

# Current Situation and Countermeasures of the Protection of Meteorological Cultural Heritage in China

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**Abstract** With the increase of global climate change and extreme weather events, more and more attention has been paid to the protection of China's meteorological cultural heritage. Meteorological cultural heritage is an important part of China's cultural heritage, which is unique and non renewable. It is of great significance to the inheritance of China's excellent traditional culture and the construction of a meteorological power. Because it is more special than water conservancy cultural heritage in China's historical development, it is not only a national context, but also mixed with foreign activities. This paper focuses on the protection and research of China's meteorological cultural heritage. Based on the current situation of the protection and utilization of China's meteorological cultural heritage, it analyzes the problems and shortcomings in the current protection work. In response to these problems, some targeted protection measures are proposed, including strengthening the construction of laws and regulations, improving the level of protection technology, enhancing public participation, and promoting the protection and sustainable development of meteorological cultural heritage. The aim is to provide useful references for the protection of China's meteorological cultural heritage in the future.

**Key words** Meteorology; Cultural heritage; Current situation; Countermeasures

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The so-called meteorological cultural heritage refers to the summary records of meteorological observations, investigations, research, and other activities that have important historical, scientific, and cultural value. This includes historical meteorological observation data, meteorological disaster records, meteorological scientific research results, meteorological instruments and equipment, historical meteorological maps, meteorological observation station sites, and so on. These meteorological cultural heritages largely reflect the process of human understanding meteorology and exploring natural laws, and the influence of meteorological activities in politics, economy, military, technology, culture, and other aspects. Moreover, meteorological cultural heritage is of great significance for studying climate change, disaster prevention and mitigation, assessing the impact of climate change, and reconstructing ancient climates.

Why is it still necessary to propose the protection of meteorological cultural heritage in today's era? Why has China proposed a high-level modernization of meteorology, but suddenly proposed to go back and protect the treasures left by our ancestors in the field of meteorology when the whole world rushes towards modernization of meteorology?

(1) Meteorological cultural heritage is the crystallization of human wisdom, and its protection and inheritance are the common responsibility of all mankind. In recent years, extreme weather disasters caused by climate change have seriously threatened the safety of meteorological cultural heritage. In October 2021, the

United Nations Educational, Scientific and Cultural Organization released the *Update of Policy Documents Related to Climate Action for World Heritage*, which stated that climate change has become one of the most significant threats to world heritage, potentially affecting their outstanding universal values, including their integrity and authenticity, as well as their economic and social development potential at the local level<sup>[1]</sup>.

(2) Meteorological phenomena are a part of reflecting the relationship between humans and nature. The recording of meteorology from ancient times to the present is an indispensable and crucial part of the long history of traditional Chinese culture. During the Han Dynasty, people clarified the twenty-four solar terms and seventy-two phenology, invented meteorological instruments such as hygrometers and anemometers, and proposed meteorological names such as "plum rain" and "trade wind". And it scientifically explained climatic seasonal phenomena such as lightning and precipitation, and refuted the ignorant ideas that thunder and lightning are "punishment from heaven" and "wrath from heaven". At the same time, the *Yueling* and the *Youguan* are the oldest works that describe abnormal weather conditions and the earliest and the most advanced climatology achievements. In the records, the coexistence of phenology and agricultural affairs reflects the development of climate knowledge in China, which has been closely integrated with the needs of agricultural production since the early days. At the same time, the *Lunheng* · *Biandong* also reflects China's long-standing history of meteorological culture. It can be seen that there is a necessity to protect China's meteorological cultural heritage.

(3) In the issued *Several Measures to Promote Meteorological*

*Culture Construction in the New Era*, it is explicitly proposed to strengthen the protection and inheritance of meteorological cultural heritage and meteorological red resources. It should intensify research and protection efforts on meteorological cultural heritage, promote and inherit the concepts of "unity of heaven and man, and the way of nature" that highlight the meteorological heritage and ecological wisdom in excellent traditional Chinese culture, and conduct in-depth research on the impact of China's climate on production, life, cultural civilization, and other aspects. It should promote the recognition and protection of WMO (World Meteorological Organization) centennial meteorological stations, China's centennial meteorological stations, and the cultural construction of meteorological stations, and enrich the cultural connotation of meteorological stations<sup>[2]</sup>.

At present, although the overall environment is still calling for the protection of various historical and cultural relics in China, the protection of meteorological cultural heritage as one of them has received little attention. This has led to some important agricultural phenology and meteorology in China not being given enough attention, with low dissemination and limited publicity efforts. The ownership of some meteorological cultural heritage has even received discordant voices internationally. If not protected, the dissemination and inheritance of China's meteorological cultural heritage will face severe challenges. Therefore, the protection of meteorological cultural heritage has its urgency.

## 1 Current status of meteorological cultural heritage in China

**1.1 Types of meteorological cultural heritage** Meteorological cultural heritage is a valuable asset of China's meteorological industry, with significant importance and permanent preservation value in the development history of the meteorological industry. They include the following categories; firstly, historical records of meteorological events that have had a significant impact at various historical periods and important historical nodes on a global, national, or regional scale; secondly, official documents, historical records, rare books or handwritten copies related to meteorology in history, as well as physical objects such as instruments, paintings, plates, rubbings, stone carvings, *etc.* related to meteorology; thirdly, the formed representative and valuable meteorological observation raw records, meteorological instruments or equipment in various historical periods, especially since modern China launched meteorological observations; fourthly, documents, reports, works, manuscripts, medals, inscriptions, logs, meeting records, photos, audiovisual materials, newspapers, commemorative medals, *etc.* that record the significant progress of meteorological development in each historical period<sup>[3]</sup>.

### 1.2 Current status of preservation of meteorological cultural heritage

(1) The legal status of meteorological cultural heritage has been elevated. In recent years, China has successively introduced laws and regulations such as the *Law of the People's Republic of*

*China on the Protection of Cultural Relics*, providing a legal basis for the protection of meteorological cultural heritage.

Any cultural relic is created by people under the technological conditions mastered at that time, thus directly reflecting the degree to which the creators of cultural relics understand and utilize nature, and reflecting the level of scientific and technological development and productivity at that time. It is through cultural relics that the historical development and great achievements of the Chinese nation in science and technology over thousands of years have been showcased to people. As early as 2500 BC, Chinese people began to look up at astronomy and survey geography, and many outstanding scientists and craftsmen emerged. They have made unparalleled and unique contributions to mankind in many fields, such as astronomy, calendar, geography, mathematics, agriculture, medicine, science and technology. A large number of excavated cultural relics related to science and technology have provided rich and important materials for specialized historical research in astronomy, geography, metallurgy, agriculture, medicine, textiles, and other fields, breaking many traditional views and gaining new understanding of the history of science and technology. Moreover, the scientific and technological achievements recorded and accumulated in cultural relics have important inspiration and reference significance for the continuous innovation of human science and technology.

(2) According to research findings, China has initially established a national, provincial, municipal, and county level meteorological cultural heritage protection system, and formed a hierarchical and coordinated protection mechanism (Fig. 1).

(3) The level of digitalization and networked management of meteorological cultural heritage is not high. With the rapid development of the internet, the storage of China's meteorological cultural heritage has also entered the digital age. However, achieving high-quality digitization requires the use of devices and software such as servers, computers, zero margin scanners, flatbed scanners, high-speed scanners, large format scanners, printers, digital processing management systems, scanning software, image processing software, OCR recognition and conversion software, PDF and other batch synthesis tools. It also requires certain technical support, such as data acquisition, data processing, data storage and other technologies, and the investment in these software and hardware requires a large amount of funds. If the technological research and development capabilities are insufficient, it may lead to difficulties in improving the level of digital and networked management.

(4) The quality and ability of meteorological cultural heritage protection workers need to be improved. The importance of protecting meteorological cultural heritage is self-evident. At present, workers engaged in the protection of meteorological cultural heritage in China have weak professional abilities, an aging workforce, and most of the positions are part-time, which leads to low efficiency of the work team and hinders the continuous development of meteorological cultural heritage protection work.

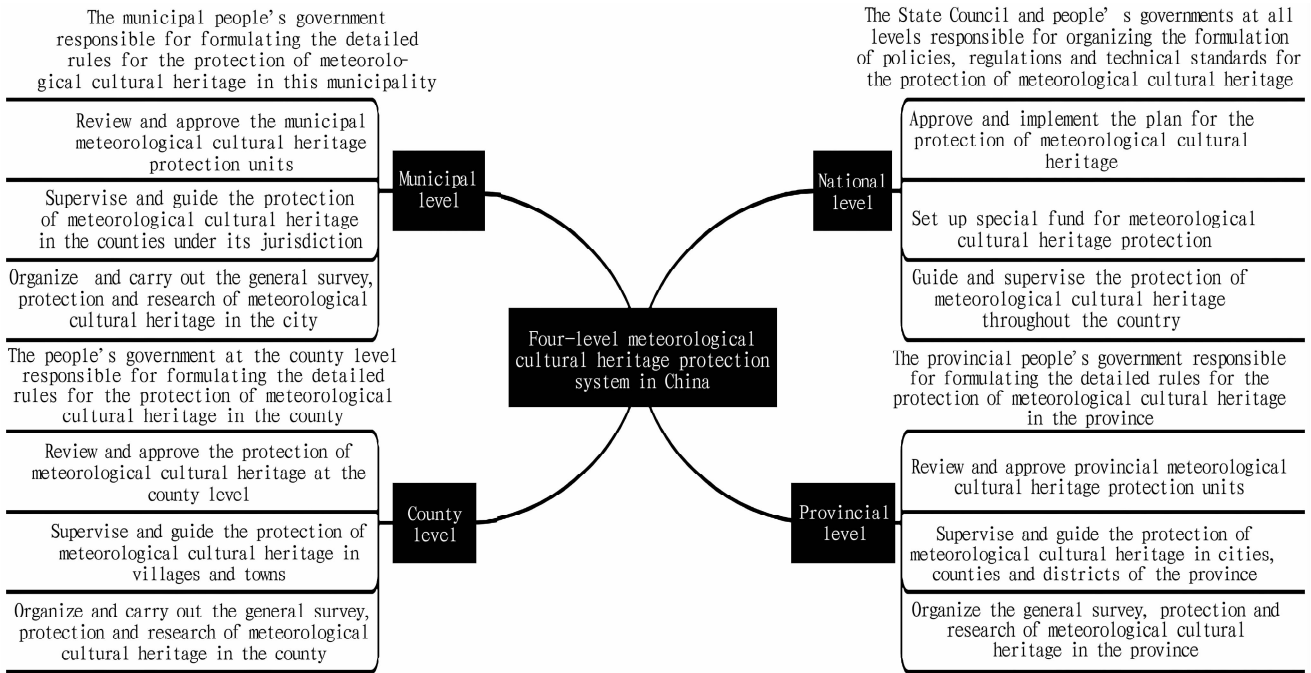


Fig. 1 Four-level meteorological cultural heritage protection system in China

## 2 Current status of utilization of meteorological cultural heritage

**2.1 Public services** With the development of networking, meteorological cultural heritage is gradually being digitized. The public can access these meteorological data through the internet or query systems, which greatly improves the development and utilization of meteorological cultural heritage, making it easier for more meteorological researchers and enthusiasts to obtain this information. Moreover, more and more museums and research institutions are using meteorological cultural heritage as their main exhibits, holding exhibitions and promotional activities to popularize meteorological science knowledge to the public and spread meteorological history and culture. These activities not only raise public awareness of meteorological cultural heritage, but also enhance people's attention to issues such as climate change and environmental protection.

**2.2 Disaster warning and decision support** Meteorological cultural heritage has high research value and has been widely used in fields such as meteorology, climatology, history, geography, etc. Researchers can gradually summarize the patterns of historical climate change, extreme weather events, and other phenomena by analyzing meteorological cultural heritage, providing reference for disaster prevention and response in today's society.

## 3 Countermeasures for the protection of meteorological cultural heritage in China

**3.1 Improving the legal and regulatory system for meteorological cultural heritage** The introduction and implementation of laws and regulations are the most powerful measures for the protection of meteorological cultural heritage. In order to improve the legal

and regulatory system of meteorological cultural heritage, efforts can be made from the following aspects:

(1) Specialized regulations need to be formulated. It should develop specialized laws and regulations for meteorological cultural heritage, clarify the definition, scope, management system, protection measures, and utilization methods of meteorological cultural heritage, and fundamentally ensure that the collection, organization, preservation, and utilization of meteorological cultural heritage have legal basis and must be followed according to law.

(2) It is necessary to revise existing laws and regulations. It needs to revise the existing laws and regulations on meteorological cultural heritage, conduct secondary review work, incorporate the newly formulated implementation rules for meteorological cultural heritage management into existing laws and regulations, clarify specific operational procedures, technical standards, and management requirements, incorporate relevant content of meteorological cultural heritage, and ensure that the protection and management requirements of meteorological cultural heritage are different from others, to guide various units to carry out meteorological cultural heritage management work.

(3) It needs to strengthen law enforcement supervision. It should strengthen the implementation and supervision of laws and regulations on meteorological cultural heritage, track and evaluate the effectiveness of the implementation of laws and regulations on meteorological cultural heritage, adjust and improve them according to actual situations, punish behaviors that violate laws and regulations, and ensure that the legal and regulatory system can adapt to the development of the times and actual needs.

(4) It is necessary to carry out legal publicity. Legal publicity is an important part of improving meteorological cultural heritage, so it is necessary to carry out legal publicity work on meteorological

logical cultural heritage laws and regulations, raise the awareness of the importance of meteorological cultural heritage in the whole society, and enhance the legal awareness of various units and the public.

### 3.2 Strengthening the research and application of meteorological cultural heritage protection technology, and improving the digital and networked management system

(1) It needs to increase investment in research and development of protective technologies and promote new technologies. The government and major management departments should increase investment in the research and development of meteorological cultural heritage protection technologies, support universities, research institutions, and enterprises to carry out relevant technical research, and actively promote and apply advanced meteorological cultural heritage protection technologies, such as digital archiving technology, moisture-proof and insect proof technology, fire prevention technology, *etc.*, to improve the safety and integrity of meteorological cultural heritage preservation.

(2) It needs to enhance the digitalization level of meteorological cultural heritage and build an integrated management platform. It should accelerate the digitalization process, integrate meteorological resources, and build an integrated meteorological cultural heritage management platform, to realize the full-process digital management of meteorological resource collection, organization, storage, and utilization, and facilitate storage, query, and utilization. At the same time, it should study and apply data compression, encryption and other technologies, to ensure the security and authenticity of digital meteorological cultural heritage.

### 3.3 Improving the quality and ability of meteorological cultural heritage workers

(1) It is necessary to strengthen the education and training of meteorological cultural heritage workers. Improving the professional quality and ability of workers requires strengthening education and training. Professional training courses, seminars, lectures, and other activities can be held to help meteorological cultural heritage workers understand the latest industry development trends, laws, regulations, and technical standards, promote information sharing, experience exchange, and collaborative research among workers, and improve the quality and ability of the entire meteorological cultural heritage protection team.

(2) Museums and other institutions should attach importance to selecting outstanding talents. To improve the quality and ability

of meteorological cultural heritage workers, it is necessary to select excellent professional talents. It can attract and select talents with professional knowledge, skills, and experience through recruitment, selection, promotion, and other channels, and optimize the structure of the work team. It is also possible to incentivize meteorological cultural heritage workers to improve their own qualities and abilities through the establishment of bonuses, promotion opportunities, honor recognition, and other means. At the same time, it is necessary to establish a scientific evaluation mechanism to objectively and fairly assess the performance of workers and promote their growth.

## 4 Conclusions

China has always adhered to the concept of life community between humans and nature. Respecting nature, integrating into nature, and adapting to nature are excellent traditions of Chinese civilization. Scholars have demonstrated through extensive evidence that the vast land of China has experienced ups and downs in climate for thousands of years. The ancient Chinese also constantly adapted to these changes and created suitable lifestyles according to local conditions. 52 years ago, Chinese scholar Zhu Kezhen made groundbreaking discussions on climate change in various periods of Chinese history. Today, although the situation we face is more complex, various actions and measures to address climate change have already been embedded in the wisdom of our ancestors to adapt to the climate and environment.

It hopes to work together with the vast number of meteorological cultural heritage protectors and people from all walks of life to promote the development of China's meteorological cultural heritage protection, and provide wisdom and strength for the meteorological industry.

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