Present Status of Digital Maps and its Application Software

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Abstract

Japan Map Center has been distributing several kinds of digital maps generated by Geographical Survey Institute with simple software for displaying maps image on personal computer since June, 1993. Owing to the efforts of third party software developers, more than 20 application software for these digital maps appeared in two years. According to the result of questionnaire to users, target of these application coincides with user needs well.

1 Introduction

Japan Map Center (hereafter, refer to JMC) has been distributing digital maps generated by Geographical Survey Institute (National Surveying and Mapping Organization of Japan, hereafter, refer to GSI) since June, 1993. These digital maps are distributed with simple software for displaying map image on personal computer NEC PC-9801(not compatible with IBM PC), and no advanced GIS software using these maps as map database existed at first. However, owing to the efforts of third party software developers, more than 20 application software for these digital maps appeared in two years. In this way, circumstances for utilizing these digital maps has becoming comfortable rapidly. In the following, characteristics of these digital maps and application software are described with the market of these maps.

These maps are called "suuti chizu" in Japanese which means digital maps, and hereafter I refer them to Digital Maps.

2 Digital Maps distributed by JMC

Six kinds of Digital Maps are available at present. They are Digital Map 10000(combined), Digital Map 25000(shore lines and administrative boundaries), 50 m mesh(elevation), 250 m mesh(elevation),

1 km mesh(elevation) and 1 km mesh(average elevation) (Table 1).

Digital Maps are text files in MS-DOS format and distributed by 1.2/1.44 Mb floppy disk with simple software for displaying maps image on personal computer NEC PC-9801. The price is 9700 Yen per one diskette.

Kind of Digital Map	Number of discs available	Characteristics
10000(combined)	248	about 5 km x 5 km in one disc only main cities
25000(shore lines and administrative boundaries)	86	about 80 km x 80 km in one disc to be revised every year
50 m mesh (elevation)	1248	about 10 km x 10 km in one disc about 4000 discs to cover Japan
250 m mesh (elevation)	88	about 80 km x 80 km in one disc all Japan already covered
1 km mesh (elevation)	1	all Japan compressed in one disc
1 km mesh (average elevation)	1	all Japan compressed in one disc

Table 1 : Kinds of Digital Map and characteristics

2-1 Digital Map 10000(combined)

GSI is generating 1:10,000 scale paper based topographic maps for big cities or cities where local governments are located. From these maps, administrative boundaries, roads, railways, symbols for buildings, boundaries of water bodies, control points and geographical names are vectorized to make Digital Map 10000(combined)(Figure 1). Digital data corresponding to one map sheet are stored in one floppy disk in compressed form. At present, 248 diskettes are available, and are planned to be revised according to the revision of paper maps of 1:10,000 scale. Parts of Tokyo and Osaka area have already completed first revision.

2-2 Digital Map 25000(shore lines and administrative boundaries)

These data are generated by vectorizing administrative boundaries up to city level from 1:25,000 scale
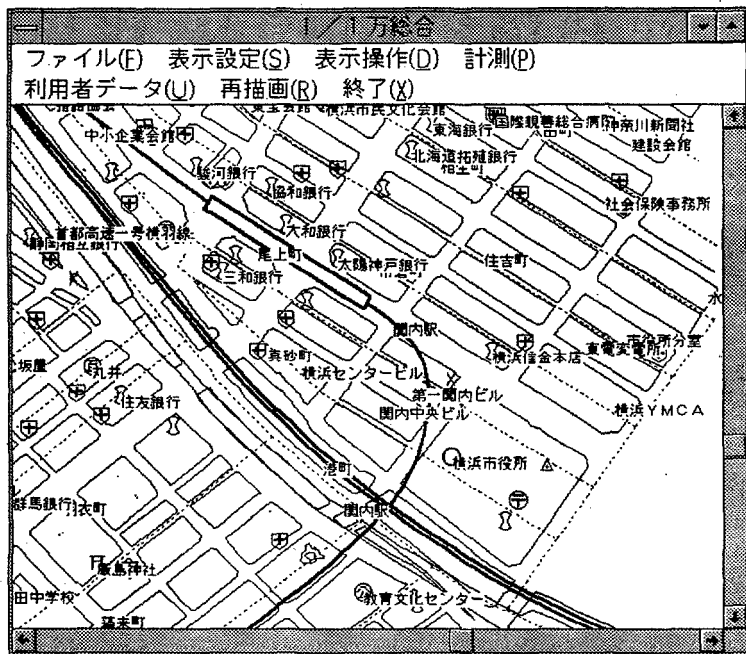
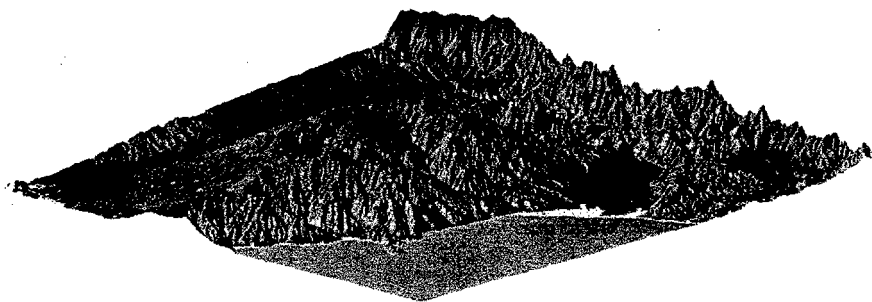Figure 1: Digital Map 10000(combined) on personal computer

Figure 2 : Bird's view image generated from 50. m mesh(elevation)

topographic maps. The data for the area of about 6,400 km^2(80 km x 80 km) are included in one floppy disk, and 86 disks are required to cover whole Japan. These data are supposed to be revised every year.

2-3 Digital Map 50 m mesh(elevation)

These data are generated by scanning contour plates of 1:25,000 scale topographic map and calculating elevations of centers of 40,000 small cells, which cover one topographic map, from scanned contour lines. These small cells are generated by dividing a map into 200 pieces for both vertical and horizontal directions, and the size of each cell is about 50 m x 50 m. That is the reason why these data are called 50 m mesh(elevation)(Figure 2). One floppy disc includes elevation data for one map sheet.

So far, 1248 floppy discs are available, but in order to cover all Japan, about 4,000 discs are required, and it will take a few years before 50 m mesh elevation data of whole Japan are available. Once elevation data are generated, data revision is not required usually. However, elevation data of Mt. Unzen, which caused big topographic change by volcanic activities, were revised after paper map was revised.

2-4 Digital Map 250 m mesh(elevation)

This digital map consists of elevation data for centers of small cells, generated by dividing 1:25,000 scale topographic map into 40 pieces for both vertical and horizontal directions. One floppy disc contains elevation data for the area corresponding to 64 map sheets (about 80 km x 80 km), and whole Japan is covered by 88 discs. These data are distributed from February, 1994.

2-5 Digital Map 1 km mesh(elevation/average elevation)

Digital map 1 km mesh(elevation) consists of elevation data for centers of small cells, generated by dividing 1:25,000 scale topographic map into 10 pieces for both vertical and horizontal directions. One floppy disc contains elevation data of whole Japan, compressed by famous archive software LHA. In Digital map 1 km (average elevation), each cell is not given elevation of center but given average elevation of 16 cells for 250 m mesh(elevation) included in each cell. These two digital map are

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distributed from September, 1994.

3 Application Software of Digital Maps

Digital maps are distributed only with simple software for displaying maps image on personal computer NEC PC-9801(not compatible with IBM PC), so cannot be used immediately for advanced GIS(Geographical Information System) analysis. However, owing to the efforts of third party software developers, more than 20 application software for these digital maps, such as converter for inputting to existing GIS software, original GIS software for Digital Maps, appeared in two years.

These application software can be divided into three groups. One is the group of general purpose GIS software. Second is the group of software with simple function for specified purpose. Third is the group for utility.

3-1 General purpose GIS software

This group contains various kinds of software from very famous existing GIS software developed in US to software running on personal computers developed for Digital Maps. These existing GIS software, generally, runs on various kinds of computers and has many functions for GIS analysis. On the contrary software developed for Digital Maps runs on personal computers and has unique characteristic, such as low price, running on simple MS-DOS environment, having very powerful edit functions.

Software in this group can handle Digital Maps 10000(combined), which have 7 layers and look like usual paper map.

3-2 Software with simple function for specified purpose

Each software in this group has limited functions, but target is very specified. So, if functions of software matches needs of user side, they can be used very effectively. Examples in this group are the software which shows statistic data for administrative unit on Digital Maps 25000, software for planning and displaying the route for distributing goods to stores in the area on Digital Maps 10000, and software for generating boring database on Digital Maps. In this group, many application

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software are expected to be developed according to various needs of user side.

3-3 Utility

As utility software relating to Digital Maps, there are software showing map image on computer display, converter for inputting Digital Maps to existing GIS or CAD (Computer Aided Design) software, and libraries for facilitating the development application software for Digital Maps.

4 Market of Digital Maps

4-1 Trend of market of Digital Maps

In this section, trend of market of Digital Maps is analyzed from the sales of Digital Maps of fiscal year 1993, and the result of questionnaire to users, who purchased Digital Maps. Table 2 shows the sales of each kind of Digital Maps for ten months. Digital Map 250 m mesh(elevation) has started the distribution from February, 1994, so sales estimation for ten months is used in the following.

Kinds of Digital Map	Number of discs sold	Average number of discs sold
10000(combined)	4,026	22
25000(shore lines and administrative boundaries)	2,491	29
50 m mesh (elevation)	3,513	13
250 m mesh (elevation)	695(3,475)	8(39)

- These are data from 1993.6 to 1994.3.

- 250 m mesh (elevation) started distribution in 1994.2. Estimation from 1993.6
   to 1994.3 is shown in parenthesis.

Table 2: Number of discs sold for Digital Maps

In terms of total amount of discs sold, Digital Map 10000(combined) is the first, and 50 m mesh(elevation), 250 m mesh(elevation) and 25000(shore lines and administrative boundaries) follows. However, in terms of average amount of discs sold, 250 m mesh(elevation) and 25000(shore lines and administrative boundaries), come first. Totally speaking, although the area contained in one disc is small (about 25 km^2), Digital map 10000(combined) has been sold well. Digital Maps

10000(combined) contain almost all features except buildings and contour lines drawn on original paper map, and cover main big cities in Japan. These seem to be the reasons why Digital Map 10000(combined) has been sold well.

As for the purpose for purchasing Digital Maps, education, analysis of topography, regional planning and assistance for administrative works are main. And the use of Digital Maps with the specified purpose, such as facility management, navigation and marketing, are not many. Many users seem to have purchased Digital Maps without the clear purpose but with the expectation that these data can be used effectively for education, topographic analysis and so on.

4-2 Relation between target of application software and sales of Digital Maps

To investigate the trend of market for each kind of Digital Maps, the purpose purchasing for Digital Maps has been calculated for each kind. The result shows the clear characteristic for each kind (Table 3).

kind purpose	10000	25000	50 m mesh	250 m mesh	Total
administrative work	11 %	10 %	11 %	8 %	11 %
education	15	26	24	26	22
facility management	15	7	3	2	8
regional planning	13	5	18	25	13
topographical analysis	9	7	26	29	16
mass communication	1	1	2	0	1
navigation	7	8	5	1	6
marketing	3	13	0	1	5
information service	17	8	4	3	9
others	9	15	7	5	9

Table 3: Purpose for purchasing Digital Map

The elevation data(50 m mesh and 250 m mesh) are mainly purchased for education, topographic analysis and regional planning. These three purposes account for about 70 % of answers. In case of administrative boundary data, education, marketing and assistance for administrative works account for about 50 % of answers. In case of 10000(combined), information service, education, facility management account for about 50 % of answers. Totally speaking, education is one of the main

purpose for all kinds of Digital Maps, and elevation data are purchased for topographic analysis and regional planning, administrative boundary data are for marketing and administrative work, and 10000(combined) is for information service and facility management.

This result seems to coincide with the target of application software. For elevation data, software for topographic analysis is available, and for administrative boundary data, system dealing with information based on administrative unit, which can be used for administrative work, is available. The persons who try to develop application software for Digital Maps seems to think the purpose of purchasing them as information service. This explains that information service is one of main reason for purchasing for Digital Map 10000(combined), and many application for Digital Map 10000(combined) are available.

5 Conclusion

In the above, Digital Maps which are generated by GSI and distributed by JMC since June, 1993 and application software utilizing Digital Maps are described. And market of Digital Maps are surveyed from sales of Digital Maps for fiscal year 1993 and the result of questionnaire for users who have purchased Digital Maps.

Number of data discs to be available and kinds of Digital Maps are increasing year by year. I hope many application using Digital Maps will appear and circumstances for utilizing these digital maps has becoming comfortable more and more.