

DEVELOPMENT IN STANDARD SYSTEM OF METEOROLOGICAL INSTRUMENTS AND METHODS OF OBSERVATION IN CHINA

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ABSTRACT

This paper focuses on how to build a comprehensive and systematic standard system of Meteorological Instruments and Methods of Observation (MIMO) in China. By analysis the internal relations in Meteorological Observation process, this paper points out the factors which influence the quality of observation data, presents the hierarchical structure diagram and standard clarification list (partly), and indicates the necessity of using standard category, standard name and standard scope in the clarification list. Based on this, the paper proposes an effective method which is to archive the existing standards into the diagram of standard system to verify whether a standard is scientific and reasonable or not. This research will be beneficial to develop and revise the standards and it is of great significance for improving the standard quality of MIMO.

1. Introduction

As a backbone of standardization research, China has been committed to researching and establishing standard systems in various areas for many years. In the field of meteorological observation, standard system diagram of MIMO is the major basis of planning and executing for the standard developing and revising, therefore, building a scientific and reasonable standard system diagram is not only the top design of developing MIMO standards, but also an extremely important basic work for standardization in the meteorological observation field. The recent years also witnessed the vigorous development and remarkable achievements of standard system constructions, most of the research results have good effects in practical application, and yielded good results.

2. Relationship between meteorological standardization and meteorological observation

Meteorological operations work is based on a perfect meteorological observation system, collects data from air, sea, land using all-around detection means, and then converts it to forecast products to serve the society.

Meteorological observation is the measurement and judgment of meteorological elements and phenomena by means of instruments and visual perception. It starts from the design and manufacture of meteorological instruments, with the input of user's requirements, outsourcing parts, site selection, and atmospheric variables, then output the meteorological data, Figure 1 illustrates the whole process of meteorological activities broadly, mainly includes meteorological instrument manufacture, use of meteorological instruments and performance monitoring. Among them, the use of meteorological instruments can be divided into method of observation, site management, equipment support, and the performance monitoring is namely quality assurance and management.

Analysis the meteorological observation process, we can find that the major factors affecting the quality of observation data include user's functional and technical requirements, instrument selection, installation and maintenance, site deployment, data acquisition and real-time quality control, performance monitoring, testing and calibration, personnel training and education, as well

as history data. Furthermore, some of matters related with observations, such as method of observation, technical support, the corresponding organization and management, etc., can also have an effect of the quality of the observation data.

Obviously, in the condition of continuous running, meteorological observation and quality management system need the support of a large number of standards. The purpose of developing MIMO standard system is to control the quality of observation data. For each individual standard, it is used to control the factors affecting the quality of observation data; for the standards as a whole, they can be used as the platform of the quality management system. Therefore, developing the diagram of MIMO standard system can make the component of the standards in the meteorological observation field scientific and reasonable.

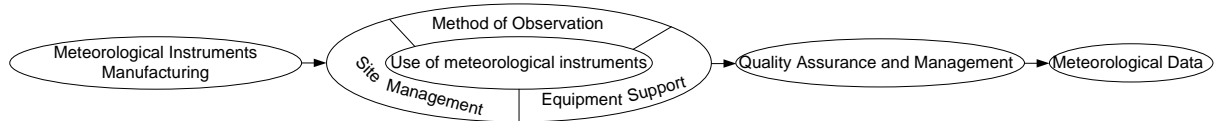


Figure 1 Diagram of meteorological observation process

From Figure 1, the complicated meteorological observation process has been simplified into meteorological instrument manufacturing, observation method, site management, equipment support, quality assurance and management five basic components, these five components are actually five sub-systems of the diagram of MIMO standard system, along with other supporting standards, the diagram of MIMO standard system has shown a good systematicness and integrality. According to Figure 1, as long as we refine the basic components into detailed processes, list the specific factors affecting the quality of observation data, and develop the corresponding standards, we can control the meteorological observation process.

3. Constructing the structure diagram of MIMO standard system

The structure diagram is the main part of the diagram of MIMO standard system, which can explain the basic structure of the MIMO standard system from the most intuitive and concise way. According to the meteorological observation process, we classify the standards as follows to ensure the quality of the observation.

(1) Structure diagram of MIMO standard system

The hierarchical relationship of structure of MIMO standard system is shown in Figure 2.

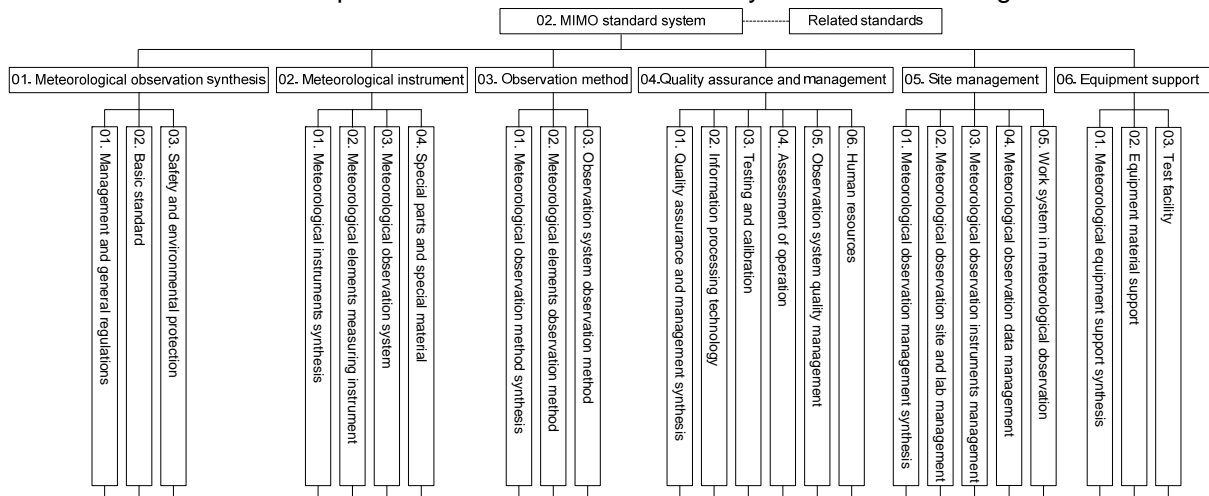


Figure 2 Structure diagram of MIMO standard system

From Figure 2 we can see that there are three layers in the structure diagram of MIMO standard system, the first two layers are overall structure block diagrams, and the left layers are some sub block diagrams, considering that there are some useful base standards and comprehensive standards which are not covered by five sub-systems, so increase the meteorological observation synthesis as one of the sub-systems. When necessary, we can refine the structure block diagram, and all standards can be given.

(2) Coding method according to structure diagram of MIMO standard system

According to Figure 2, in the first four layers, there is a sequence code encoded by two digits in each box. While in every box of the fifth layer, there is a series sequence code (i.e., fragment code) composed of three digits. This coding method of series sequence code can compress the hierarchical structure.

Generally speaking, standards are in the fourth or fifth layer. The code of standards in the structure diagram of MIMO standard system is a series sequence code of numbers taken from the first layer to the layer of the every standard in it, each series sequence code is separated by the sign of ". ". Standard code is composed of five-layer codes, when the standard is arranged on the fourth layer, the code of the fifth layer will be "000". Like an 'id' card, the code of standards is unique in the structure diagram of MIMO standard system, the structure and length of code are the same.

Titles are usually arranged in the first to the third layer, sometimes in the fourth layer, and the title box has code, too. Therefore, there are only one to four layers of code for the title boxes, shorter than the standard code.

4. Standard clarification list of MIMO standard system

In order to make clear the specific condition of the existing standards and analysis how to develop the needed standards in the future, based on the structure diagram of MIMO standard system, we need to build a more perfect standard system clarification list, namely the standard clarification list. This list can cover all standards of MIMO standard system in the form of table, each column in the table has a heading title, which can be standard category, standard name, standard scope or main content, such titles indicate the subject of the standard, distinguish the scope of the standard, and avoid the overlapping, repeat, and even contradictory of all the standards. Table 1 presents the standard clarification list of MIMO standard system partly.

Table 1 Standard clarification list of MIMO standard system (partly)

Serial No.	Code	Standard category	Standard name	Scope or main content	Comment
1.	02.01	---	Meteorological observation	---	
2.	02.01.01	General (standardization)	Developing and application guide of MIMO standard system	Developing principles, hierarchical structures, revising requirements and application methods of MIMO standard system	
3.	02.02.01.01	---	Basic standard	---	
4.	02.02.01.01.01	Basic standards	Meteorological observation term	General terms and definitions commonly used in the field of meteorological instruments	Upper story is atmospheric science noun and meteorological observation
...

Note: series sequence code should be listed in front of the name standard, omitted due to the space relationship here.

On the basis of standard clarification list, the process of combing the existing standards is also the

process of verifying the standard clarification list. There must be a very accurate position in the standard clarification list for every standard, if we can't find the right place, only two possibilities: one is the standard system structure is not complete yet, we need revision, and the other is this existing standard doesn't belong to the category of MIMO standard system. Hence, further analysis on "scope or main content" of the existing standard should be made, which means that the standard should be revised.

5. MIMO standardization in China

The National Standardization Technical Committee 507 on meteorological instruments and methods of observation of China (SAC/TC 507) was established in November 2010 with the approval of SAC and its secretariat is taken by CMA Meteorological Observation Center. SAC/TC 507 is responsible for the management of national meteorological instruments and methods of observation standardization activities, and in charge of developing, publicizing and promoting related standardization laws, regulations, guidelines and policies issued by government and administration bureaus. Also SAC/TC 507 takes the responsibility of researching, lecturing, explaining and training of national standards on meteorological instruments and observation methods; developing, reviewing and related activities on the national standards.

So far, SAC/TC 507 has released about 69 standards which include 3 National Standards and 66 Meteorological Standards, as shown in Table 2. Furthermore, SAC/TC 507 also has 87 standards in compiling which include 30 National Standards and 57 Meteorological Standards.

Table 2 Standard information released by SAC/TC 507

Serial No.	Standard System Hierarchy	Amount
1	Meteorological Observation Synthesis	4
2	Meteorological Instrument	28
3	Observation Method	21
4	Quality Assurance and Management	10
5	Site Management	5
6	Equipment support	1
Total:		69

Since it was founded in 2010, after three years of accumulation, SAC/TC 507 has accumulated much experience in standard reviewing, approval and management, construction of MIMIO standard system also has got a great advance.

6. Conclusion

Diagram of MIMO standard system includes developing explanation of standard, structure diagram of standard system, statistics information of standard and standard clarification list, the structure diagram of MIMO standard system which points out the structure of the standard system is the core part. To develop good structure diagram and clarification list of MIMO standard system, we need to make clear our purpose first, then explore in which scope the standard system will obtain the best hierarchy, and according this to determine the integrity of the standard system, which is to make sure that branch systems and sub-systems are package and comprehensive, finally coordinate the relationship of MIMO standard system with other standard systems.

Diagram of MIMO system is the major basis of planning and executing for the standard developing and revising, it covers the existing, needed and expected standards and is the blueprint in a certain range, and this standard system diagram will be updated constantly with the development of

science and technology.

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