

# THE STATUS OF CONSTRUCTION AND UPDATING OF NATIONAL GEOSPATIAL DATABASES IN CHINA

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### Abstract:

After years of efforts, the construction and updating of the geo-spatial databases in China have made great advances. Currently the national level databases have covered the whole territory and under dynamic updating. While the provincial and municipal level databases are expanding the coverage and increasing the update frequency. This paper briefly introduces the status of the national and provincial level databases.

## 1. Introduction

The administration of geographic information in China operates under the principle of unified leadership and decentralized organization, including national level, provincial level, municipal level and county level. The National Administration of Surveying, Mapping and Geo-information of China (NASG) is the leading organization in the central government in charge of geographic information in the whole country.

The responsibilities of NASG include: (1) Formulate laws, regulations, development plans, policies and technical standards in surveying, mapping and geo-information; (2) Organize and manage topography, boundary and cadaster surveying and mapping; (3) Establish and maintain national geodetic reference systems; (4) Provide public and emergency geo-information services; (5) Coordinate national geomatics industry development; (6) Regulate surveying, mapping and geo-information market; (7) Manage national basic surveying and mapping results; (8) Supervise map publication; (9) Promote technological innovations and international exchanges in geospatial information fields.

Under the unified administration of NASG, the national level, provincial level and municipal level geo-spatial databases are constructed and maintained with funding from the national, provincial and municipal governments separately. Generally the scales of national level database include 1:1 million, 1:250,000, 1:50,000. The scales of provincial database include 1:10,000 and 1:5,000. The scale of municipal level database includes 1:2,000, 1:1,000 and 1:500.

National Geomatics Center of China (NGCC) is the government agency for national level databases construction, maintenance and distribution. There is one similar agency in each province and municipal, responsible for the databases within the area.

## **2. Status of national geo-spatial databases**

During 1990-2005, the first version of national level geo-spatial databases was established by digitizing the paper topographic maps. This first version databases include:

- (1) 1:1 million scale database. There are totally 77 map sheets. The contents include topographic features, place names and digital elevation model (DEM). The construction was finished in 1993 and the first update was finished in 2002.
- (2) 1:250,000 scale database. There are 816 map sheets. The contents include topographic features, place names and DEM. The construction was finished in 1998 and the first update was finished in 2002.
- (3) 1:50,000 scale database. There are 24218 map sheets. The contents include topographic features, place names, digital raster graph (DRG), digital ortho model (DOM) and DEM. The construction was finished in 2006.

These databases effectively alleviated the urgent need from social-economic development. However, due to the constraints of technical conditions and limited experiences at that time, the completeness, accuracy and uptodateness of these databases are not good enough.

Since 2006, several important programs have been implemented by NASG to upgrade the national level geo-spatial database. The programs include image data acquirement, 1:50,000 database updating, second time 1:250,000 database updating, surveying and mapping in western unmanned area.

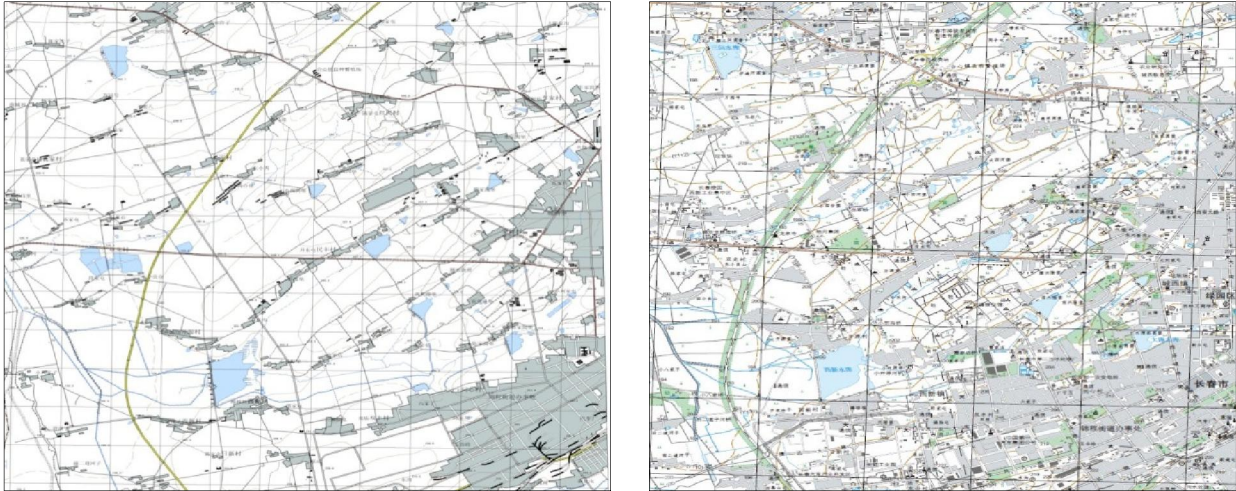
### **2.1 National image acquirement program**

A great volume of satellite images and aerophotos have been collected. Recently more and more images come from Chinese surveying satellites such as ZY-3, etc. According to statistics, there are already about 1158 TB images in the National image database, among them 965 TB aerophotos and 194 TB satellite images. There are several versions of low resolution ( $\leq 2.5$  meter) satellite image covering the whole land area. Approximately 9 million square kilometers land area has been covered by high resolution images ( $> 1$  meter). These aerospace remote sensing image data have greatly supported the construction and updating of the geo-spatial database, as well as various applications.

### **2.2 1:50,000 database updating**

During 2006-2011, NASG had finished the updating of 19150 sheets of 1:50,000 data, covering 80% of land territory. The updated contents include topography features, 1 meter and 2.5 meter DOM, and DEM.

The updated topographic features include water system, residential area, traffic, boundary, contour, land cover, control points, etc. The catalog of features increased from 101 to 437 (as shown in Fig.1). The uptodateness of all features is 2006-2010(as shown in Fig.2). The images are all acquired after 2005 while 80% are after 2007 (as shown in Fig.3).



(a) before updating

(b) after updating

Fig. 1 Feature catalog increased

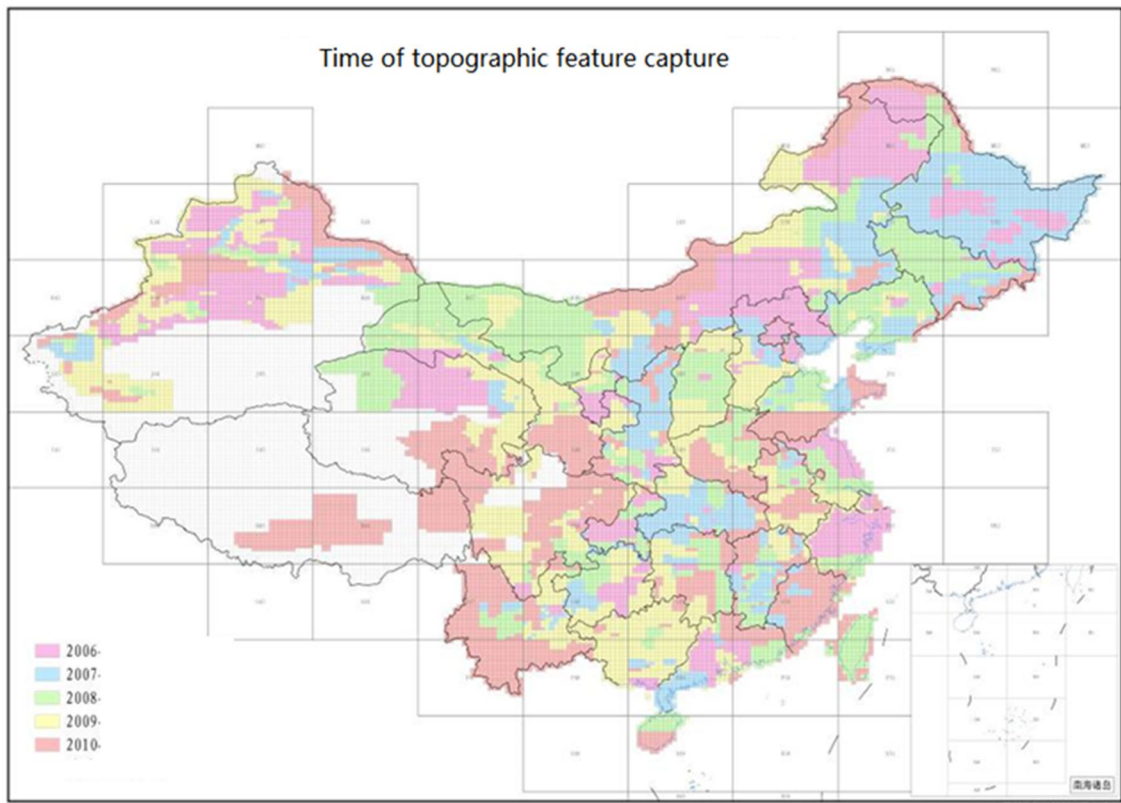


Fig. 2 Uptodateness of topographic features

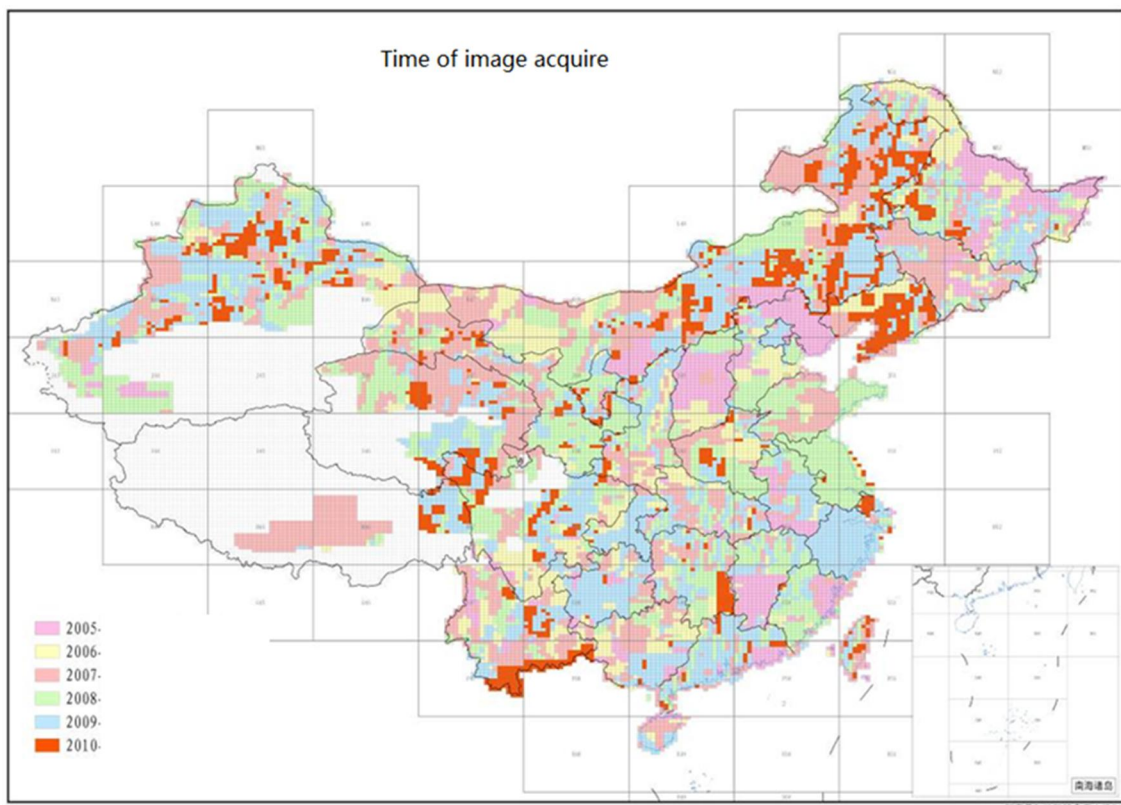


Fig. 3 Uptodateness of DOM

### 2.3 The second time updating of 1:250,000 database

The second time updating of 1:250,000 database was finished in 2008. Most place names had been field verification. All high level roads (highway, national road, provincial road) had been updated with GPS data. See Fig.4, Tab.1, Fig.5 and Fig.6.



Fig. 4 Field verification and GPS data collection

Table 1- Statistic of updated key features

features	Updated map sheets	Percentage of updated map sheets	Average updated proportion
water	527	64.6%	9.7%
boundary	594	72.8%	27.9%
Road	699	85.7%	20.9%
Railway	398	48.8%	9.5%
Village area	667	81.7%	34.4%
Residential area	496	60.8%	75.3%
contours	232	28.4%	0.1%

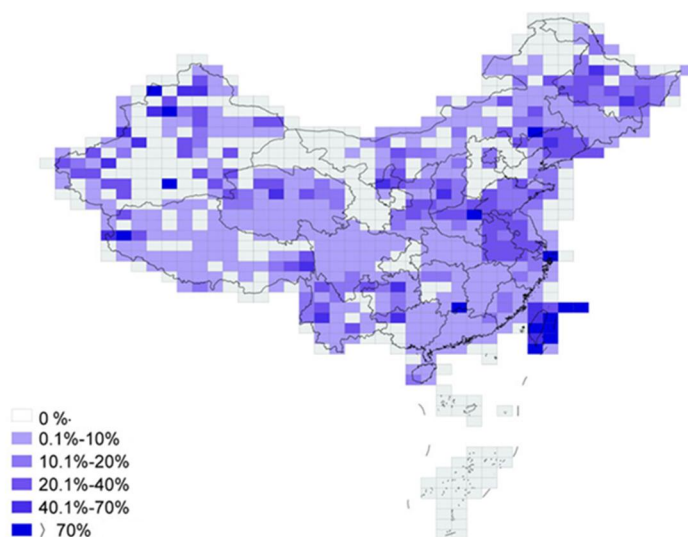


Fig. 5 Updated water features

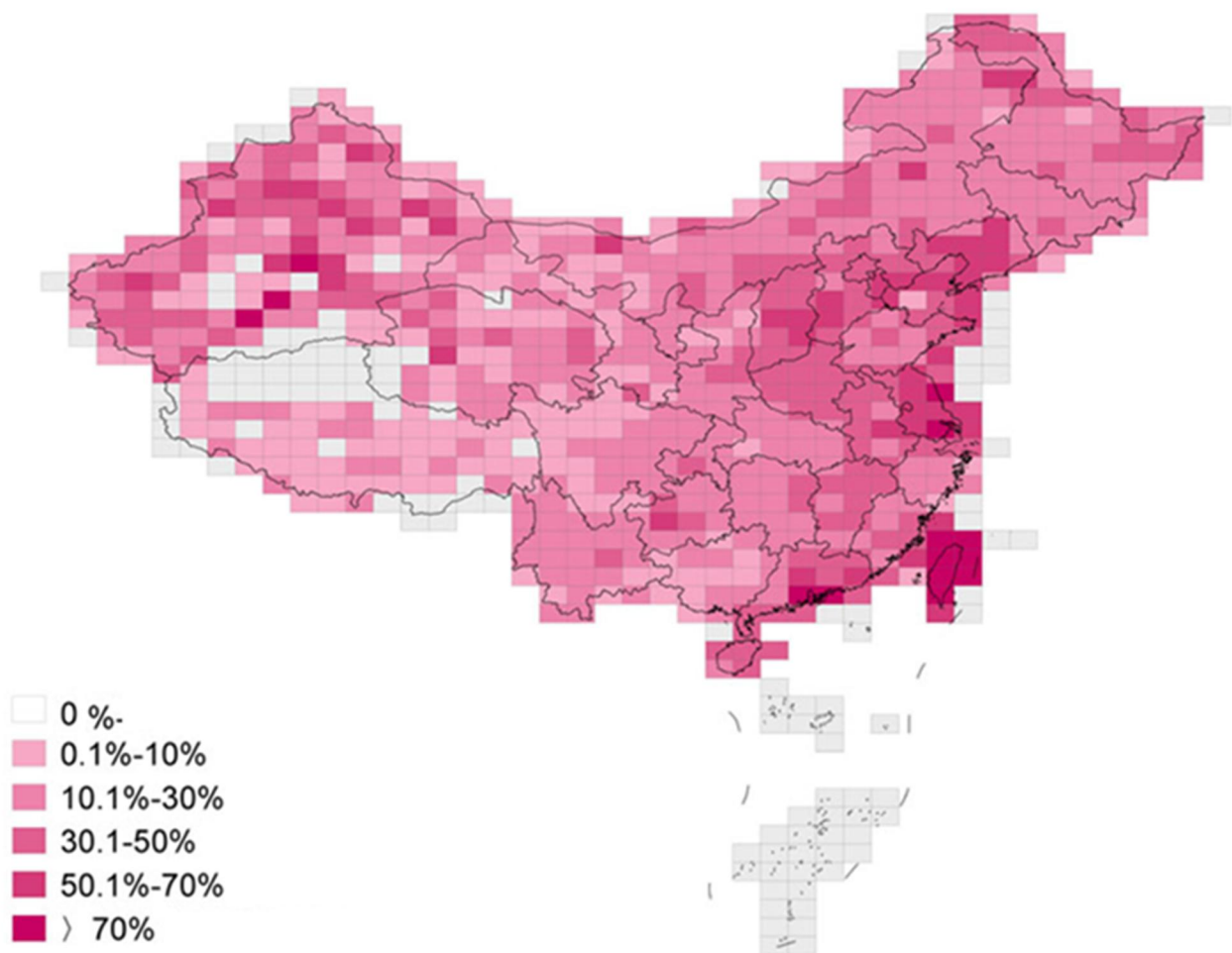


Fig. 6 Updated roads

## 2.4 Surveying and mapping in Western unmanned area

Before 2006 there are no 1:50,000 maps or data in the desert or mountainous western area of China. During 2006-2011 NASG carried out the program to survey the 2 million square kilometers unmanned area. Some special techniques have been used to fit the special natural and geographical environment of the area, such as digital mapping with three-dimensional large-scale satellite image, scarce control point adjustment, InSAR, etc. Total 5032 map sheets have been finished and the database has been established accordingly.

## 3. Status of provincial geo-spatial database

By 2010, the 1:10,000 scale database has covered more than 45% territory of China (As shown in Fig.7). Among 31 provinces in China, 20 have established the 1:10,000 database covering the whole province; 5 have database covering more than half of the province. More than 10 provinces have finished the first round updating. Some provinces in eastern part of China update their database every 2 or 3 years while update key features twice a year.



Fig. 7 Coverage of 1:10,000 scale database

#### 4. Status of municipal geo-spatial database

NASG launch the “digital city” program in 2006. By now more than 310 cities start to build the municipal geo-spatial database and more than 150 of them have finished. The large scale geo-spatial database has covered more than 0.2 million square kilometer urban areas.

#### 5. Conclusion and further tasks

After years of efforts, the construction and updating of the geo-spatial databases in China have made great advances. Currently the national level databases have covered the whole territory and the provincial and municipal level databases are expanding the coverage. All of the databases are under continuous updating.

In order to keep the up-to-dateness of the databases, NASG started to dynamically update national database since 2012. The main aims include updating and publishing National 1:50,000 database covering the whole country once a year and using the result to update smaller scaled databases at 1:250,000, 1:1,000,000. While in provincial and municipal level, the surveying and mapping agencies are also work hard to increase the frequency of the updating.

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