JAPAN INTERNATIONAL COOPERATION AGENCY

STATE SECRETARIAT OF PLANNING, SCIENCE AND TECHNOLOGY
THE STATE OF SERGIPE, THE FEDERATIVE REPUBLIC OF BRAZIL

THE STUDY
ON
WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN
THE FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT
SUPPORTING
(VOLUME I)
MASTER PLAN STUDY

[M] HYDROLOGICAL DATABASE SYSTEM

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YACHIYO ENGINEERING CO., LTD. (YEC)

THE STUDY ON WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN THE FEDERATIVE REPUBLIC OF BRAZIL

SUPPORTING REPORT (M)
HYDROLOGIC DATA-BASE SYSTEM

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CHAPTER 1 OUTLINE OF DATA-BASE SYSTEM

1.1 Outline of Data-base System

This Data-base system was designed to make tables and figures of discharge date (daily discharge), rainfall data (daily rainfall), meteorological data (daily rainfall, daily maximum temperature, daily minimum temperature, relative humidity, evapo-transpiration, wind velocity, daylight hours), as well as to arrange basic data for hydrological analysis.

This Data-base system does not include the function to make source data to be suitable for this Data-base system. For this purpose, another editing program is needed because source data for this Data-base system must be text type data (∗.qdt for discharge data, ∗.rdt for rainfall data, ∗.mdt for meteorological data).

1.2 Operation Method of Hydrological Data

1.2.1 Discharge Data

(1) Data to be operated

Data to be operated for this Data-base system is; name of observation station, basin area, river name, elevation of the station, responsible organization of the station, location of the station, method of observation, constant of water level – discharge curve (Constant A, B in $Q=A(H-B)^2$), discharge observation data (year-month-date, water level, discharge), daily discharge.

(2) Data Input Format

Except data of character type, data of numeral value type is distinguished from the others by one space among them.

Data					Content
PROPRIA					○ Characters :Name of the station
623500					○ Values :Basin area(km²)
Sao Francisco River					○ Characters :Name of river basin
9999.99					○ Values :Elevation of the station
CHESF					○ Characters: Responsible organization
999.9999	999.9999				○ Values: Location of the station, latitude and longitude (degree)
Staff Gauge					○ Characters: Method of discharge observation
5.2	835.0				○ Values: Constant A, B of water level – discharge curve
10					○ Values: Number of observed discharge data. In this example, number of observation is 10.
1990	6	2	841.3	187.6	○ Values: Order of observed discharge data
1990	6	3	841.8	263.9	Year, month, day, water level (EL.m), discharge(m³/s)
1990	6	4	840.1	121.9	
1990	6	8	834.4	0.6	
1991	2	2	836.0	5.0	
1990	5	12	835.5	1.5	
1987	7	20	836.7	15.5	
1980	11	29	837.5	31.8	
1978	8	9	841.1	190.3	
1990	4	5	835.5	3.0	
1995	1	1	2011.0		○ Values: Order of daily discharge data
1995	1	2	1853.0		Year, month, day, discharge(m³/s)
1995	1	3	1799.0		
1995	1	4	1799.0		
1995	1	5	2184.0		
1995	1	6	2346.0		-Following data sets are identified as daily discharge data
1995	1	7	2206.0		-In case of no data, blank or –99 must be input into the column
1995	1	8	2043.0		

(3) Result of Output Data

Output from the Data-base system for daily discharge data has three items as shown below;

< Daily discharge annual table >

Temporary files ("table-o.csv") will be made in "csv" type file of excel. In the Data-base system, the Excel file will be input as an object file to be operated.

Outputs are; responsible organization of the station, name of the station, basin area, name of river, name of river basin, location of the station, method of observation, daily discharge. In addition, the items below will be output.

- Monthly summary by each year
  (Monthly total, monthly maximum, monthly minimum, monthly average)
- Seven-day average discharge annual table
- Annual summary
  (Annual total, annual maximum, annual minimum, 95-day discharge (the 95th daily discharge form the maximum one during one year), 185-day water level discharge (the 185th daily water level from the maximum one during one year), low flow (the 275th daily discharge from the maximum one during one year), 355-day flow (the 355th daily discharge form the maximum one during one year), average, 7- day minimum average discharge.
- Table of annual total
- Monthly average discharge

< Figure of flow regime >

Printer can directly draw figures of flow regime as listed below;

- Discharge data in order of occurrence (bar graph)
- Discharge data in order of magnitude (line graph)
- Name of the station, basin area, name of river, name of river basin, responsible organization of the station.

< Figure of discharge observation result >

Printer can directly draw figures and figures of discharge observation results.

- Figure of discharge observation data (year, month, day, water level, discharge)
- H-Q curve
- Original data of discharge observation (year, month, day, water level, discharge)
- Name of the station, basin area, name of river, name of basin area, responsible organization of the station
- Formula indicating H-Q curve.

1.2.2 Rainfall Data

(1) Data to be operated

Data to be operated is; name of the station, elevation of the station, responsible organization of the station, location of the station, method of rainfall observation, rainfall data (year, month, day, rainfall).

(2) Input Data Format

Except data of character type, data of numeral value type is distinguished from the others by one space among them.

Data	Content
3894664 999.99 SUDENE 999.9999 999.9999 Automatic 1978 10 1 0.0 1978 10 2 0.0 1978 10 3 0.0 1978 10 4 0.0 1978 10 5 0.0 1978 10 6 0.0 1978 10 7 0.0 1978 10 8 0.0 1978 10 9 0.0	○ Characters :Name of the station ○ Figures :Elevation of the station ○ Responsible organization of the station ○ Figures: Location of the station, latitude and longitude(degree) ○ Characters :Method of rainfall observation ○ Figures: Order of daily rainfall data Year, month, day, daily rainfall (mm) -Following data sets are identified as daily rainfall data -In case of no data, blank or --99 must be input into the column

(3) Result of Output

< Annual table of daily rainfall >

Output from the Data-base system for daily rainfall data has two items as listed below.

< Daily rainfall annual table >

Temporary files ("table_o.csv") will be made in "csv" type file of the Excel. In the Data-base system, the Excel file will be input as an object file to be operated.

Output items are; responsible organization of the station, name of the station, elevation of the station, location of the station, method of the observation, daily rainfall. In addition, the items below will be output.

- Monthly summary by each year
  (Monthly total, monthly maximum, monthly average, number of rainfall days)
- Annual summary
  (Annual total, annual average, annual maximum, rainfall days by year
- Monthly total rainfall

< Figure of rainfall fluctuation >

Printer can directly draw figures as listed below;

- Discharge data in order of magnitude (bar graph)
- Name of the station, responsible organization of the station.

1.2.3 Meteorological Data

(1) Data to be operated

Data to be operated is; name of the station, elevation of the station, responsible organization, location of the station, daily temperature (year, month, day, rainfall (mm), daily maximum temperature(degree), daily minimum temperature(degree), relative humidity(%), wind velocity(m/s), daylight hours (hours)).

(2) Input Data Format

Data										Content
SAMPLE-D										○ Characters :Name of the station
999.99										○ Values :Elevation of the station
CODEVASF										○ Responsible organization of the station
999.9999		999.9999								○ Values: Location of the station, latitude and longitude(degree)
1975	1	1	-99	-99	20.8	75.2	-99	-99	7.5	○ Values: Order of data set is as follows; Year, month, day, daily rainfall (mm), daily maximum temperature(degree), minimum temperature(degree), relative humidity(%), evapo-transpiration(mm), wind velocity(m/s), daylight hours(hr)
1975	1	2	-99	-99	21.0	74.6	-99	-99	8.7	
1975	1	3	-99	-99	22.4	74.7	-99	-99	8.0	
1975	1	4	-99	32.2	-99	68.3	-99	-99	8.2	
1975	1	5	-99	30.8	-99	75.3	-99	-99	9.0	
1975	1	7	-99	32.6	-99	78.6	-99	-99	0.0	-Following data sets are identified as meteorological data -In case of no data, blank or –99 must be input into the column

(3) Result of Output

Output from the Data-base system for daily meteorological data is two items as listed below.

< Annual table of daily meteorological data >

Temporary files ("table_o.csv") will be made in "csv" type file of the Excel. In the Data-base system, the Excel file will be input as an object file to be operated.

Output items are; responsible organization of the station, name of the station, elevation of the station, location of the station, daily meteorological data. In addition, the items below will be output.

- Monthly summary by each year

  Rainfall
  Monthly total, monthly maximum, monthly average, number of rainfall days

  Other than rainfall
  Monthly total, monthly maximum, monthly minimum, monthly average

- Annual summary

  Rainfall
  Annual total, annual average, annual maximum, rainfall days by year

  Other than rainfall
  Annual total, annual maximum, annual minimum, annual average

- Table of monthly average

The order of annual table is; 1) rainfall, 2) daily maximum temperature, 3) daily minimum temperature, 4) relative humidity, 5) evapo-transpiration, 6) wind velocity, 7) daylight hours. In addition, annual tables are individually made for each item.

< Figure of rainfall fluctuation >

Printer can directly draw figures of flow regime as listed below;

Rainfall
- Rainfall data in order of occurrence (bar graph)
- Name of the station, responsible organization of the station.

Other than rainfall
- Data in order of occurrence(line graph)
- Name of the station, responsible organization of the station
- Monthly average
- Daily maximum and daily minimum drawn in the same figure.

CHAPTER 2 DATA-BASE OPERATION METHOD

This Chapter is the manual for this Data-base System. The program flow chart flow chart of this Data-base System is shown in Figure-2.1. The opening figure appears as shown in Figure-2.2 by starting "HDSYSYEM. EXE". The next steps can be available by clicking the option button to select the data to be operated (discharge, rainfall, meteorology) and by selecting the printer to print out the results (see Figure-2.3).

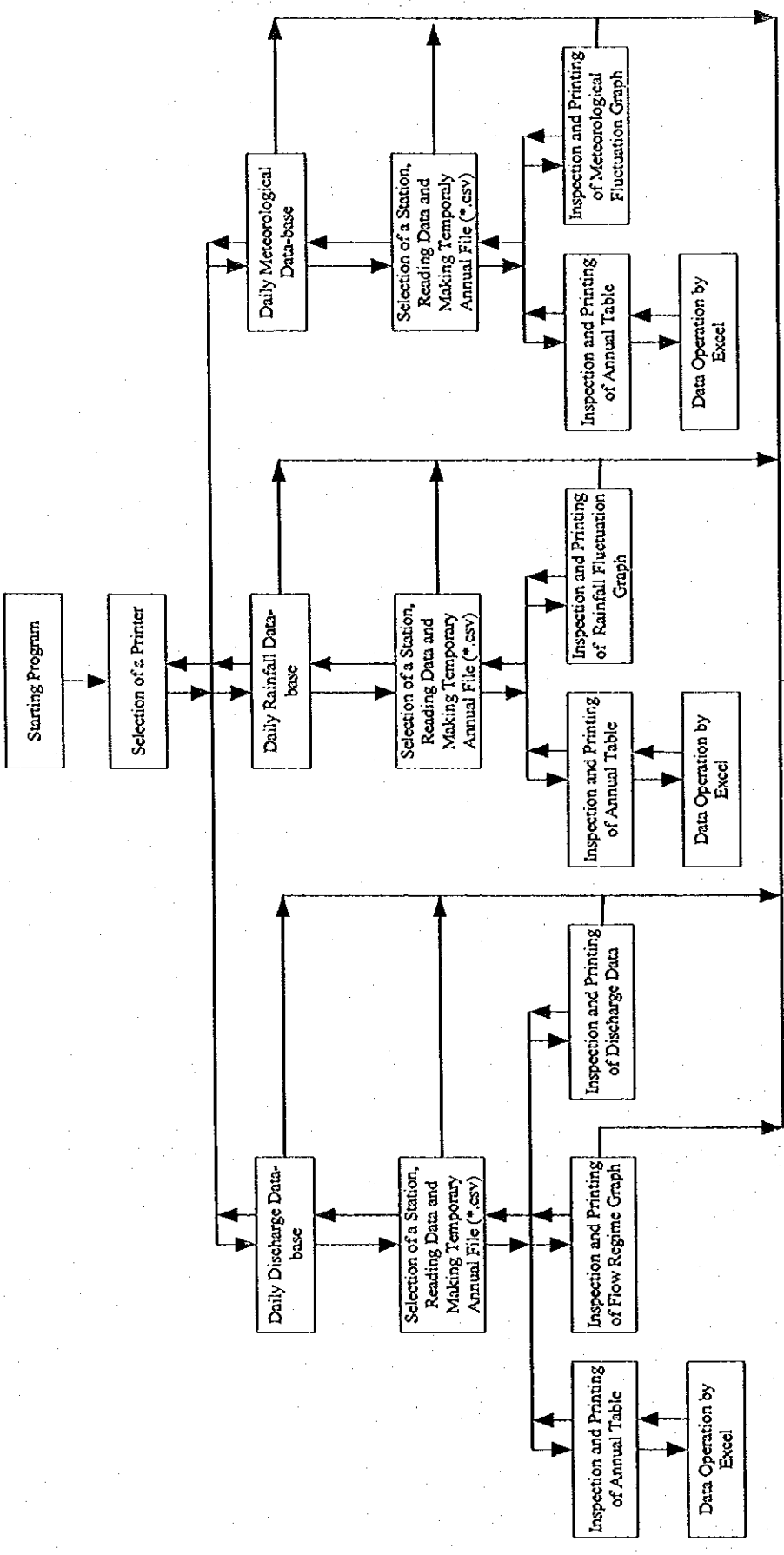

Figure-2.1 Program Flow Chart

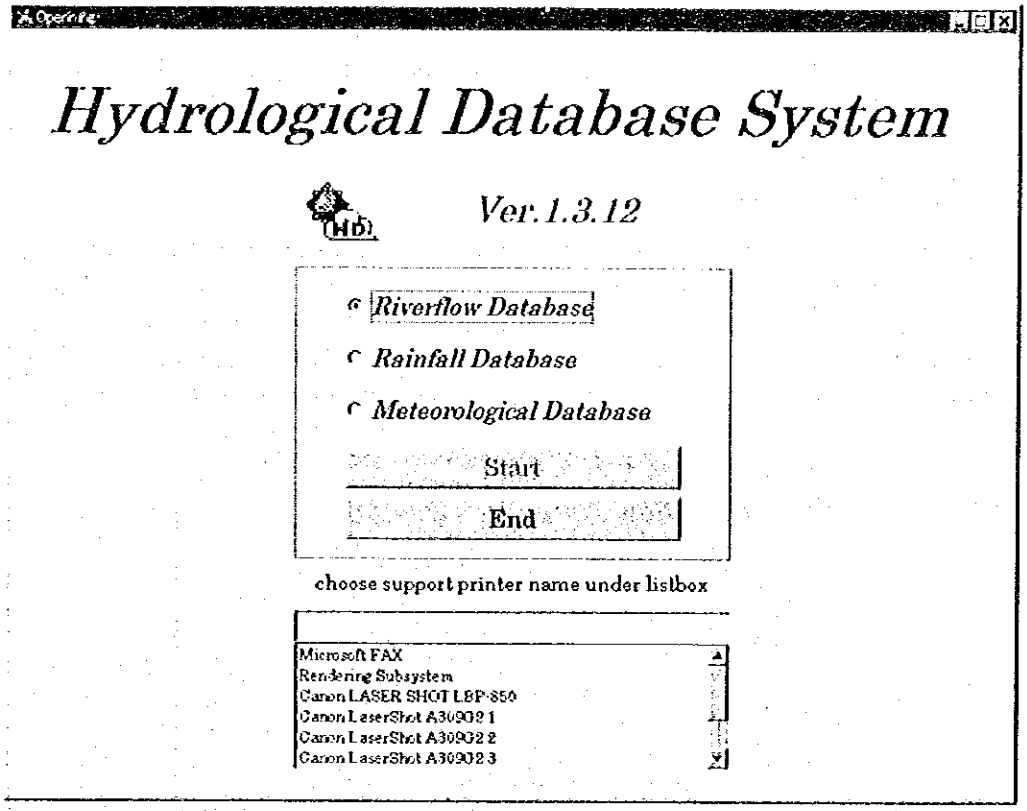

Figure-2.2 Title of Data-base System

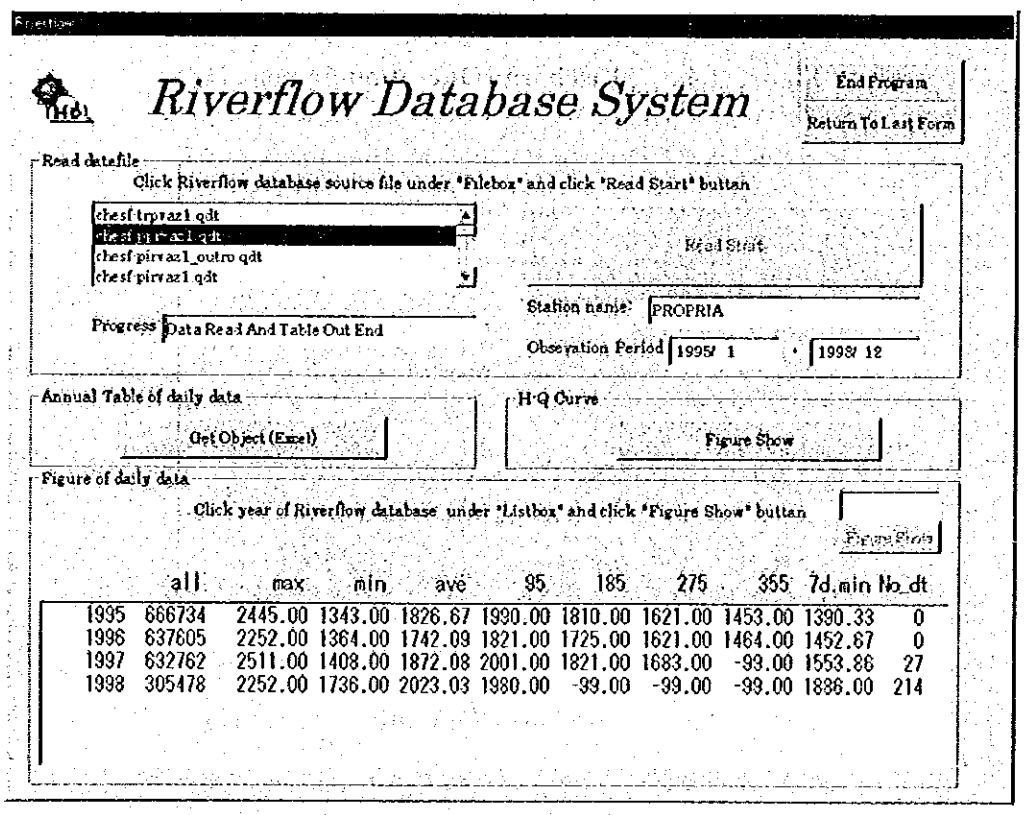

Figure-2.3 Operation Screen

2.1 Discharge Data

Screen shows discharge data as shown in Figure-2.4 by selecting discharge data in previous screen (see Figure-1.2).

2.1.1 Input Data and Data Operation

File to be operated is selected from list box by clicking the files name, then the Data-base system starts reading data. After reading it, the data will be operated (calculation of maximum, minimum and so on), then next step will be available. During the data operation mentioned above, the screen shows the progress of the operation showing name of the station, observation period, number of days without observation (see Figure-2.5).

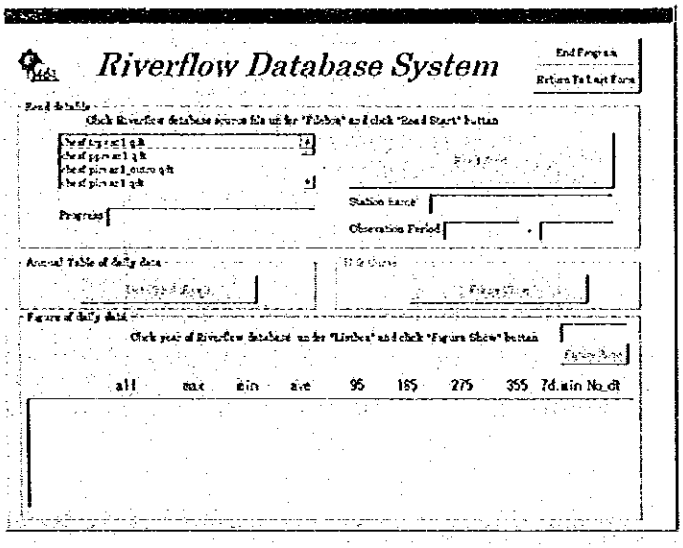

Figure-2.4 Discharge Operation Screen (1)

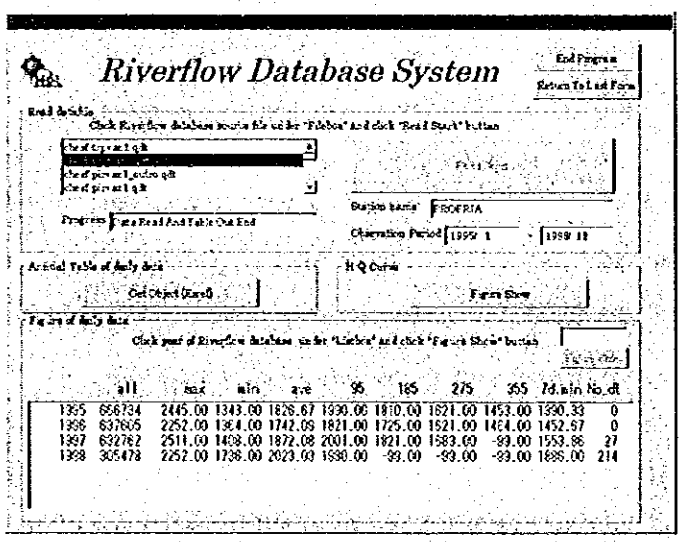

Figure-2.5 Discharge Operation Screen (2)

2.1.2 Inspection and Printing Out of Annual Table

Screen shows a figure as shown in Figure-2.6 by clicking "Get Object (Excel)" in Figure-2.5. The central part of the screen with cells shows the Excel file input as an object file by the Data-base system.

The Excel sheet can automatically input annual tables in order to print out and inspect the annual tables in detail by clicking the object (see Figure-2.7). Printing out is available using printing function of the Excel itself. The screen returns to Figure-2.6 by finishing the Excel.

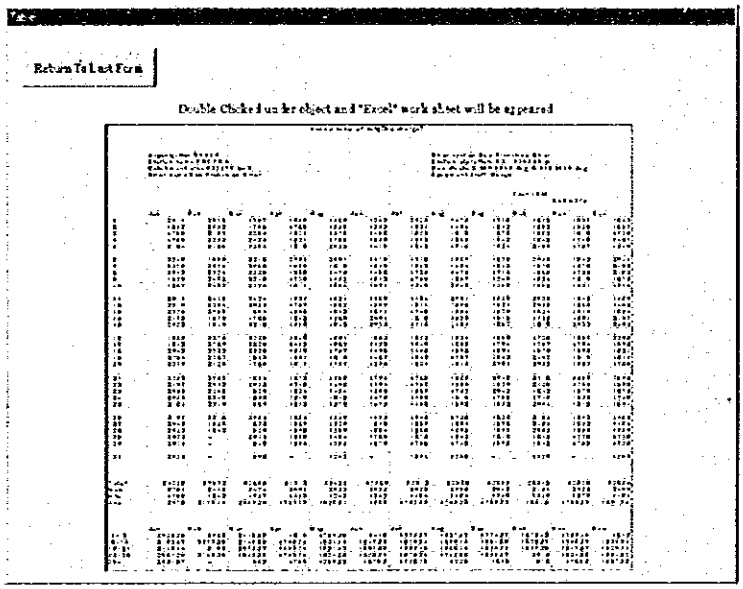

Figure-2.6 Discharge Operation Screen (3)

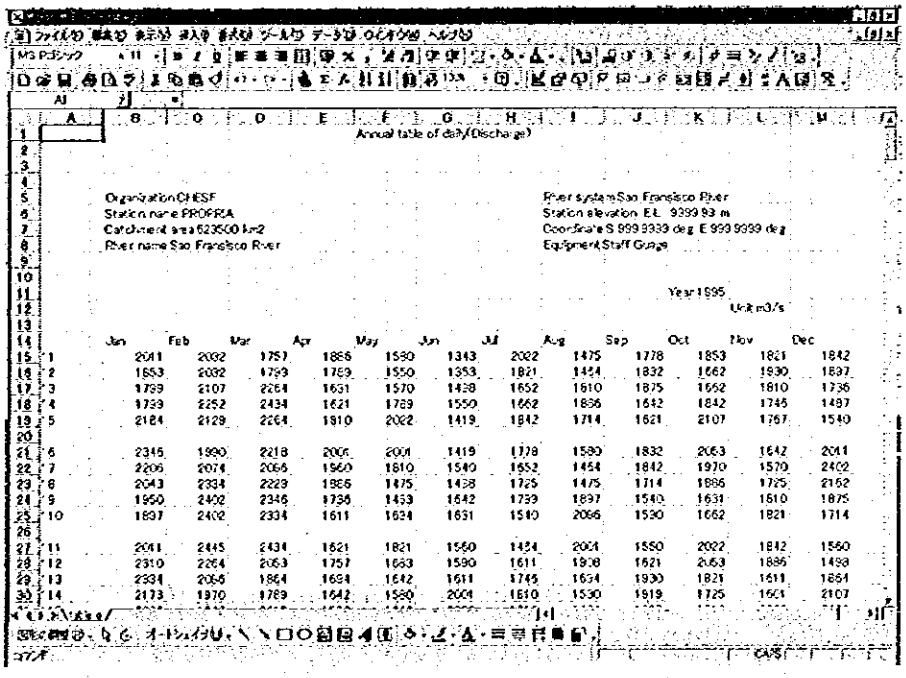

Figure-2.7 Discharge Operation Screen (4)

2.1.3 Inspection of Discharge Observation and Printing Out

Screen shows figure as shown in Figure-2.8 by clicking "Figure Show" in Figure-2.5. Original data of the discharge observation is shown on the right of the screen. In addition, the H-Q curve established at the station can be seen as shown in Figure-2.9 by clicking the "White Figure On CRT". Tables and figures can be printed out by clicking key of "Printing Out".

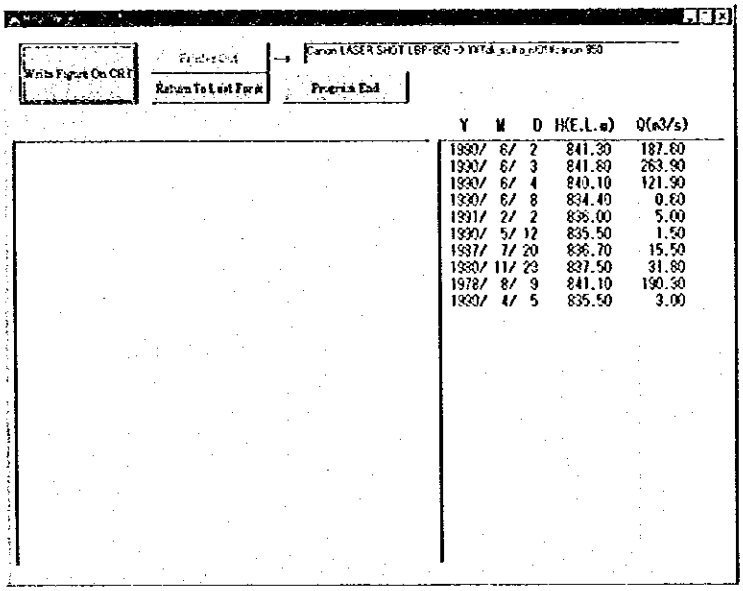

Figure-2.8 Discharge Operation Screen (5)

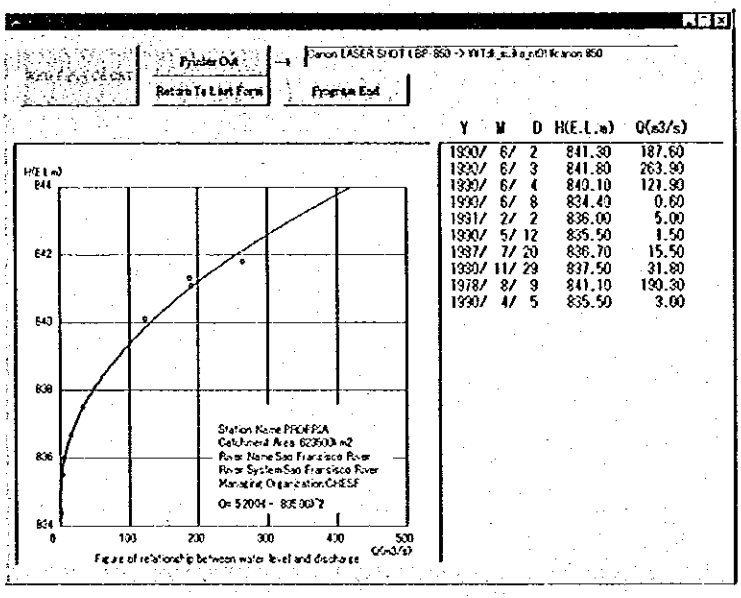

Figure-2.9 Discharge Operation Screen (6)

2.1.4 Inspection and Printing Out of Flow Regime

Screen shows the year of which data to be operated as shown in Figure-2.13 by clicking the year in the list box of Figure-2.6 "Figure of daily data". The screen shows Figure-2.11 by clicking "Figure Show". In addition figure of flow regime can be seen in the center of screen as shown in Figure-2.12 by clicking "Write Figure On CRT". This figure can be printed out by clicking "Printer Out".

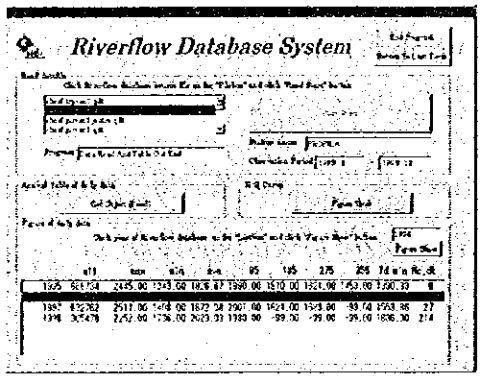

Figure-2.10 Discharge Operation Screen (7)

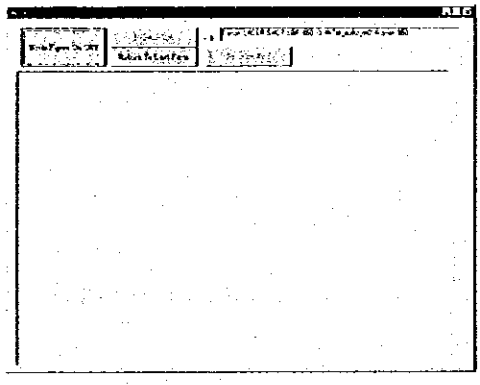

Figure-2.11 Discharge Operation Screen (8)

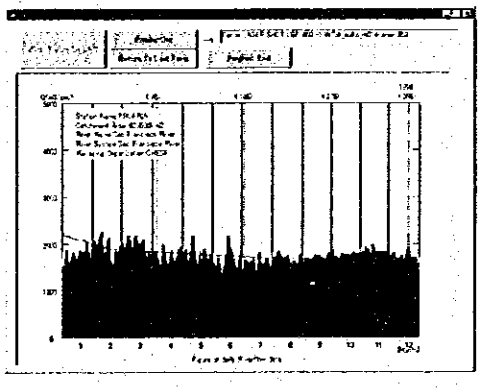

Figure-2.12 Discharge Operation Screen (9)

2.2 Rainfall Data

The screen shows figure as shown in Figure-2.13 by selecting rainfall data in Figure-2.2.

2.2.1 Reading Data and Data Operation

File to be operated is selected from the list box by clicking the file name, then the Database system starts reading data by clicking "Read Start". After reading it, the data will be operated (maximum, minimum, and so on), then next step will be available. During the operation, name of the station, observation period, number of days without observation can be informed (see Figure-2.14) .

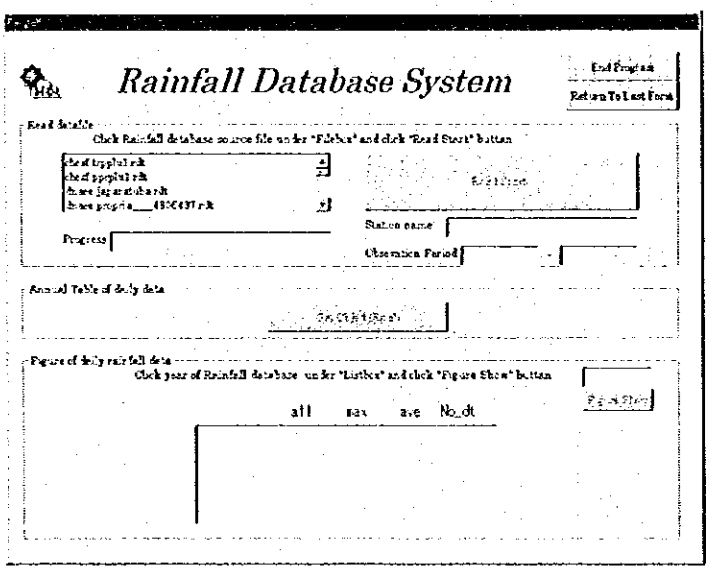

Figure-2.13 Rainfall Operation Screen (1)

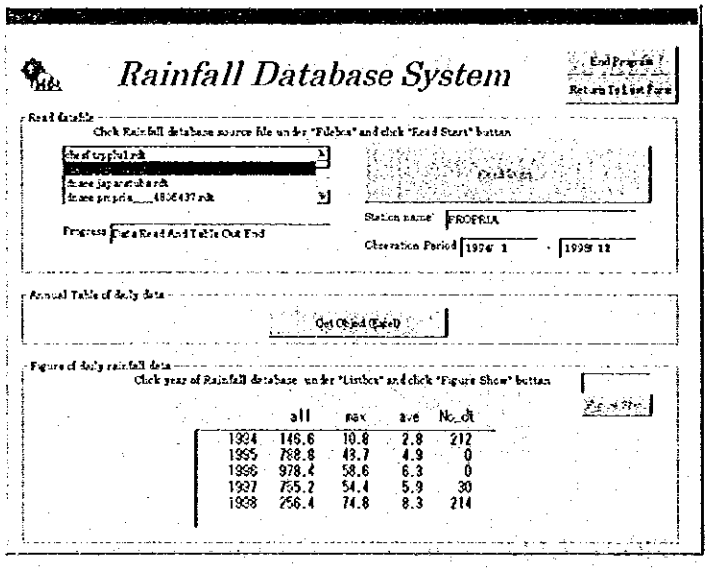

Figure-2.14 Rainfall Operation Screen (2)

2.2.2 Inspection and Printing Out of Annual Table

The screen shows figure as shown in Figure-2.15 by clicking "Get Object (Excel)". The central part of the screen with cells shows the Excel file input as an object file by the Data-base system.

The Excel sheet can automatically input annual table in order to print out and inspect it in detail by clicking the object (see Figure-2.16). Printing out is available using printing function of the Excel itself. The screen return Figure-2.15 by finishing the Excel.

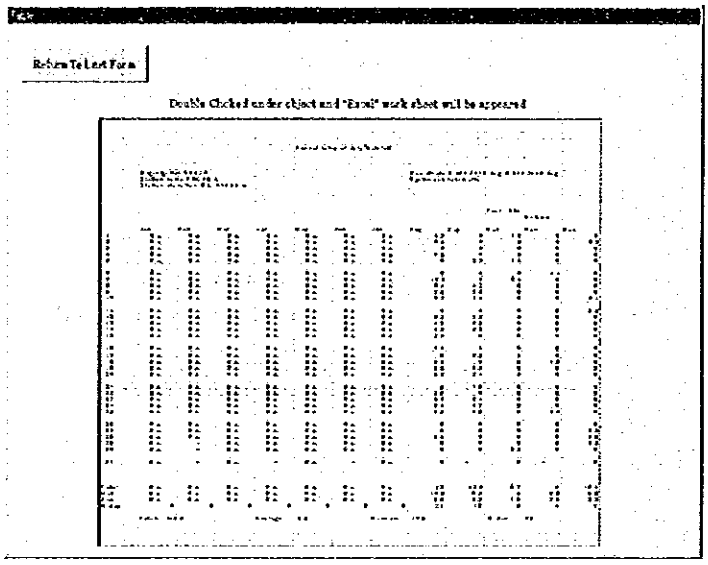

Figure-2.15 Rainfall Operation Screen (3)

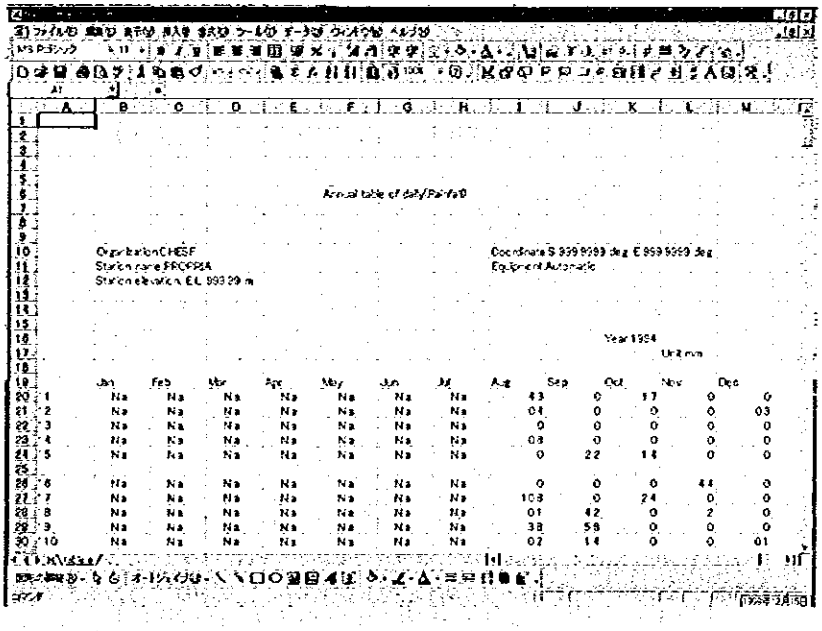

Figure-2.16 Rainfall Operation Screen (4)

2.2.3 Inspection and printing Out of Rainfall Fluctuation

Screen shows the year of which data to be operated as shown in Figure-2.14 by clicking the year in the list box of Figure-2.14 "Figure of daily data". The screen shows Figure-2.18 by clicking "Figure show". In addition, figure of rainfall fluctuation can be seen in the center of the screen as shown in Figure-2.19 by clicking "Write Figure On CRT". This figure can be printed out by clicking "Printer Out".

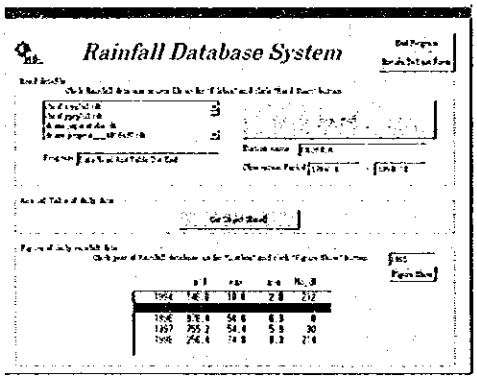

Figure-2.17 Rainfall Operation Screen (5)

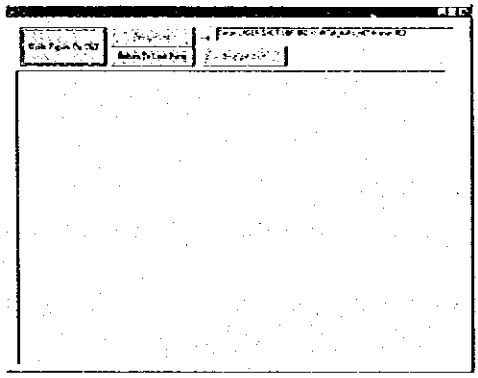

Figure-2.18 Rainfall Operation Screen (6)

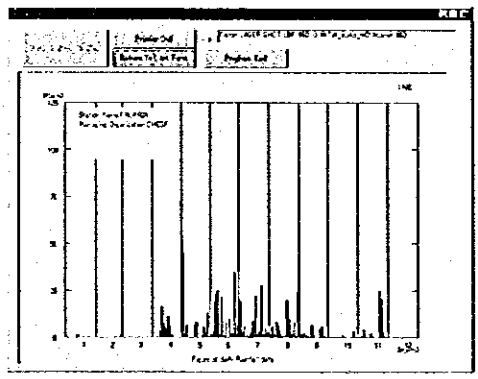

Figure-2.19 Rainfall Operation Screen (7)

2.3 Meteorological Data

The screen shows figure as shown in Figure-2.20 by clicking meteorological data.

2.3.1 Reading Data and Data Operation

File to be operated is selected from the list box by clicking the file name, then the Data-base system starts reading data by clicking "Read Start". After reading it, the data will be operated (maximum, minimum, average and so on), then next step will be available. During the operation, name of the station, observation period, number of days without observation can be informed (see Figure-2.21) .

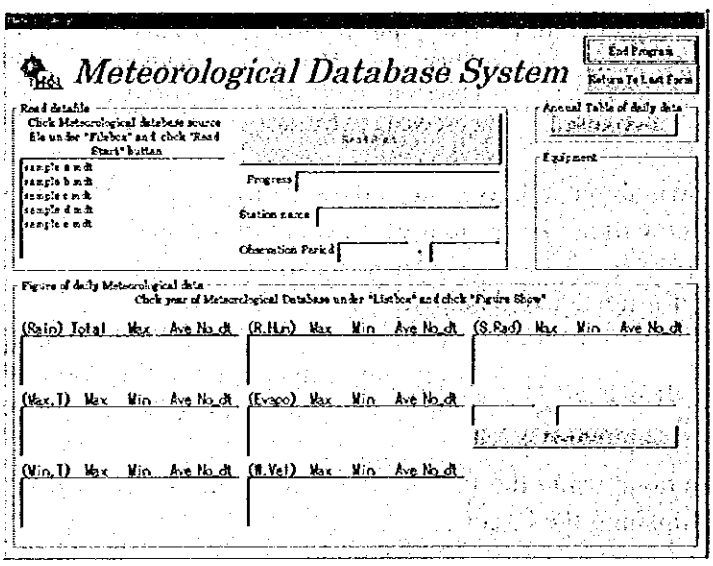

Figure-2.20 Meteorological Operation Screen (1)

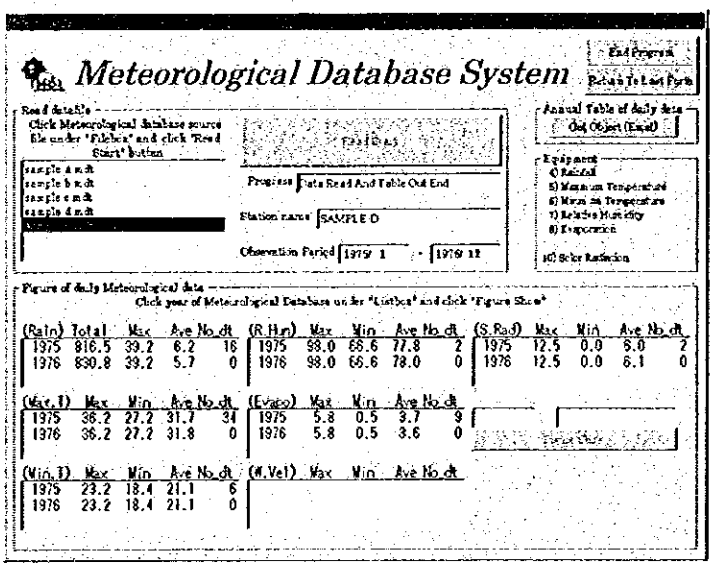

Figure-2.21 Meteorological Operation Screen (2)

2.3.2 Inspection and Plotting out of Annual Table

The screen shows figure as shown in Figure-2.22 by clicking "Get Object (Excel). The center of screen with cells shows the Excel file input as an object file by the Data-base system. The annual table is automatically taken into the Excel sheet by double-clicking the object to inspect and print out the annual table in detail (see Figure-2.2,2.3).

The order of items in the annual table is; rainfall, daily maximum temperature, daily minimum temperature, relative humidity, evapo-transpiration, wind velocity, day light hours, with each item being listed according to year. If there is an item without observation throughout one year, an annual table can not be made for this item.

(Example)

	Rainfall	Daily Max. Temp.	Daily Min. Temp.	Relative Humidity	Evapo-transpiration	Wind Velocity	Day Light Hours
1996	observed	observed	observed	No data	observed	observed	No data
1997	observed	observed	observed	No data	No data	observed	No data

In the example shown above, relative humidity and day light hours were not observed. In this case annual table will not be made for relative humidity and day light hours.

Table will be made for items listed below;
1996 rainfall, 1997 rainfall, 1996 maximum temperature, 1997 maximum temperature, 1996 minimum temperature, 1996 minimum temperature, 1996 evapo-transpiration, 1997 evapo-transpiration, 1997 evapo-transpiration, 1996 wind velocity, 1997 wind velocity.

Printing out can be done using the Excels function. The screen will return automatically to Figure-2.22 by finishing the Excel.

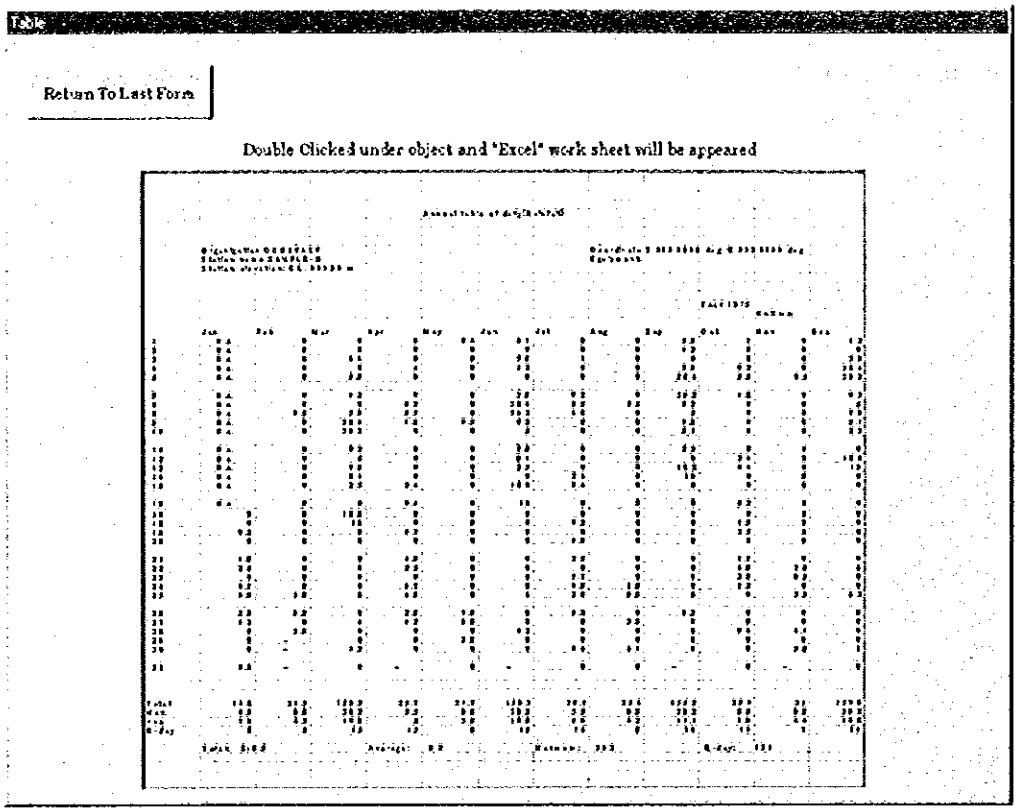

Figure-2.22 Meteorological Operation Screen (3)

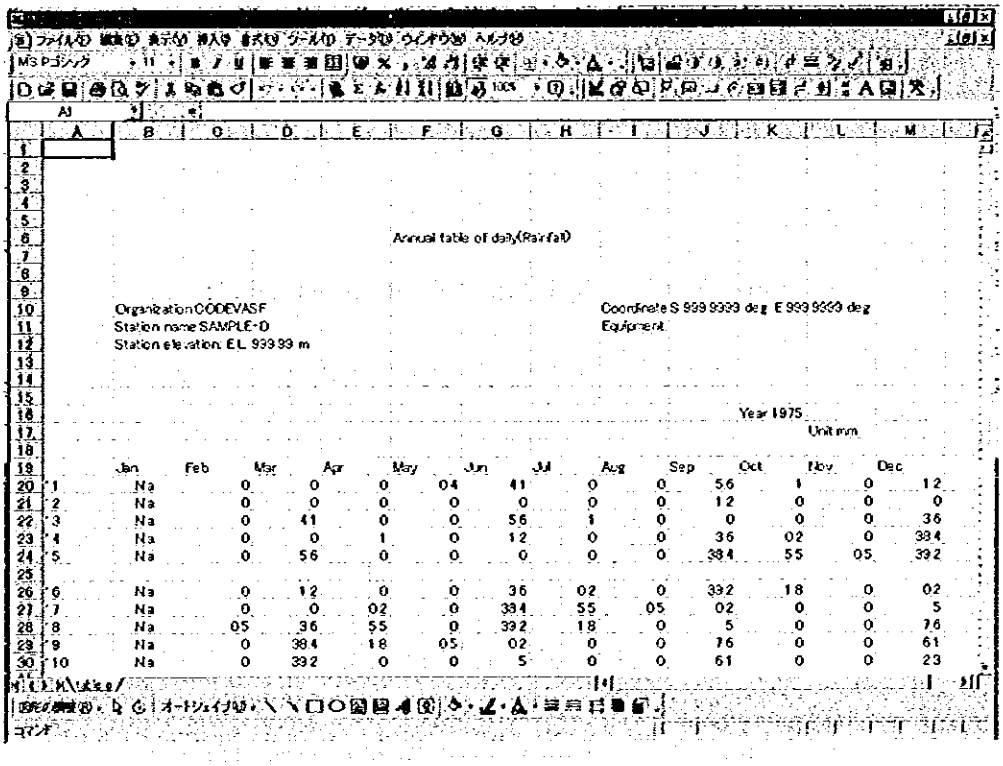

Figure-2.23 Meteorological Operation Screen (4)

2.3.3 Inspection and printing Out of Meteorological Data

Items and year of which data to be operated must be selected from the list box of Figure-2.21 "Figure of daily data".

(1) Rainfall Data

The screen shows year of which data to be operated as shown in Figure-2.24. The screen shows Figure-2.25 by clicking "Figure Show". Figure of rainfall fluctuation can be seen in the center of the screen by clicking "Write Figure On CRT" as shown in Figure-2.26. This figure can be printed out by clicking "Printer out".

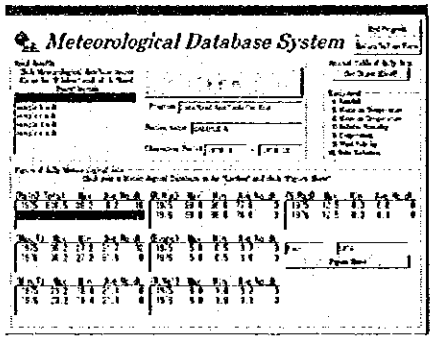

Figure-2.24 Rainfall Operation Screen (1)

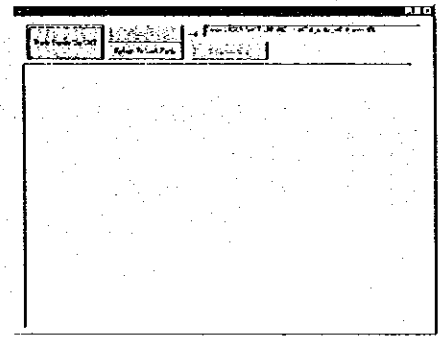

Figure-2.25 Rainfall Operation Screen (2)

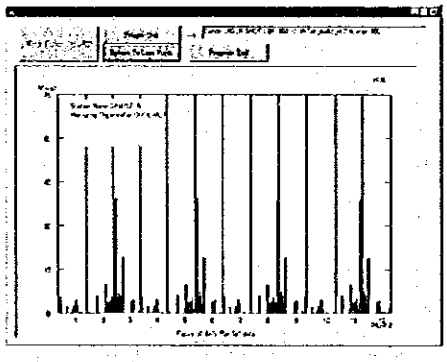

Figure-2.26 Rainfall Operation Screen (3)

(2) Maximum Temperature Data

The screen shows year of which data to be operated as shown in Figure-2.27. The screen shows Figure-2.28 by clicking "Figure Show". Figure of temperature fluctuation can be seen in the center of the screen as shown in Figure-2.29. In addition minimum temperature as well as maximum temperature can be seen in the figure. All the figures above can be printed out by clicking "Printer Out".

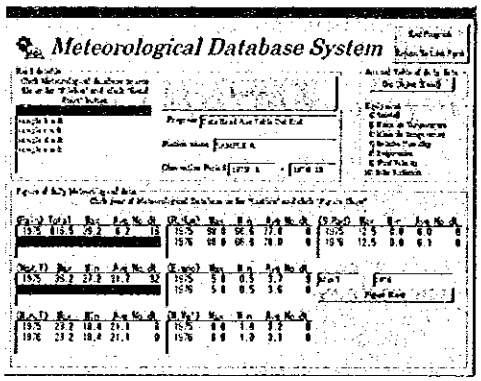

Figure-2.27 Maximum Temperature Operation Screen (1)

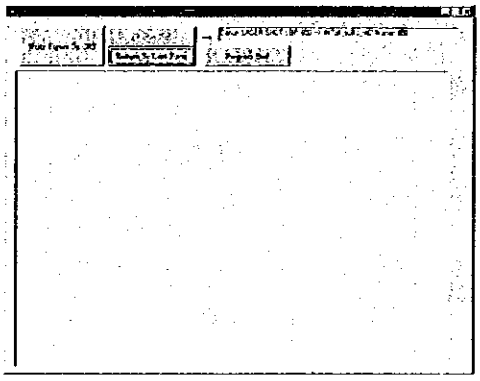

Figure-2.28 Maximum Temperature Operation Screen (2)

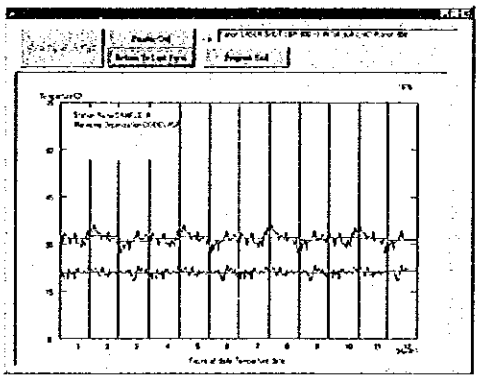

Figure-2.29 Maximum Temperature Operation Screen (3)

(3) Minimum Temperature Data

The screen shows year of which data to be operated as shown in Figure-2.30. The screen shows Figure-2.28 by clicking "Figure Show". Figure of temperature fluctuation can be seen in the center of the screen as shown in Figure-2.29. In addition minimum temperature as well as maximum temperature can be seen in the figure. All the figures above can be printed out by clicking "Printer Out".

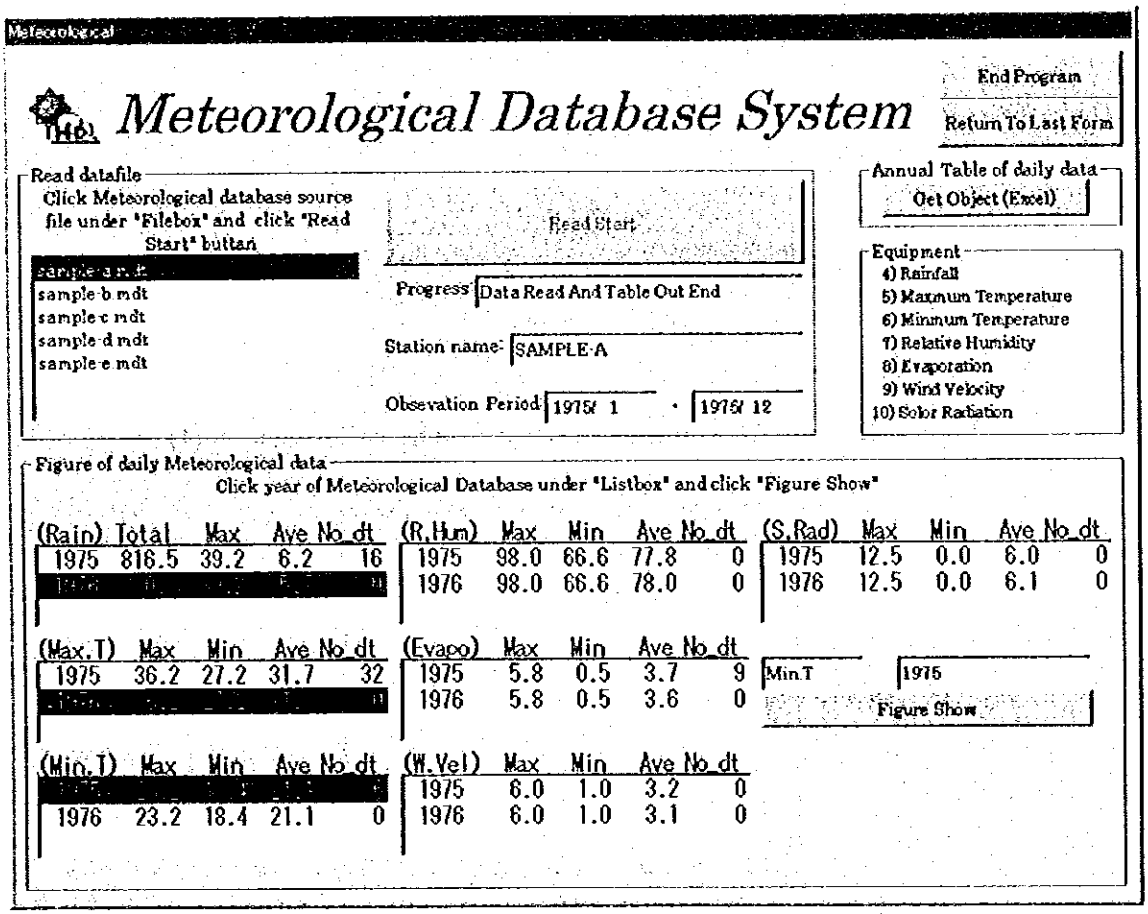

Figure-2.30 Minimum Temperature Operation Screen

(4) Relative Humidity

The screen shows year of which data to be operated as shown in Figure-2.31. The screen shows Figure-2.32 by clicking "Figure Show". Figure of relative humidity fluctuation can be seen in the center of the screen as shown in Figure-2.33 by clicking "Write Figure On CRT". The figure above can be plotted out by clicking "Printer Out".

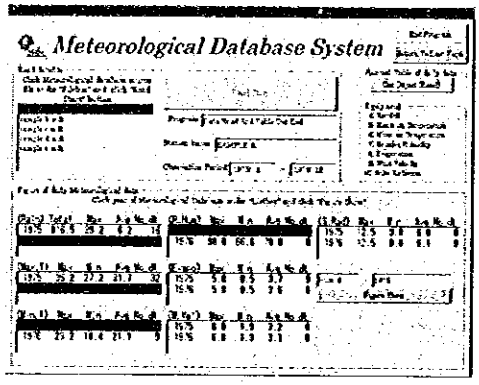

Figure-2.31 Relative Humidity Operation Screen (1)

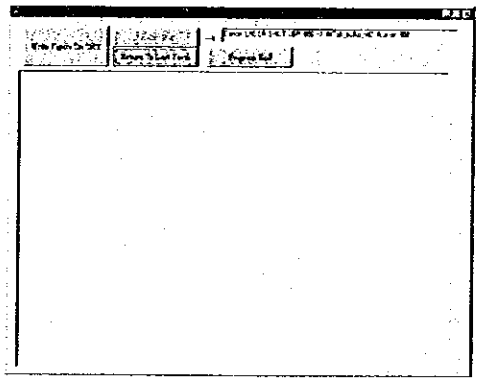

Figure-2.32 Relative Humidity Operation Screen (2)

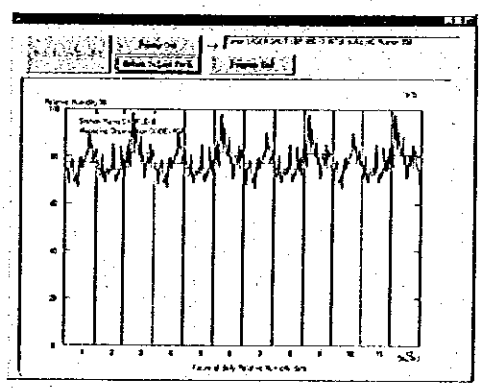

Figure-2.33 Relative Humidity Operation Screen (3)

(5) Evapo-transpiration Data

The screen shows year of which data to be operated as shown in Figure-2.34. The screen shows Figure-2.35 by clicking "Figure Show". Figure of relative humidity fluctuation can be seen in the center of the screen as shown in Figure-2.36 by clicking "Write Figure On CRT". The figure above can be plotted out by clicking "Printer Out".

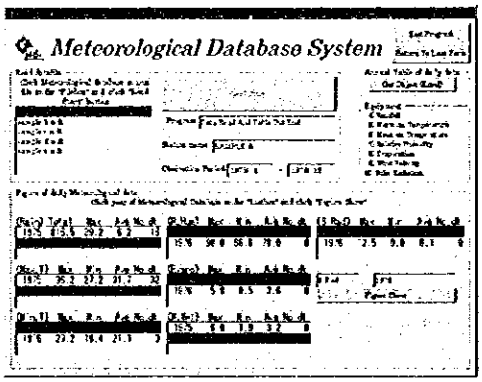

Figure-2.34 Evapo-transpiration Operation Screen (1)

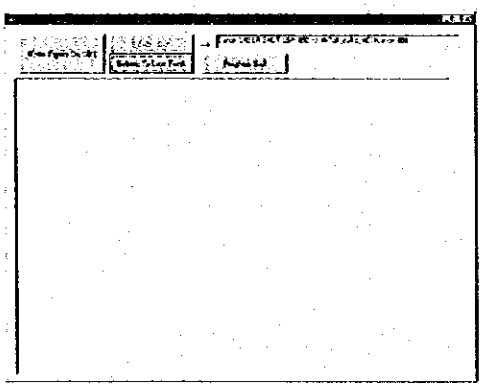

Figure-2.35 Evapo-transpiration Operation Screen (2)

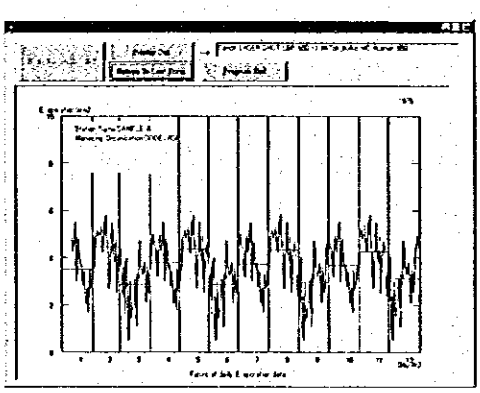

Figure-2.36 Evapo-transpiration Operation Screen (3)

(6) Wind Velocity

The screen shows year of which data to be operated as shown in Figure-2.37. The screen shows Figure-2.38 by clicking "Figure Show". Figure of relative humidity fluctuation can be seen in the center of the screen as shown in Figure-2.39 by clicking "Write Figure On CRT". The figure above can be plotted out by clicking "Printer Out".

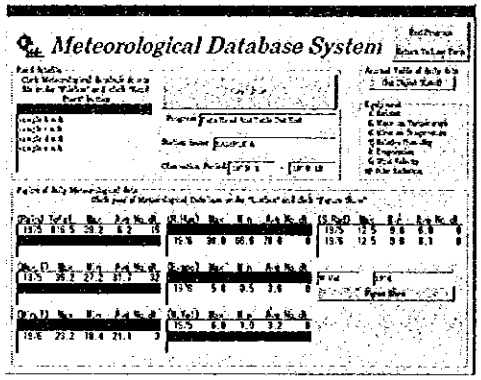

Figure-2.37 Wind Velocity Operation Screen (1)

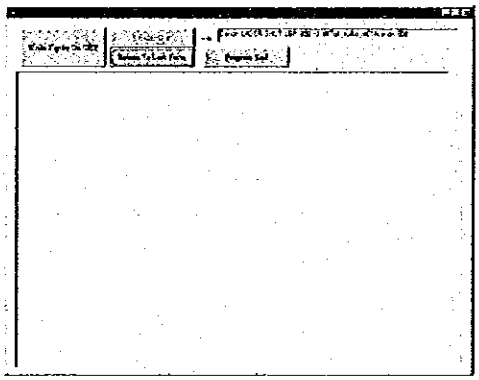

Figure-2.38 Wind Velocity Operation Screen (2)

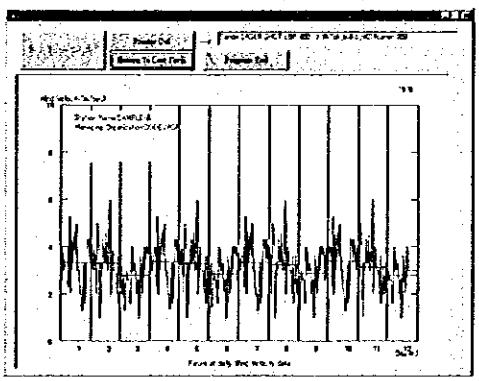

Figure-2.39 Wind Velocity Operation Screen (3)

(7) Daylight Hour Data

The screen shows year of which data to be operated as shown in Figure-2.40. The screen shows Figure-2.41 by clicking "Figure Show". Figure of relative humidity fluctuation can be seen in the center of the screen as shown in Figure-2.42 by clicking "Write Figure On CRT". The figure above can be plotted out by clicking "Printer Out".

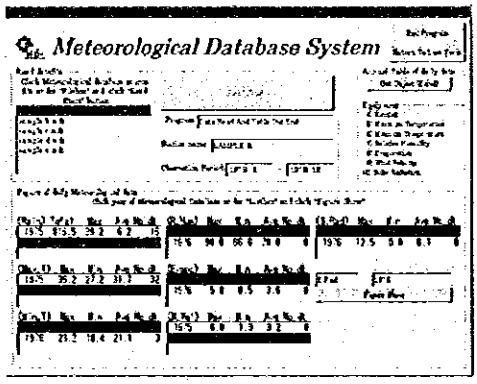

Figure-2.40 Daylight Hour Operation Screen (1)

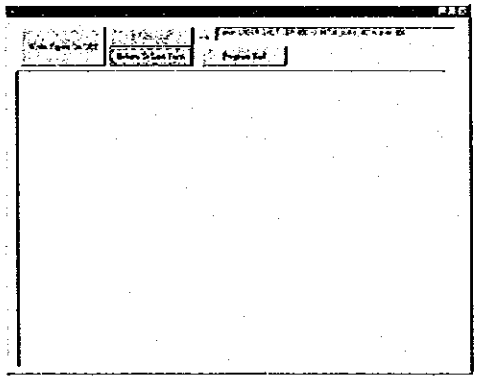

Figure-2.41 Daylight Hour Operation Screen (2)

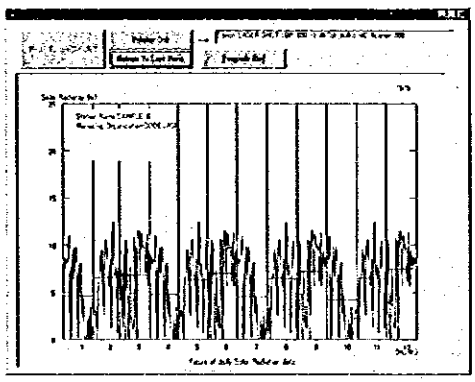

Figure-2.42 Daylight Hour Operation Screen (3)

2.4 Available Environment of Computer System

Hard ware

Personal computer	:	Personal computer installed Window 95 system
Printer	:	Printer available for Windows 95 system

Soft ware

O.S.	:	Microsoft Windows 95 system.

This Data-base system is not always available without Visual Basic 5.0 system

JAPAN INTERNATIONAL COOPERATION AGENCY

STATE SECRETARIAT OF PLANNING, SCIENCE AND TECHNOLOGY
THE STATE OF SERGIPE, THE FEDERATIVE REPUBLIC OF BRAZIL

THE STUDY
ON
WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN
THE FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT
SUPPORTING
(VOLUME I)
MASTER PLAN STUDY

[N] SATELLITE IMAGERY INTERPRETATION

MARCH 2000

YACHIYO ENGINEERING CO., LTD. (YEC)

THE STUDY ON WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN THE FEDERATIVE REPUBLIC OF BRAZIL

SUPPORTING REPORT (N)
SATELLITE IMAGERY INTERPRETATION

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CHAPTER 1 INTRODUCTION

Satellite image analysis was conducted to examine natural condition of Sergipe State for the purpose of Mater Plan Study. As the results of satellite image analysis, maps listed below were completed which gave effective information for the Master Plan Study.

- Geological Map (1:100,000)
- Geomorphological Map (1:100,000)
- River Map (1:100,000)
- Land-use Map (1:100,000)

CHAPTER 2 ORIGINAL SCENE OF SATELLITE IMAGE INTERPRETATION

Original pictures of satellite image analysis are called as scenes. The original scenes were obtained from INPE of Sao Paulo by the Study Team. The scenes obtained were listed in Table-2.1.

Table-2.1 Scenes Obtained from INPE

Item	BASE*	PONTO*	QUAD*	Data	Cloud Covering (%)	CODIGO DO PRODUTO*	BAND
1	215	67	A	20.11.94	0	64C3	3,4,5
2	215	67	A	11.03.89	0	64C3	3,4,5
3	215	67	B	11.03.89	0	64C3	3,4,5
4	215	67	B	20.11.94	1	64C3	3,4,5
5	215	67	C	17.11.87	0	64C3	3,4,5
6	215	67	C	27.10.97	10	64C3	3,4,5
7	215	67	D	08.03.88	10	64C3	3,4,5
8	215	67	D	27.10.97	20	64C3	3,4,5
9	215	68	A	03.07.84	40	64C3	3,4,5
10	215	68	A	09.12.95	30	64C3	3,4,5
11	215	68	B	03.07.84	70	64C3	3,4,5
12	215	68	B	09.12.95	10	64C3	3,4,5
13	214	67	C	09.12.86	10	64C3	3,4,5
14	214	67	C	11.06.90	20	64C3	3,4,5

Note: BASE*, PONTO*, QUAD*, CODIGO DO PRODUTO* are symbols used by INPE to show the location of satellite scenes.

2.1 Outline of Acquired Scenes

Outline of acquired scenes are as follows;

- The total number of scenes obtained was fourteen (14).
- All the scenes were digitized in 'TIFF' format and saved in CDs' (Compact disks).
- Bands of 'TIFF' files are 3,4,5.

Original scenes were saved in three types of mediums. The Study Team acquired the scenes saved in CDs because it makes analysis easier than other mediums.

2.2 Number of Scenes Necessary for Satellite Image Analysis.

Sergipe state is covered by 3 scenes of the Landsat, each of which is subdivided into 4 scenes. Then total number of the sub-divided scenes is 3 x 4 = 12, of which 5 scenes cover only Bahia State or the Atlantic Ocean. Finally 7 scenes were necessary to cover all the Study area. INPE has several different scenes for the same area which have different age of photographing each other. As the accuracy of the analysis is dominated by amount of clouds recorded in the scenes, those with the least clouds in the scenes must be selected. Hence, two scenes with different age of photographing were selected for each area from the scenes which have the least amount of clouds. The Study Team finally acquired 7 scenes x 2 age = 14 scenes.

CHAPTER 3 SURVEY AND ANALYSIS

3.1 Field Survey

Field survey was conducted in Master Plan Study in order to improve accuracy of land-use analysis. 200 sites were selected for the field survey from the area which caused some difficulty in the analysis, then observation teams were dispatched to investigate the actual land-use situation. By the comparison between the actual land-use and the satellite image, accuracy of the land-use interpretation was improved.

3.2 Analysis

Geology

Geological map was created by Satellite image interpretation comparing the satellite image with the existing geological map. In this interpretation, efforts was made to identify large geological structure which is not indicated in the existing geological maps.

Geomorphology

Geomorphological map was created by Satellite image interpretation comparing the satellite image with the existing geomorphological maps.

River system

River system map was created by Satellite image interpretation comparing the satellite image with the existing topographical maps with scale of 1:100,000.

Land-use

Land-use map was created by satellite image interpretation comparing the satellite image with the result of field land-use survey and the existing land-use map.

3.3 Result of Interpretation

(1) Interpreted Map

The results of the satellite image interpretation was shown in the maps below;

- Geomorphological map (1:100,000)
- Geological map (1:100,000)
- River system map (1:100,000)
- Land-use map (1:100,000)

The interpreted maps were utilized by the Study Team for Master Plan Study as fundamental data showing natural condition of Sergipe state related to water resources development. Sergipe side also evaluated the interpreted maps and intends to make use of them for several purposes. Four (4) kinds of the interpreted maps as listed above were provided to Sergipe side with original data saved in CDs. The interpreted maps are shown with reduced scale in some related parts of this Final Reports.

(2) Area Calculation

In this Study, all the results of the satellite image interpretation were digitized for the more effective use. As example of this application, resultant area classified for each category by the interpretation was easily calculated. That is ; as all the boundary drawn by the interpretation were digitized, it made calculation of each area surrounded by the each boundary easier. For example, areas of sub-divided river basin were easily calculated and area for some specified land-use or areas for some specified geology were also easily calculated for single or multiple municipalities.

CHAPTER 4 DATA CONVERSION FOR GIS

Interpreted results were digitized for the use of GIS which can enable more effective use of the results. As SRH intends to introduce Geo-media system, a kind of GIS. In accordance with a request from SRH, the Study Team converted the results of satellite image interpretation into digitized data for Geo-media system. In addition, the Study Team also converted the results into DXF file for more extended use. The Sergipe side intends to enforce water resources development and management with the effective use of GIS, the Study Team provided fundamental data for that purpose.