tag name: Flood, Drought, Hail, Low_temperature, Typhoon). Each table is a 2 * 2 matrix form; the first column of the worksheets records the name of the province/municipality; time dimension (1949 – 2015) is given in the first line and matrix values are in units of 10^4 ha.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	
Beijing	0	0	0	0	0	0	0	3.466667	0	0	18.86667	14.8	24.46667	23.66667	13.33333	6.266667	9.066667	4.4	0	
Tianjin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hebei	257.3333	134.4	241.9333	139.2	247.3333	367.5333	281.2667	324.6667	154.2	405.4667	221.6667	845.1333	672.6667	397.0667	474.6667	335.4	310	197.7333	0	
Shanxi	7.533333	35.46667	81.33333	23.33333	79.6	106.6	169.4	77.86667	180.6667	39.26667	119.7333	308.4667	159.5333	296.2	93.66667	7.133333	254.6667	89.06667	0	
Inner Mongolia	11.33333	8.333333	306.4	12.8	74.4	29.06667	89.2	29.53333	342	59.53333	61.4	268.8667	213.8	302	208	16.2	236.2667	169.8667	0	
Liaoning	45.53333	17.73333	89.8	39.26667	56.8	33.53333	84.2	20.06667	74.06667	120.2667	43.33333	248.5333	179.2667	45.66667	151.4	74.2	43.06667	14.53333	0	
Jilin	0	0.533333	30.73333	1.533333	10.2	14.13333	35.93333	112.6	68.86667	200	36.66667	127.3333	113.3333	172.4	167.7333	49.06667	74.66667	23.46667	0	
Heilongjiang	1.333333	93.73333	40.33333	3.066667	9.533333	0	26.46667	107	73	74.86667	182.8667	137.0667	158.1333	245.2	82.26667	113.0667	132.8667	11.26667	0	
Shanghai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Jiangsu	128	73.66667	37.73333	15.4	190.4667	231.8	138.3333	248.4	99.53333	107.5333	260.2667	399.3333	370.9333	251.6667	104.8	53.33333	156.6667	73.33333	0	
Zhejiang	20.6	7.133333	18.6	33.86667	73.53333	30.2	62.8	49	55.93333	52.8	70.73333	111.2	158.4667	68.66667	68.2	0	12.6	5	0	
Anhui	204.7333	235.2667	103	231.2667	355.2	331.4667	41	351.5333	247.3333	334.1333	376.8667	452.2667	489.6	255.4	158.6667	105.1333	148.2	210.2667	0	
Fujian	0	0.6	3.6	8.866667	44.46667	22.4	43.86667	46.93333	24	13.13333	32.33333	86.53333	108.5333	20.53333	51.06667	2.666667	4.933333	11.33333	0	
Jiangxi	8	29.8	90.33333	10.46667	83.4	83.26667	80	67.26667	23.33333	82.06667	46.66667	40	104.3333	83.06667	95.13333	61	0	59.93333	0	
Shandong	106.5333	32.06667	134.4667	47	342	227.7333	113.1333	69.6	459.8667	377.5333	627.4	857.1333	823.8667	304.4667	204.4667	369.7333	178.0667	346.6667	0	
Hennan	90	295.5333	67.26667	67.86667	388.2	202.3333	160.8	399.8	463.0667	178.6	769	847.5333	830.6667	432.4	408.4	360	253.3333	297.2667	0	
Hubei	22.66667	36.13333	1	68	106.9333	156.4	70.53333	18.93333	80	129.7333	400	236.4	345.8667	117.4667	33.73333	51.8	3.8	168.6667	0	
Hunan	21.06667	36.86667	33.8	17.06667	67.13333	97.13333	107.4	95.73333	132.8	72.73333	231.0667	150.6667	258	104.3333	202.2667	98	46.86667	162	0	
Guangdong	0	7.163333	1.333333	46.66667	63.53333	172.3333	17.53333	108.8	44.13333	136.6667	298.0667	181.9333	70.93333	162.6	65.33333	43.33333	132.1333	0	0	
Guangxi	1.466667	2.2	8.533333	19.93333	44.73333	71.86667	70.66667	120.6	78.86667	132.5333	40.86667	93.73333	75.6	77.06667	155.3333	99.73333	2.933333	102.2667	0	
Hainan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Chongqing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sichuan	0	0	100.9333	62.46667	0.466667	45.06667	22.26667	11	4.4	21.66667	408.0667	330.6667	390.5333	182.4667	129.7333	113.9333	16	64.4	0	
Guizhou	0	0	0.2	5.533333	0	1.733333	60.33333	21.93333	10.53333	56.4	79.73333	56.26667	58.06667	38.33333	39.8	9.666667	6.533333	87.66667	0	
Yunnan	0	0	0.333333	0.2	4.066667	8.333333	3.8	0.4	6.466667	136.1333	24.73333	112.0667	64.06667	20.13333	102.6667	31.46667	0.533333	12.53333	0	
Xizang	0	0	0	0	0.333333	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	
Shaanxi	6.8	9.4	7.666667	10.33333	4.133333	7	153.5333	19.73333	143.3333	44.53333	146.7333	291.4667	200.2	146	97.2	160.6667	100.7333	74	0	
Gansu	1.6	6.266667	0	0	89.13333	13.66667	31.86667	13.06667	71.13333	28	16.46667	170.8667	86.86667	114.2	40.73333	15.66667	36.53333	82	0	
Qinghai	0	1.533333	9.933333	0	20	0	0	0	8.933333	4	30.93333	29.66667	12	1.4	3.266667	8.933333	17.8	0	0	
Ningxia	0	0	8.733333	0	4.733333	0	0	0	1.933333	2.466667	22	25.53333	0	6.8	0.666667	0	0	0	0	
Xinjiang	0	0	0	0	0.4	0	0	0	1.6	4.666667	3.666667	19.46667	3.333333	42.4	26.93333	3.666667	1.266667	0	3.133333	0
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Figure 2 Moderately-affected area at provincial level

4. Quality control and assessment

Quality control involved detailed inspection and exploration of patterns to detect any typographical errors or other data errors. The data provided herein were re-processed from the raw data supplied by MAC and CSYD, and as such depended on the quality and reliability of the data sources. Zhao et al. (2017) used the above data to analyze the tempo-spatial characteristics of natural disasters and grain losses in China from 1949 to 2015, and found that flood and typhoon were concentrated in, and greatly limited to, central China, eastern China and the southeast coast of China, unlike other disasters which were randomly distributed. Their findings were hence consistent with the findings of Guan et al. (2015) and Du et al.(2015).²⁻⁵

5. Usage notes

The dataset is released via Science Data Bank (<http://www.sciencedb.cn/dataSet/handle/540>), and the Resource Service System of the CERN Data Center (<http://www.cnern.org.cn>), where users can log into the system, click data resources and select data to enter the download page. There are no copyright or proprietary restrictions on the dataset.

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References

1. Liu Y, Yu Y & Li L. Major natural disasters and their spatio-temporal variation in the history of China. *Journal of Geographical Sciences* 22 (2012): 963 – 976.
2. Du X, Jin X, Yang X et al. Spatial-temporal pattern changes of main agriculture natural disasters in China during 1990 – 2011. *Journal of Geographical Sciences* 25 (2015): 387 – 398.
3. Gu X, Zhang Q & Zhang S. Spatio-temporal properties of flood/drought hazards and possible causes and impacts in 1961 – 2010. *Scientia Geographica Sinica* 36 (2016): 439 – 447.
4. Zhao Y, Guo J, Mao K et al. Spatio-temporal distribution of typical natural disasters and grain disaster losses in China from 1949 to 2015. *Acta Geographica Sinica* 27 (2017): 1261 – 1276.
5. Guan Y, Zheng F, Zhang P et al. Spatial and temporal changes of meteorological disasters in China during 1950 – 2013. *Natural Hazards* 75 (2015): 2607 – 2623.

6. Shi W & Tao F, Spatio-temporal distributions of climate disasters and the response of wheat yields in China from 1983 to 2008. *Natural Hazards* 74 (2014): 569 – 583.
7. Yang J, Huo Z, Wu L et al. Indicator-based evaluation of spatiotemporal characteristics of rice flood in Southwest China. *Agriculture, Ecosystems and Environment* 230 (2016): 221 – 230.
8. Li W, Qin Z & Lin L. Quantitative analysis of agro-drought impact on food security in China. *Journal of Natural Disasters* 19 (2010): 111 – 118.

Data citation

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Authors and contributions

Guo Jingpeng, Master's student; research area: remote sensing monitoring of agricultural disasters. Contribution: motivation of study, data analysis, writing.

Chen Huiqian, Master's student; research area: climate change, agricultural economic assessment. Contribution: manuscript writing.

Zhang Xiaorong, Master's student; research area: prevention and control of social disasters. Contribution: data collection.

Zhao Yinhui, PhD, Associate Professor; research area: environmental changes in urban and rural areas. Contribution: project supervision and modification.

Mao Kebiao, PhD, Professor; research area: remote sensing of environment, landscape effects. Contribution: motivation of study.

Li Ning, Master's student; research area: remote sensing monitoring of agricultural disasters. Contribution: data analysis.

Zhu Liang, Master's student; research area: regional agricultural economy. Contribution: data collection.

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