3-7. Construction of the Asian Disaster Reduction Internet GIS

3-7-1. Background on the Development of the Asian Disaster Reduction Internet GIS

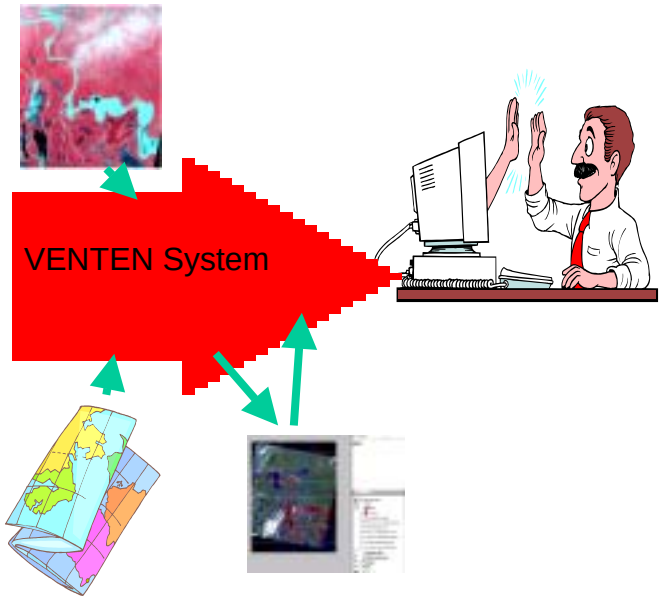
Increased reliability of information extracted from satellite images with the progress of image processing technology in recent years is gradually establishing the environment for extracting various information by remote sensing without restriction in time and place and using this information for disaster reduction. At this point, no system which can be linked directly to the reduction of disasters and operate in conjunction with disaster reduction activities is available. This is due to the focus on technological breakthroughs by satellite image providers which resulted in the lack of enthusiastic participation of the side actually implementing the disaster reduction activities in this area. It is also due to the difficulty in using the information extracted from satellite images in actual operations by itself only-information becomes useful for the first time only with the combination of general geographical information such as topography and natural conditions, and social information such as population, constructions, and infrastructures. In the introduction of the geographical information system (GIS), which is the platform for analysis by combining these geographical information, high costs and skills required pose as enormous hurdles in the use of the satellite information for disaster reduction.
At the first ADRC International Meeting, held February 16 to 18, 1999, a workshop entitled “Use of Technology” was organized to discuss the use of GIS and remote sensing for disaster reduction. The following conclusions were reached:

- All member countries recognized the value of GIS and remote sensing, and their advantages in information management.
- Future tasks include acquiring real-time satellite images, acquiring satellite data at lower costs, technological support for introducing GIS and remote sensing, and acquiring technologies for extracting disaster reduction information.

Despite the high interest shown in GIS and remote sensing by the disaster reduction authorities in each country, high costs and the necessary skills pose as obstacles in the application of these technologies. Also pointed out were the high costs required for the use of satellite and geographical data.
In order to resolve these problems, the ADRC developed VENTEN (Vehicle through Electric Network of disasTer gEographical informatioN), a disaster reduction Internet geographical information system which can be accessed by anyone, anywhere, using the rapidly growing Internet.

The goals in the development of VENTEN were to provide both a system and data. This system can be used with a PC connected to the Internet and a World Wide Web browser.
Various international organizations, etc. provide basic geographical information such as topography and natural conditions. In order to browse and understand this information, it is necessary to convert the data format according to the GIS used. Thus in developing VENTEN, various geographical information was gathered and converted to a format which can be used immediately on the VENTEN system, and provided with the system.
Fig. 3-7-1-1 shows the positioning of VENTEN. On the left, are the development and research organizations and organizations providing information such as aviation photograph information

Fig. 3-7-1-1 Pointing of VENTEN



service organizations, which provide the primary data. In order to extract useful information for disaster reduction from this primary data, numerous image processing and adjustments are required, as are the means to send this information to the side handling the actual disaster reduction work. Disaster reduction researchers can also browse, analyze information, and add results to VENTEN. The VENTEN system has database and analysis functions for disaster reduction remote sensing information, and by serving as the information transmission route to those working on disaster reduction, it enables the use of disaster reduction remote sensing information in actual activities, to reduce damage such as the preparing of disaster reduction plans and support of rescue activities.

Figure 3-7-2-1 Processing Flow of VENTEN

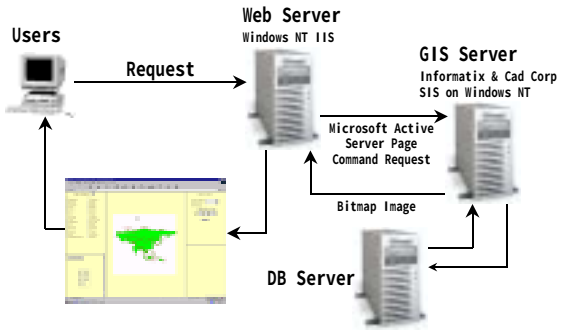
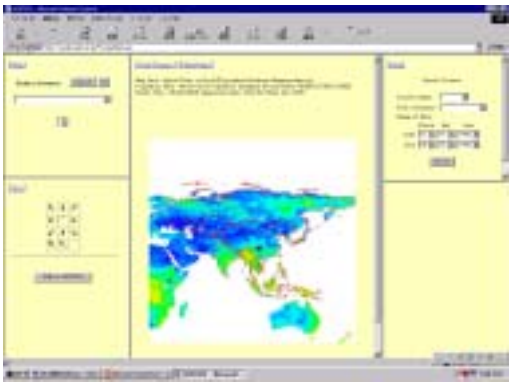


Figure 3-7-2-2 VENTEN Main Page

Figure 3-7-3-3 VENTEN System Initial Screen



3-7-2. VENTEN System

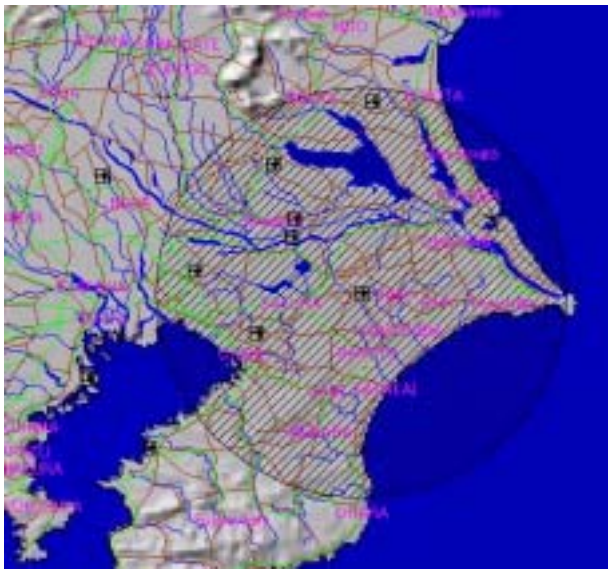
VENTEN system consists of the Web server, GIS server and database server. Fig. 3-7-2-1 shows the information processing flow in VENTEN. Upon request from users, the Web server specifies necessary information including what geographical data and what part of area are needed (more than one geographical data is possible to be specified), for GIS server. The GIS server, if necessary, referring to the data server, abstracts the necessary part of area from the geographical data accumulated within itself, and then processes it to send to the Web server in a form of a raster image data. The Web server adds to it country selection menu, disaster geographical information selection menu, show/hide selection button for basic geographical data and button for changing scale and area to be displayed other than geographical data. Then it sends users information in hypertext format including the raster image data provided by GIS server.

In the aim to create a system which can be used easily even by first-time users, the main page was sharply revised this year (Figure 3-7-2-2). NOAA satellite images were also added. Figure 3-7-2-3 shows the initial screen of the VENTEN system.

There are a couple of systems for Internet based GIS. For example, one of them can be used by downloading an application program. Another system based on an image map only provides geographical information. VENTEN can be positioned in between those two systems in system wise. In

other words, users can process vector data on VENTEN, but obtain only raster data based on the vector data. Although it restricts users to obtain data, this system solves the problems of difference in response caused by different network environments and performance of client machine at the time of operation, and of property right for data. For Internet GIS, traffic load of network in sending data is problematic. However, since VENTEN only sends a fixed scale of image of 470 x 470 pixel to be displayed at center of VENTEN screen, it take server longer in calculation and difference in network environment between VENTEN and end users does not have significant impact in data sending. Most data processing is done by server machine and all the client machine should do is to display data it receives, so that difference of performance in various client machines does not have significant impact. It is easy to persuade many data providers to join in this system because vector data which is very close to the original information in its amount, is not given to users. The users will finally get only raster data, but user can process it as if they could process directly vector data.

Figure 3-7-2-4 Designation of 50 km range from Narita Airport as Buffer on VENTEN (Top) and Results of Calculation of Population in Buffer Area (Bottom)



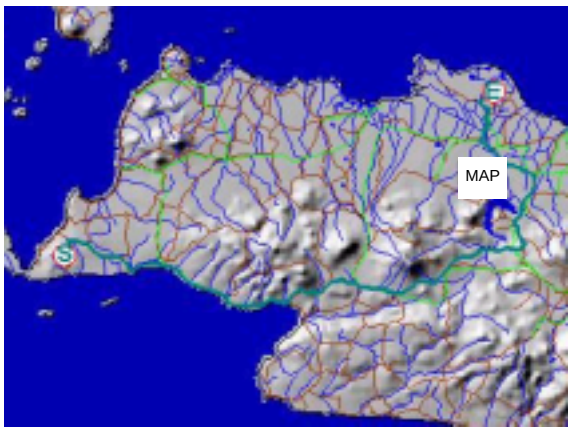
VENTEN has GIS standard functions of "drawing map in any scale", "buffering", "overlaying" and "searching by location and attribute". Fig. 3-7-2-4 shows a buffer with abstracted results of population of cities in the buffer. The buffer is set to 50 km with Narita International airport as its center. The city names and their population in that area are displayed as the results as shown in the following.

City	Population
Ichihara	241207
Narashino	137415
Funabashi	507906
Sakura	125069
Yachiyo	142402
Abiko	113239
Tsuchiura	119956
TOTAL	1387193

Figure 3-7-2-5
Results of Analysis of Shortest Route

Another newly developed function is the shortest route analysis function. It determines the shortest route for evacuation and transportation of supplies. Specifically, the source of the supplies is taken as the starting point S and the stricken area as the destination E. Among the many routes displayed, the shortest route is displayed in bold lines (Figure 3-7-2-5). This function is not only useful for searching for the shortest route but also as an operational function which can be used together with other buffering functions for searching for routes to avoid damaged area

In this way, VENTEN provides raster based information to the end users, but the users can make various requests to process vector data on the server.



3-7-3. Data Provided by VENTEN

VENTEN gathers data for the 23 member countries of the ADRC. Two types of information are collected; basic geographical information whose use is not restricted to disaster reduction, particularly topography and natural conditions, and disaster reduction geographical information on maps. Until now, the following information has been gathered:

1) Basic geographical information

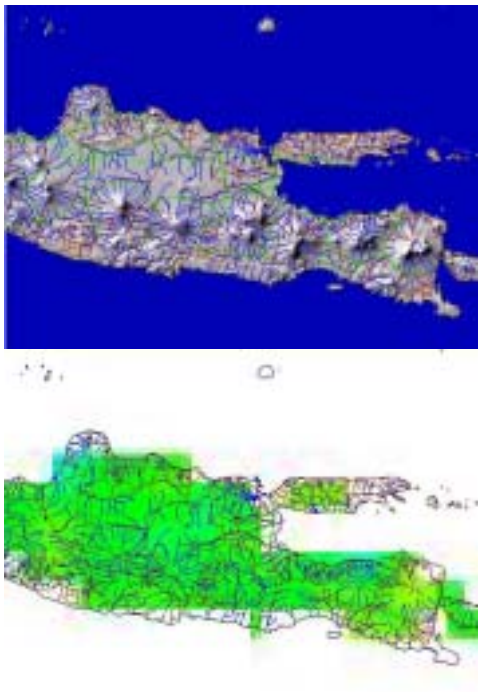
National borders (region), water systems (line, region), railroads (line), roads (line), airports (dot), position of cities (dot), city name (character strings), population (number), shaded image based on sea level (raster image), contour drawings of sea level (raster images) (Data source: DCW (Digital Chart of the World), GRID, GTOPO30).

2) Disaster reduction geographical information

Flood areas during the 1998 Chang Jiang flooding, damage to homes around Nishinomiya Station during the 1995 Great Hanshin-Awaji Earthquake, damage by street number of town based on the household damage survey during the 1995 Great Hanshin-Awaji Earthquake, active fault distribution drawing.

A menu on basic geographical information is provided at the bottom right of the VENTEN screen, to enable the information to be displayed or turned off anytime.

Figure 3-7-3-1 Map of basic Geographical Information (Top) and Maps including Satellite Data of NOAA Vegetation Indices (Bottom)



One data improvement made this year was the introduction of NOAA satellite data, which is the vegetation index with 16 km resolution. (two terms, July and December 1998). This offers the advantage of acquiring covered land maps which are indispensable to disaster measures. In addition, this introduction plays a large role as a test of the introduction of satellite data such as LANDSAT and SPOT, etc. The ADRC plans to analyze the results of the trial introduction this year and review the introduction of other satellite data in the future.

3-7-4 . VENTEN Experiments and Future Prospects

In order to run the VENTEN system abroad, the absolute cooperation of the governments and research organizations in the concerned country is required. For this reason, we have been conducting a case study in Indonesia, one of the developing countries with excellent partnership between the representative of this research and the organization belonged to. Indonesia is prone to various natural disasters such as earthquake, tsunamis, volcanic eruptions, forest fires, landslides, floods, etc., making it a country where effects of joint research sharing data and using information processing can be looked forward to considerably. Test runs in Indonesia are useful in aiming at a VENTEN system which can be used properly during actual disasters. During the tests runs in Indonesia, tasks no transmission speed and operatability were mainly organized. The ADRC plans to continue tests on mutual data exchange between Japan and Indonesia using information technology.

The development of disaster reduction geographical information systems using the Internet has mainly been explained from the viewpoints of background, system, and data provided. At this point, VENTEN only has the minimum performance for disclosure. The ADRC hopes to increase data, perform tests in disaster reduction administrations, and based on the results, improve the interface, expand functions, improve engineering software performance, and set up high speed Internet lines. To increase users, efforts will be made to construct a system which takes users needs into consideration as well as

implement further PR activities.