

# **Development Geographic Information Standardization and Joint Tracking with ISO 19100 Standards in China**

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**ABSTRACT:** Attention is being paid on geographic information standardization in China since starting developing GIS early 1980s. The paper gives a Brief Overview of Geographic Information Standardization in China, Action for Introducing ISO/TC 211 19100 standards to China, Creating Some National Standards Referencing ISO/TC 211 CDs to joint track with international standards for geographic information. It describes activities about geographic information standardization and some results obtained in China in past years. It also introduces responsible organizations for geographic information standardization in China, relationship with the ISO/TC211 and some issues faced in the standardization.

## **(1) Brief Overview of Geographic Information Standardization in China**

Geographic information standardization has been recognized as a very important component at the beginning of GIS development in China early 80's. Since then geographic information standardization as one of key projects is placed on the national research plan and national standard working-out plan.

Before 1995, researching on the field of geographic information standardization related to data classification and coding system, data quality control and estimation; data transfer format; data updating rules; symbol system for digital mapping at the all scales from 1:500 to 1:1,000,000; data dictionary for information of surveying and mapping; technical linkage between topographic data base and geographic names data base; digital products, and so on.

Based on the researching, several national standards have been worked out, such as "Geographic Grid", "Classification and Codes for National Fundamental Geographic Information", "Classification and Codes for Features at the scales of 1:500, 1:1,000, 1:2,000", "Classification and Codes for Forest Resources", "Coding System of River Names of China", etc.

The national standards, "Guide to Standardization for Urban GIS", had been developed for urban GIS. It is based on experiences of researching, designing, developing and using UGISs by 15 main organizations including the National Geomatics Center of China of the SBSM, the National Key Laboratory of Resources and Environment Information System, the Institute of Standardization and Information Classifying and coding of China, the Institute of Urban Planning and Designing of China, the Information Center of the Ministry of Construction, the Institute of Comprehensive Surveying and Designing of the Ministry of Construction, the Beijing University, the National Information Center, the National Bureau of Land Management, etc. Another national standard, "Coding Structure and Rules for Urban Geographic Features--City Roads, Road Intersections, Blocks and Municipal Piping System", was worked out as well.

Some existing national standards in the fields of information technology and others have been adopted as GIS standards, such as "Codes for the administrative Divisions for the P. R. China", "Rules for the Code Representation of Administrative Divisions under Counties", "Code for Highway Classification", "Name and Number of National Trunk Highway Route", "the Naming and Coding Rules for Highway Bridge", etc. They are good supplement to the Geographic information standardization in China.

The stress in the area of geographic information standardization is put not only on working out standards, but also on enforcing to implement them when developing any GIS or spatial data base in China. The Chinese national standards are divided into two parts: forced and recommendatory.

To organize and cooperate work for geographic information standardization, one of the seven commissions of the Chinese Association for GIS (CAGIS), the Commission of Standardization and Quality Control (Comm. 2), was founded in December 1994. Approved by the China State Bureau of Technical Supervision (CSBTS), the National Technical Commission of Geographic Information Standardization (CSBTS/TC230) was founded in 1997. Its secretariat is set up at the National Geomatics Center of China (NGCC). The scope of the TC is geographic information standardization at the national level. It is responsible for researching and making suggestions of guiding principles and policies, drawing up and revising national standards, implementing issued national standards, studying issues related to standardization, exchanging experiences of standardization with foreign countries on the field of geographic information standardization.

China was one of the O-members of the Technical Commission of Geographic Information/Geomatics of ISO (ISO/TC211) when the TC was founded in June, 1994. China became a P-member since December, 1995. The secretariat of China national body for ISO/TC 211 is set up at the NGCC as well.

## **(2) Action for Introducing ISO/TC 211 19100 standards to China**

Before participating activities of ISO/TC 211 in 1995, China was stand alone for working-out national geographic information standards. All of national standards developed are mainly thinking the technical condition and applications in China, lack of putting the stress on joint track with the ISO standards. But after that, large changes were made. China attaches importance to actively take part in ISO/TC 211 activities, to learn experiences from other ISO/TC 211 members, to make good relationship with the ISO 19100 standard series when providing new items and working out new national standards. For example:

There are more than 40 organizations take part in the activities related to ISO/TC 211 in China. Expert Groups relevant to the 5 working groups of ISO/TC211 have been formed. The responsibility of these groups is reviewing and discussing ISO/TC 211 draft documents and make comments.

China has sent experts attending the 3rd to 12th Plenary Meetings. More than ten Chinese experts are filled in all 5 Working Groups of the TC. The 7th Plenary Meeting of ISO/TC211 and its WG meetings were hold in Beijing in Sept., 1997.

Documents of ISO 19100 standards are being translated into Chinese partly, and implications of ISO/TC 211 standards are introduced to the Chinese geographic information community, to facilitate the development and implementation both national standards and product standards or product specifications. To understand the ISO 19100 standard series, several technical workshops were held, such as metadata, UML, XML, conformance and testing, data quality control, etc.

Some drafts of ISO/TC 211 standards have been used for special projects, such as: CDs of geographic information - Quality principles (19113) and geographic information - Quality evaluation procedures (19114) were used for data quality control of the 1:250,000 database of the NFGIS; the CD of geographic information – metadata (19115) was used for the national key project “Sharing of Sustainable Development Information in China”, the NFGIS databases, databases of land and resources, etc.

To make the work of the secretariat of China national body for ISO/TC 211 more efficiently, the catalogue of ISO/TC 211 documents and standard drafts is being managed by computer since 1995; the Email address is used to contact with the ISO/TC 211 secretariat since 1996; the documents and drafts are managed and transmitted electronically since 1997; the comments and votes of NP, WD, CD were sent to ISO/TC 211 secretariat by email since 1998; and the comments and votes of DIS and FDIS were sent through the ISO electronic balloting system since this year (Fig. 1 and 2).

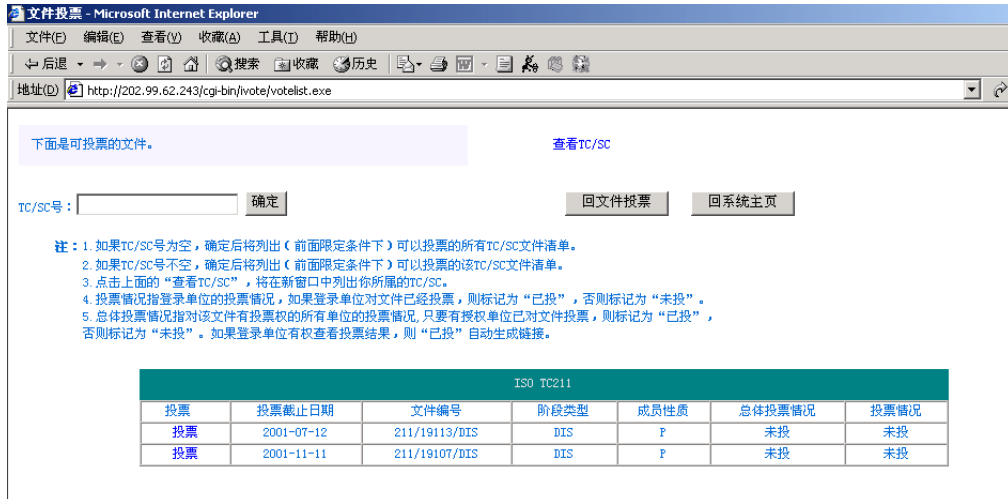
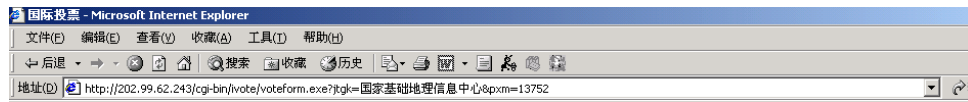


Fig. 1



### 投票:

- 同意
- 同意附意见
- 反对
- 弃权

Fig. 2

The web site of the secretariat of China national body for ISO/TC 211 is being developed. Figure 3 is the draft homepage.

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ISO/TC211是国际标准化组织ISO的下属部门之一，负责有关地理信息方面国际标准的制定。受国家技术监督局和国家测绘局委托，中心承担国际标准化组织地理信息/地球信息技术委员会 (ISO/TC211) 国内技术归口管理工作，组织国内专家参与地理信息国际标准的制定，跟踪有关国际标准，为提高我国地理信息标准水平和与国际标准接轨提供技术支持。归口管理办公室设在专题应用部。



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Fig. 3

### (3) Creating Some National Standards Referencing ISO/TC 211 CDs

Now there are 7 national geographic information standards being developed in China. Some related documents of ISO 19100 standard series are used as references, to enable the acceleration of China's standards to joint track with international standards.

#### 1. Using the CD of geographic information - Feature cataloguing methodology (ISO 19110) for revising the national standard "Classification and Codes for National Fundamental Geographic Information"

"Classification and Codes for National Fundamental Geographic Information" is defining catalogue and codes for features showing on topographic maps at the scales from 1:5,000 to 1:1,000,000. It allows data to be transferred from one scale database to another without codes changing. It was the first time in China to put all codes of features on multi-scale topographic maps in one standard. It was approved by CSBTS in 1992 and need to revise to add some new classes and codes for new features. Compare with the CD of ISO 19110, it does not define feature classes and attributes clearly. Table 1 and 2 show the difference for feature of lake before and after revising.

Tab. 1: Before revising

Code	Feature Class
23000	Lake
23010	Lake with water perennially
23011	Lake with sweet water perennially
23012	Lake with salt water perennially
23013	Lake with bitter water perennially
23020	Lake with water temporally
23021	Lake with sweet water temporally
23022	Lake with salt water temporally
23023	Lake with bitter water temporally

Tab. 2: After revising

Code	Feature Class	Attribute 1	Attribute 2
23000	Lake	1 -- sweet water 2 -- salt water 3 -- bitter water	1-- with water perennially 2-- with water temporally

It is not only taking the new method from the CD, but also keeping stability of feature classes and codes with such kind of revising.

**2. The national standard “Data Quality Control of the Geographic Information” is being developed with relation to the CD of geographic information - Quality principles (ISO 19113) and the CD of geographic information - Quality evaluation procedures (ISO 19114) standards.**

Taking the principles about data quality elements, data quality evaluating procedures and content of report, the national standard is being worked out. Here is the list of data quality elements:

- **Data Completeness, including:**
  - Data file Completeness
  - Feature Completeness
  - Attribute Completeness
- **Logical consistency, including:**
  - Attribute consistency
  - Format consistency
  - Layer consistency
  - Topological consistency
  - Feature relationship consistency
- **Positional accuracy, including:**
  - Absolute accuracy of points, lines and polygons
  - Relative accuracy of points, lines and polygons
  - Generalized polygon shape comparability
- **Attribute accuracy, including:**
  - Classification correctness
  - Qualitative attribute correctness
  - Quantitative attribute accuracy
- **Edge matching, including:**
  - Edge positional matching
  - Edge attribute matching
- **Temporal accuracy, including:**
  - Temporal consistency
  - Temporal currency
  - Data capture time
- **Linage and document completeness, including:**
  - Metadata
  - Linage

- Design document
- Other documents

### 3. The CD of Geographic Information - Metadata (ISO 19115) is the basis for working out the national standard “Geographic Information Metadata”.

Similar the CD, metadata are divided into two levels: core metadata and full metadata. But the codelists and enumerations are more suitable Chinese condition. As an example, a part of Metadata at the level one (V. 1.0) is shown as follows:

#### **METADATA (LEVEL ONE)** ---- FOR THE 1:1M-SCALE TOPOGRAPHIC DATABASE OF THE NATIONAL FUNDAMENTAL GEOGRAPHIC INFORMATION SYSTEM OF CHINA

##### **CATALOGUING METADATA INFORMATION:**

**Title (Chinese):** 国家基础地理信息系统全国 1: 100 万地形数据库

**Title (shortened form, Chinese):** 1: 100 万地形数据库

**Title(English):** 1:1M-Scale Topographic DataBase of the National Fundamental Geographic Information System of China

**Title (shortened form, English):** 1:1M DB (NFGIS, PRC)

**Edition:** 1.0

**Series name:** National Fundamental Geographic Information System

**Issue identification:** The first step

**Issue date:** 199408

##### **Initiative identification information:**

**Initiative name:** National Fundamental Geographic Information System Networking

**Initiative type:** Ministry key project

##### **Responsible party information:**

**Responsible party organization name:** State Bureau of Surveying and Mapping (SBSM)

**Responsible party individual name:**

**Responsible party role:** Management

**Country:** People Republic of China

**Administrative area:** Beijing City

**City:** Beijing

**Postal address:** No. 9 Shanlihe Road

**Postal code:** 100830

**Electronic mail address:**

**Web-site:** <http://www.sbsm.gov.cn>

**Telephone:**

**Fax:**

##### **Dataset extent:**

**Geographic extent coordinates:**

**West bounding coordinate:** 72° E

**East bounding coordinate:** 135° E

**North bounding coordinate:** 54° N

**South bounding coordinate:** 3° N

**Geographic extent name:** People Republic of China

**Temporal extent date/time:**

**Temporal extent type:** 1

**Temporal 1:** 19901231

**Temporal 2:**

**Scale:** 1:1,000,000

**Resolution:**

**Language of dataset:** Chinese, English

**Dataset content information:**

**Abstract:** Covering entire China. Data contain administrative boundary, reservation, hydrography, railway, road, hypsography, vegetation, etc. The data source is the topographic map at the scale of 1:1,000,000 published in 1980s, with totally 77 map sheets. Data are divided into 17 layers.

**Purpose:** As a common platform for locating all kinds of thematic data for governments, organizations, institutions, agencies and so on; for compiling small scale maps in digital or simulative form.

**Progress code:** Complete

**Theme name:** Surveying and Mapping

**Keyword (s):** Surveying and mapping / Fundamental information / spatial data / Database / GIS / NFGIS

...

#### **4. The concept of the geographic information - Reference model (ISO 19101) will be used for developing and optimizing the guidelines of standards or general list.**

In China, there are already some standard guidelines or general lists of standards needed. In fact there are just tables of standard names. It does not show relationship and dependency between different standards. The ideal of reference model will be used to optimize the guidelines of standards or general list in China. For example, the Ministry of Land and Resources is on the way to create a reference model for standards related to the theme of national land and resources optimizing the guideline of standards in such field.

#### **5. Like the principals of the CD of geographic information - spatial referencing by coordinates (ISO 19111), there is compound coordinate reference system in China.**

Here are the referencing systems and datum used in China:

-- Horizontal coordinate systems:

- Beijing 1954 Coordinate System
- Xi'an 1980 Coordinate System
- local coordinate system



-- Vertical datum:

- Yellow Sea Height Datum 1956
- National Height Datum 1985
- local datum

The horizontal coordinate systems will be put in the codelist of referencing systems by coordinates (Tab. 3):

Tab. 3

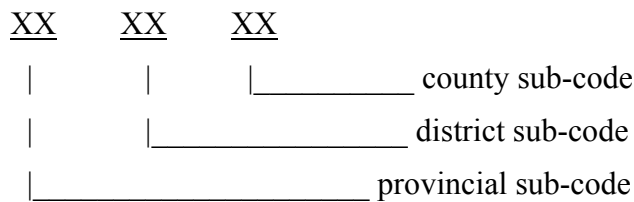
No.	Name	Code	Note
1	Beijing 1954 Coordinate System	1	
2	Xi'an 1980 Coordinate System	2	
3	Local Coordinate System	3	

**6. Some codes or coding system of existing national standards will be reduced to the spatial referencing by geographic identifiers to enhance their functions.**

The follow existing national standards are related to spatial referencing by geographic identifiers:

- Codes for the administrative Divisions for the P. R. China
- Coding System of River Names of China
- Coding System of Mountain and Peak Names of China
- Name and Number of National Trunk Highway Route

There are called identifier codes. In fact these are of spatial referencing by geographic identifiers according to the principal of the geographic information - Spatial referencing by geographic identifiers (ISO 19112). The structure of codes for the administrative divisions for the P. R. China is as follows:



These codes could be used to uniquely identify a location, in spite of a province, a district or a county.

**7. The geographic information - Terminology (ISO 19104) and the geographic information - Conformance and testing (ISO 19105) will be basis for related national standards. And more ISO 19100 standards will be applied in China.**

(4) Issues faced in China

China still faces some issues in the area of geographic information standardization. The main problems are:

- The national standards are not structured
- People are always felt standards are not enough
- Different points of view among experts and among organizations have to be hardly coordinated
- It is a long way to go through all steps for working out a standard and spent much money
- Some new terms are hardly to translate into Chinese, such as profile, coverage, portrayal, operation, and so on, even geomatics it self.

General speaking, ISO 19100 standard series is useful and valuable. They are very important international standards. We will make more efforts to enable the acceleration of China's geographic information standards to comply with ISO 19100 standards.

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