

3 OPERATION MANUAL OF IDRISI32

1. IDRISI32

GeoConcept is the fundamental GIS software in IIMS. However it is not enough to support the data to handle the raster data including DEM data in IIMS. It is supposed that IIMS provides with the wide applicability to support data. There are several merits to use IDRISI32 software in Senegal as follows:

- 1 Easy to operate
- 2 Provision with the user friendly interface
- 3 Provision with Image processing module for raster data
- 4 Provision with Data exchange format
- 5 Provision with useful help and manuals
- 6 Reasonable cost and easy to maintain software

IDRISI32 can manage the various kinds of map projection in GIS, if the user sets up the georeference parameters. On the other hand, beside there are many merits and operation is very easy in the mentioned above before, there are some software bugs based on the difference of OS and the UNIT. However, the user can solve these issues by himself if the user reads the reference manual as detailed as possible. This manual includes the follows topic:

- 1 Basic operation of IDRISI32
- 2 Preprocessing of the raster data
- 3 Import and export
- 4 Raster/Vector data conversion
- 5 Modules to be related DEM
- 6 Modules of topographic data analysis

OVERVIEW of IDRISI32

IDRISI32 provides modules for the input, display and analysis of geographic data. These geographic data are described in the form of map layers -- elementary map components that describes a single theme. All analysis acts on map layers. However, for display, a series of map layers may be brought together into a map composition.

Because geographic data may be of different types, IDRISI incorporates two basic forms of map layers: raster image layers and vector layers.

Image layers describe a region of space by means of a fine matrix of cells. These cells each contain numeric values that express the nature of the land at that location. Image layers are excellent for describing spatially continuous data such as elevation, temperature and rainfall data.

Vector layers are useful for describing distinct features in the landscape. These include features such as roads, property boundaries, administrative districts, and the like. To do so, vector layers store a set of points (each referenced by a pair of locational coordinates) that describe either the locations of the features (if they are points), or their course or boundary by means of a sequence of points that should be joined by straight lines.

Although IDRISI is adept at the input and display of both image and vector layers, analysis is primarily oriented towards the use of image layers. As a result, it is commonly described as a raster system (i.e., one that describes space by means of raster images). However, IDRISI offers a set of very rapid vector-to-raster conversion routines that allow vector layers to be incorporated into analyses with ease. In addition, it incorporates a database management system that is directly linked to vector data. Thus it offers a strong solution for geographic analyses that require both types of map layers.

2 Operation of IDRISI32

2.1 File/Data Paths

The Project Environment dialog allows the user to specify a set of data paths to be used for a particular project. The Working Folder is listed first in the pick list, is searched first for a filename that has been typed in, and is the default output folder. (See Fig.2.1)

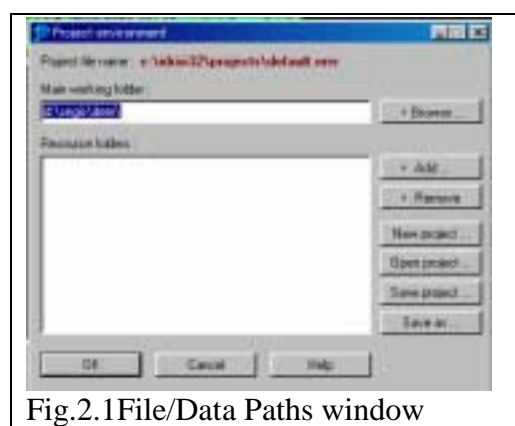


Fig.2.1 File/Data Paths window

2.2 IDRISI File Explorer

The IDRISI File Explorer provides an environment for managing and viewing IDRISI files (see Fig.2.2). Use this utility to:

- rename, copy, delete or move selected files
- list all files of a particular type or with a particular name in a directory
- display a selected raster or vector layer (using default Display Launcher settings)
- open the documentation file in Metadata for a selected raster, vector or values file
- view the binary byte-by-byte contents of any selected file
- view the structure for a selected image or binary vector file

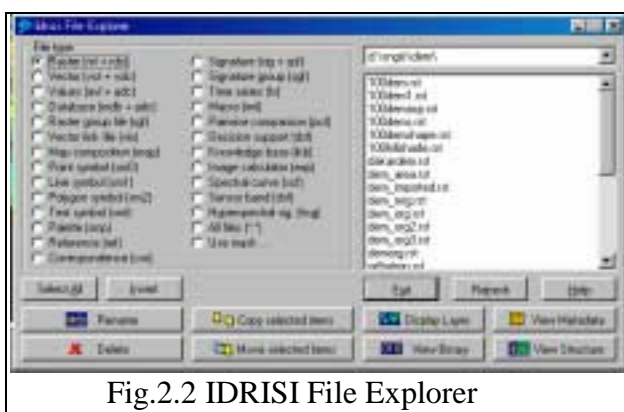


Fig.2.2 IDRISI File Explorer

2.3 MetaData

METADATA is used to create, view and edit documentation files accompanying IDRISI raster, vector and attribute values files (see Fig.2.3). It is also used to create, view and edit Reference System Parameter Files. The folders of user's current project environment will be displayed with the Working Folder at the top and opened and all resource folders beneath.

- Operation: Raster Files:
- Operation: Vector Files ;
- Operation: Attribute Values Files
- Operation: Reference Files

Refer help on the contents of a particular field, see FILE STRUCTURES.

This module supports the data management of parameters, legends and notes at the header information of raster data, vector data, attribution data and Georeference data.

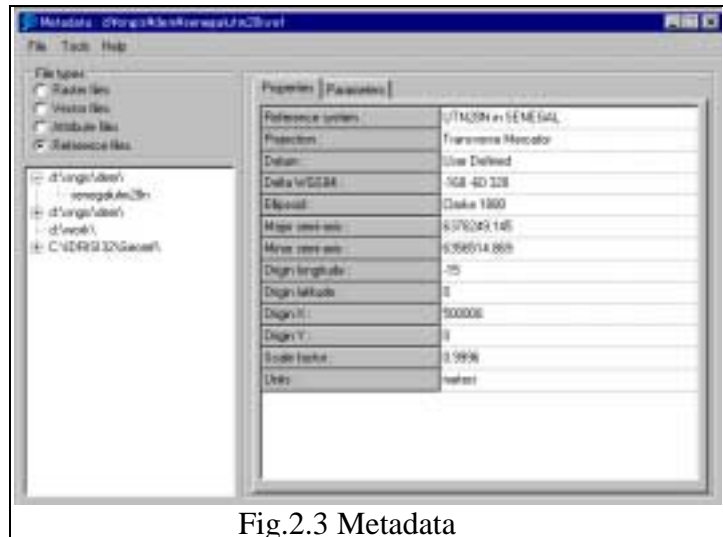


Fig.2.3 Metadata

2.4 Run Macro

Allows user to run an IDRISI command macro. Refer the menu of macro in the help of each module. Macro command helps batch processing of GIS. Specific instructions on the syntax for using each module in a macro can be found within the Help System of each module that supports command line processing. The macro file .IML extension, typically, will be done with the EDIT module data (see Fig.2.4.1). To run the macro, select the Run Macro option in the File menu data (see Fig.2.4.2).

```

REM Import MIF file to IDRISI32
mifidris x
1*5*GStudyArea*IStudyArea*DakarUtm-28n*m*1.0

REM Initialize of Study area
initial x GStudyArea*1*1*-9*1*DakarDEM*m*Study
Area in Dakar GIS project

REM Vector raster conversion
polyras x IStudyArea*IDakar_Area

REM delete all tmp file
delete x tmp*.*

REM Overlay in out of area
overlay x 7*outofarea*DakarDEM*tmp1
    
```

Fig. 2.4.1 Example of Macro file in EDIT module

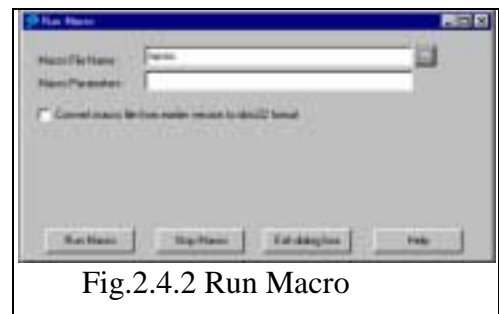


Fig.2.4.2 Run Macro

2.5 User Preference

The User Preferences dialog allows the user to set several options for the working environment.

Operation: There are three tabs: System Settings, Display Settings, and Language in User Preferences (see Fig 2.5). On the System Settings tab, the following options are provided:

- Automatically display the output of analytical modules.
- Enable overwrite protection.
- Specify the location of CartaLinx for the execution from the Data Entry menu.
- Specify the auto-generated output filename prefix. The default prefix is TMP.
- The Reset the output filename counter button is used to set the sequence back to 000.

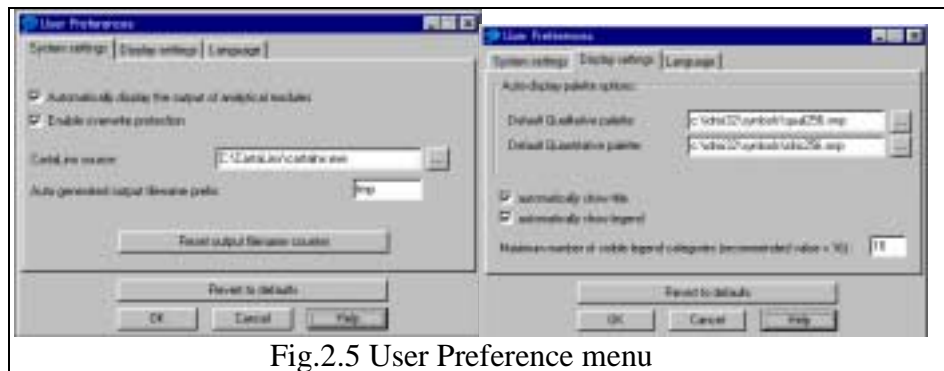


Fig.2.5 User Preference menu

On the Display Settings tab, the following options are provided:

- Specify the default qualitative palette - These palettes will be used with the automatic display of module results.
- Automatically show title. - A title will be displayed in any automatic display. In addition, whenever Display Launcher is opened, the Title option, legend option and other options will be enabled automatically.

Set the maximum number of visible legend categories. - A legend may have many more categories than can be displayed on the screen.

2.6 IMPORT

Import module mainly treat a various kinds of useful data format in IIMS shown in Table 2.6. The detail operation is mentioned in help of each module and the introduction of file structure in help.

See example of data import in Fig.2.6.

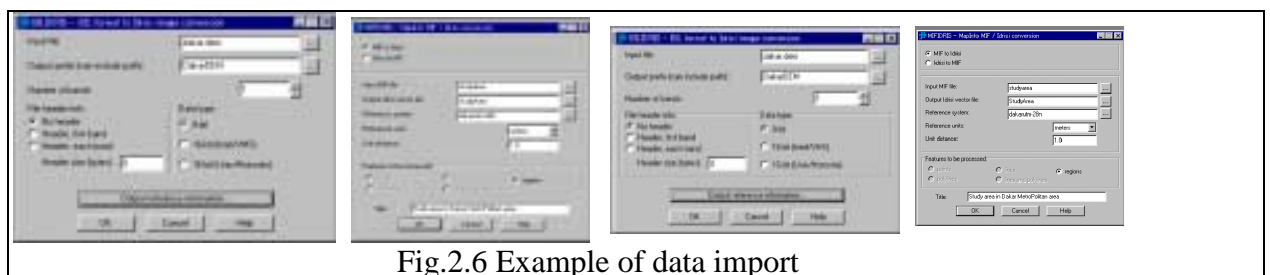


Fig.2.6 Example of data import

Table 2.6 Available data format Import

Available data format of data import in IIMS	GeoConcept	Catalinx	ArcInfo
General Conversion Tools: BIL BIP.	Ok Ok	Ok Ok	Ok Ok
Government/Agency Data Formats; CTG: USGS standard (UTM) character format Composite Theme Grid data. USGS Digital Elevation Model (DEM) files. DLG: USGS Optional Format DLG (Digital Line Graph) data. SDTS: Digital Elevation Model data in Spatial Data Transfer Standard.		Ok	Ok Ok Ok
Desktop Publishing Formats: BMP DXF TIFF	Ok Ok Ok	Ok Ok Ok	Ok Ok Ok
Software-Specific Formats; ARCINFO Ungererate File ATLAS*GIS BNA formats. ERDAS (Ver. 7.3 or 7.4) GRASS Version 4.0 formats Spot Image's SPOT View 1.5 and 4.0 format MIF: MapInfo Inter exchange Format and accompanying MID file SHAPE ArcView Shapefiles X, Y and Z ASCII format	Ok Ok	Ok Ok Ok Ok	Ok Ok Ok Ok

2.7 EXPORT

Export module also mainly treat a various kinds of useful data format in IIMS shown in Table 2.7. The detail operation is mentioned in help of each module and the introduction of file structure in help. These format are available for import to IDRISI32. See example of data import in Fig.2.7.



Fig.2.7 Example of data export

Table 2.7 Available data format Export

Available data format of data import in II	GeoConcept	Catalinx	ArcInfo
General Conversion Tools: BIL(IDRISI Image file is BIL format without header)	Ok	Ok	Ok
Desktop Publishing Formats; BMP DXF TIFF	Ok Ok Ok	Ok Ok Ok	Ok Ok Ok
Software-Specific Formats; ARCINFO Ungererate File ATLAS*GIS BNA formats. ERDAS (Ver. 7.3 or 7.4) GRASS Version 4.0 formats MIF: MapInfo Inter exchange Format and accompanying MID SHAPE ArcView files X, Y and Z ASCII format	Ok Ok Ok	Ok Ok Ok Ok	Ok Ok Ok Ok

3. Display Module

3.1 DISPLAY LAUNCHER

(1) DISPLAY LAUNCHER is the module to open a new display window either a raster layer or a vector layer. It begins the map composition process and is always the first operation required to create a new map display. As soon as a map layer is displayed, several buttons on the tool bar become functional.(see Fig.3.1.1)

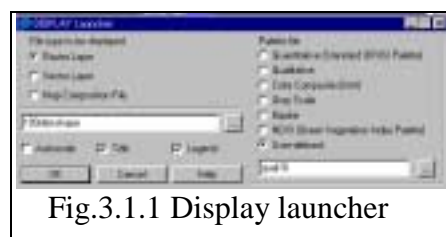


Fig.3.1.1 Display launcher

Displaying Maps and Map Layers:

DISPLAY is the name given to a collection of modules that act together to facilitate the production of map compositions, for display either on the screen or on some form of hard copy output (e.g., paper).

Maps are composed of layers -- elementary themes in geographic data. By combining map layers and giving them graphic renditions. Map compositions may contain one layer or many layers. Map compositions are created as a natural consequence of working with the IDRISI display system.

The composition is then stored in a file with a ".map" extension by Save Composition in Composer.

Attribute data is embedded in raster layers, and may be encoded in vector layers. In addition, vector layers may be encoded with feature identifiers that link each feature to a set of attributes in a database. These attributes can be displayed through the use of a vector link file (.vtx), which is created with the Collection Editor.

(2) COMPOSER

As soon as the first display window has been opened, the COMPOSER window will appear on the screen. COMPOSER will stay present on the screen as long as at least one map display window is open(see Fig.3.1.2). COMPOSER allows user to:

- add or remove layers from the composition
- change the order in which layers are drawn (called the priority of a layer)
- change the symbol or palette file associated with a layer
- temporarily toggle a layer to be invisible (i.e., hide it) without removing it
- gain access to the MAP PROPERTIES editing environment
- save the current composition (as displayed) as a MAP file
- zoom and pan
- view layer properties
- print the composition

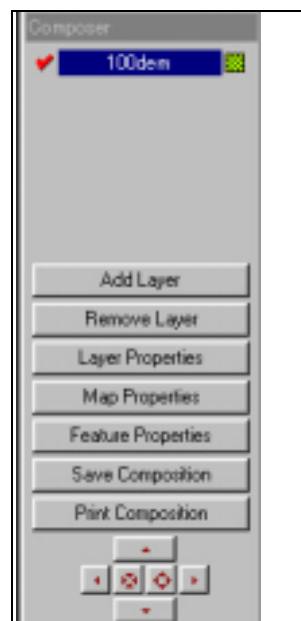


Fig.3.1.2
COMPOSER

(3) Layer Properties

The Layer Properties button on Composer provides information about the highlighted layer in the Composer layer list. To see the properties of another layer, first close the Layer Properties box, then highlight the desired layer in Composer and choose Layer Properties again(see Fig.3.1.3).

The properties that are listed in the Layer Properties dialog include: Layer Name, Layer Type, Data Type, Ref System, Ref Units, Min X, Max X, Min Y, Max Y, Min Value, Max Value, Rows and Columns (for raster layers) and Database and Table (for vector layers).

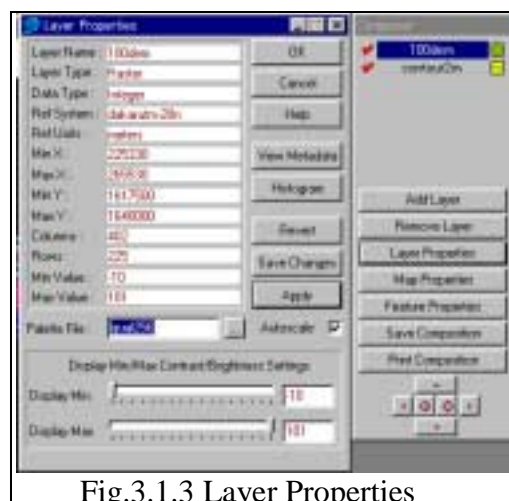


Fig.3.1.3 Layer Properties

- 1 Symbol or palette file:
The symbol or palette file used in the display is shown. To change this, type in or select a different symbol or palette file from the pick list and click Apply to activate the change.
- 2 Autoscaling may be toggled on or off by clicking the Autoscale check box. Display min/max contrast/brightness settings may be interactively changed by moving the sliders taking into consideration with display saturation points. These are initially set at the Display min and Display Max values.
- 3 The View MetaData button opens the layer documentation file in the METADATA module.
- 4 The Histogram button launches the HISTO module to produce a histogram of the selected raster image.
- 5 The original display may be restored with the Revert button.

(4) MAP WINDOW

The MAP WINDOW manages the properties of display window. It can be likened to the concept of a graphic "page" whose color can be changed by means of the background tab on the Map Properties dialog. Right click is available on map window (see Fig.3.1.4)

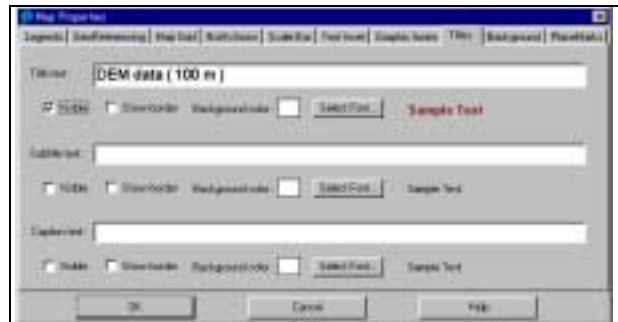


Fig.3.1.4 MAP WINDOW

A single Map Window contains one Layer Frame (which holds the geographic data layers) and any number of other

Map Components, such as a scale bar, titles, graphic insets and so on. The visibility and characteristics of all these map components may be altered through Map Properties. The layer frame and all other map components may be moved by double clicking on them, then dragging them to the desired location. The example of MAPWINDOW is shown in Fig.3.1.5.

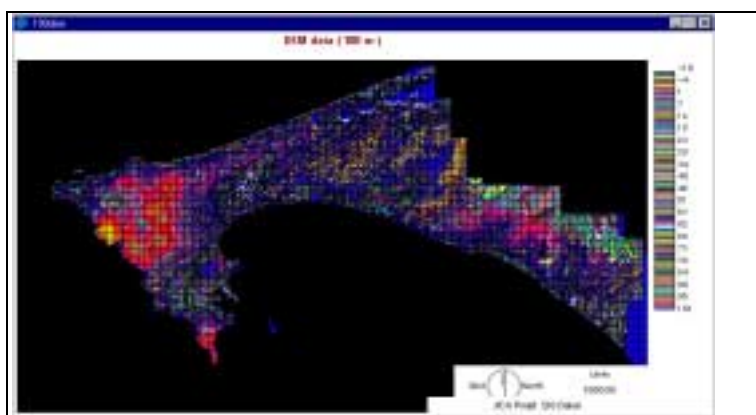


Fig.3.1.5 The example of MAPWINDOW

Layer Frame The layer frame is the "box" in which all map layers are placed. If the layer frame is resized and the resulting frame is smaller than the underlying map area, scroll bars will appear.

Legend Whenever there are more legend categories than the number that should be visible, a vertical scrollbar will be attached to the legend. Legend captions may be entered or edited in the legend tab of the METADATA module.

Title The title can be moved by holding down the left button on the mouse.

Scale Bar The scale bar can be both moved and sized.

North Arrow The north arrow can also be both moved and sized.

Grid A grid can be placed on the layer frame by specifying the interval and starting values in the Map Properties option in Map Properties.

Text Inset The text inset is moveable and sizeable and incorporates automatic wordwrap.

Graphic Insets The insets can be used to hold an inset map or picture in the form of a Windows Bitmap or Metafile.

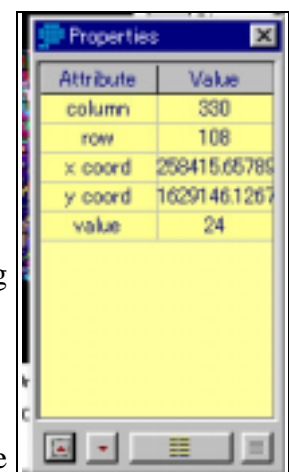


Fig.3.1.6 Properties

(4) Properties shows the attribute and value of raster layers and vector layers by click of mouse on MAP WINDOW (see Fig.3.1.7).

(5) Save Composition

At any point in your use of the COMPOSER system, it is possible to save user's composition in several ways. The following option are availavle: MAP file; COMPOSER will create a complete record of the composition in a file with a ".map" extension.

Windows bitmap (.bmp) file.

Windows metafile.

Windows enhanced metafile.

Screen dump the map window to the clipboard.

Save the current view of the highlighted raster layer as a new IDRISI image.

(6) Print Composition

Print map Window (see Fig.3.1.8).



Fig.3.1.7 Save Composition

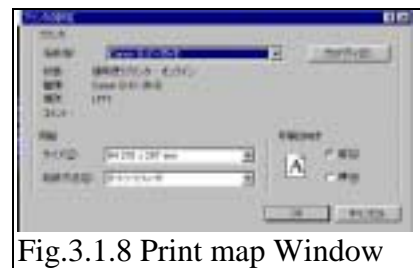


Fig.3.1.8 Print map Window

3.2 SYMBOL WORKSHOP

SYMBOL WORKSHOP is used for the creation and editing of IDRISI symbol and palette files. These files record the graphic renditions for up to 256 symbols (see Fig.3.2). There are five different types of symbol files supported by IDRISI: point, line, polygon, text and palette symbol files. Internally these are identified by files with ".sm0", ".sm1", ".sm2", ".smt" and ".smp", extensions respectively. See the detail in help of this module.

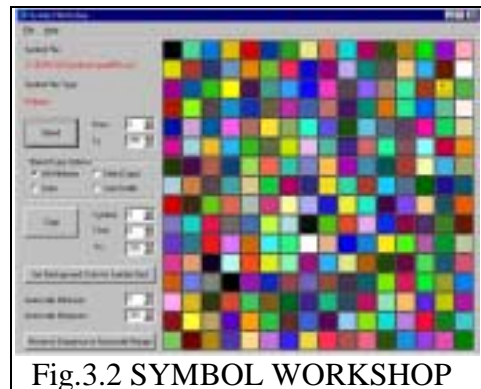


Fig.3.2 SYMBOL WORKSHOP

3.3 HISTO

HISTO produces a frequency histogram of cell values in an IDRISI image. HISTO creates histograms by dividing the data range into classes of a user-specified width. The frequency within each class is tabulated. Both graphic and numeric output options are available. HISTO also outputs basic statistics about the file (see Fig.3.3).

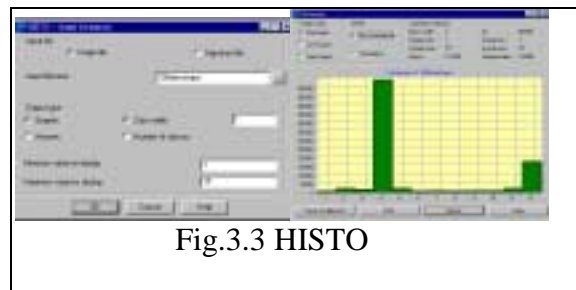


Fig.3.3 HISTO

4 CONVERT

4.1 CONVERT

CONVERT files between all possible combinations of IDRISI32 data and file types supported for image and vector files (see Fig.4.1).



FIG.4.1 Convert

4.2 PROJECT

PROJECT transforms raster images and vector files from one grid referencing system to another. In doing so, it undertakes projection transformations using ellipsoidal formulas and datum transformations. Understand the configuration of Georeference by the help and manuals.

PROJECT may also be used to change the resolution of an image by a non-integer multiple

PROJECT makes use of Reference System Parameter Files (REF) as a means of specifying the complete characteristics (projection, datum, origin, units, etc.) of both the input and output reference systems.

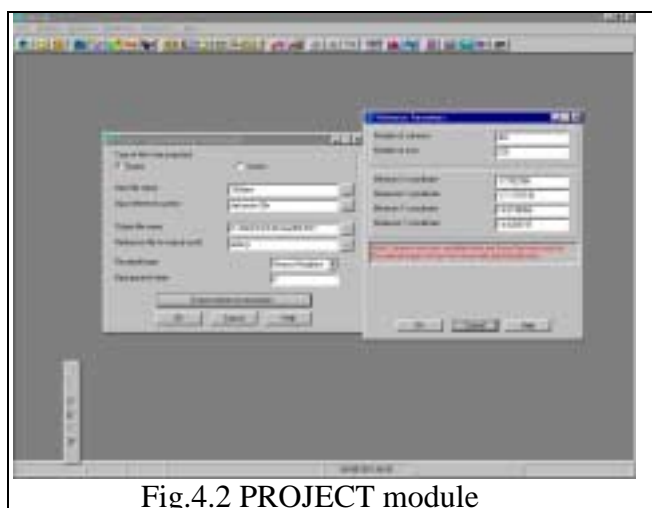


Fig.4.2 PROJECT module

See Reference System Parameter File Structure for more information on the parameters of the .ref file.

PROJECT Operation is as follows shown in Fig.4.2 as follows:

- PROJECT first requires that user specify whether the type of file to be transformed is raster or vector.
- Enter the name of the input file with the name of the reference system in the Input Reference System input box.
- It is required to enter a new name for the transformed output file and the name of the REF file that defines the grid referencing system for this new output file.
- Specify the type of resampling to be used: nearest neighbor or bilinear. See the detail in help.
- Specify the value to use for background areas.
- For vector data, press OK to process.
- For raster data, enter the numbers of columns and rows that should span the region which will contain the entire output image after the transformation.
- Specify minimum and maximum X and Y coordinate values of the region to be output, using the new (output) coordinate system.

4.3 RESAMPLE

RESAMPLE registers the data in one grid system to a different grid system covering the same area (see Fig.4.3). The actual process is one in which a new grid is constructed and a set of polynomial equations is developed to describe the spatial mapping of data from the old grid into the new one. The new grid is then filled with data values by resampling the old grid and estimating, if necessary, the new value.

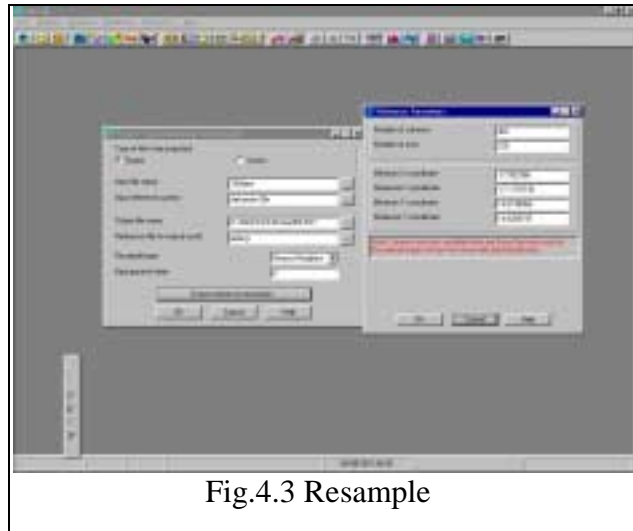


Fig.4.3 Resample

Resampling options include a nearest neighbor option in which the new grid value is the same as that in the nearest cell in the old grid, and a bilinear interpolation option in which the new value is a distance weighted average of the four nearest neighbors in the old grid. RESAMPLE is used for a variety of operations, including:

- registering remotely sensed imagery to a grid referencing system;
- registering maps with different reference systems over small areas (larger areas require a projection change) when one or both reference systems are not supported by PROJECT;
- undertaking minor changes in projection when one or both reference systems are not supported by PROJECT;
- making non-integer changes in the resolution of an image.

RESAMPLE requires the Correspondence file for a well distributed set of points about their position in the old grid system and the position they should take in the new one as follows:

N					; Number of GCP
1305.0	1974.3	427362.06	713704.19		; A set of point between old and new.
1284.7	1997.0	427309.78	713745.81		
xxxx.x	yyyy.y	XXXX.X	YYYY.YY		

In use, RESAMPLE first requires that user input the type of file, image or vector, to be resampled (or transformed) and its name, and must enter the name of the input file, the output file and the name of the correspondence file.

Enter the mapping function, the order of polynomial fit desired; linear (first order), quadratic (second order), or cubic (third order). See the detail in the help and accumulate experiences. In general, user should use the lowest order of polynomial that provides a reasonable solution. Linear requires a minimum of 3, quadratic requires 6 and cubic requires 10. In practice however, you should have at least twice the minimum required for a reasonable fit!

In the case of image resampling, It is required to select the type of resampling method of interpolation whether nearest neighbor or bilinear. See the detail in the help.

Choose the Output reference parameters button and enter the reference system, the reference units for the output file, as well as the unit distance. The default is set to 1.

Input the minimum and the maximum of X and Y coordinates of the final output image or map.

User will also need to input the number of columns and rows that will span that region to set any resolution.

Check RMS error by selection or omitting of GCP point in correspondence file to reduce the residuals. If user can not a good result, one must select more precise point carefully and process the resample command again.

TOPIC about geometric correction

When user treats the scanning data, it is necessary for this data to provide the georeference data.

Resample command same as this command in charlatan needs the correspondence file to have the georeference data.

It is necessary for user to process the geometric correction by using GCP point to rectify data.

GCP point is the correspondence point between the scanning data and map. The user always considers the precise GCP point for data entry of digitizing.

The data structure of the correspondence file in IDRISI32 and CartaLinx is as follows:

```
No ; Number of GCP
x y X Y ; x is the coordinate on the Original data, y is the
coordinate on the Original data, X is the coordinate of
MAP, Y is the coordinate of MAP.
```

For example
4
203 3013 232000 1641000
3206 3003 237000 1641000
195 23 232000 1636000
3251 19 237000 1636000

This data can be edited by the editor.

Projection command processes the GIS data automatically according to the georeference file of the input file. The user should define the map projection in the GIS data.

The execution of Project command is as follows:

- 1) Select the input file name.
Projection parameter is set automatically by the selection of input file.
- 2) Select the correspondence file.
- 3) Enter the output file name.

4.4 WINDOW

WINDOW extracts a sub-image from an original image to a new image, or sub-image windows from a whole set of images. It may be used to isolate a study area, or to break large images into smaller parts for processing (see Fig.4.4).



Fig.4.4 Window command

4.5 CONCAT

CONCAT allows the pasting together of images to form a larger one. It may also be used to cover a portion of an image with a new image. All images to be concatenated should have the same spatial resolution (see Fig.4.5).

CONCAT provides with the choice of a placement type: manual placement by rows and columns or automatic placement using the file reference coordinates. With the latter option, the images are joined based on their geographic locations, as indicated in their documentation files.



Fig.4.5 Concat

-1 Manual placement by rows and columns:

Specify the concatenation type. Select input files and off set address of column and rows to paste the images against the reference image with the option

-2 Automatic placement using reference coordinates:

The first image listed in the file list will be on the top of the second image and so forth. Choose between having zeros in the top image opaquely cover the underlying image or transparently cover the underlying image.

4.6 RASTER/VECTOR CONVERSION

4.6.1 PPOINTRAS

PPOINTRAS converts point vector data to a raster representation. In this conversion process, an existing image file is updated with the vector data (see Fig.4.6.1). Values in the output raster image are determined according to one of four options: record the identifier of each point; record the frequency of points in each pixel; record presence of one or more points in each pixel; or record the sum of the identifiers of the points in each pixel.



Fig.4.6.1 Pointras

Only the portion of the vector file that overlaps the raster image is processed.

4.6.2 LINERAS

LINERAS converts vector lines to their raster equivalents. In this conversion process, an image file is updated with vector line attribute values in overlapping areas of the image and vector files (see Fig.4.6.2).

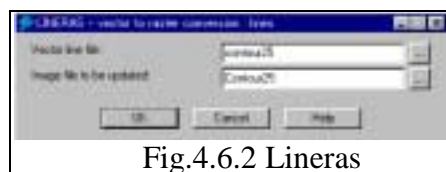


Fig.4.6.2 Lineras

4.6.3 POLYRAS

POLYRAS converts vector polygons to a raster representation. In this conversion process, an image file is updated with vector polygon attribute values in overlapping areas of the image and vector files (see Fig.4.6.3).

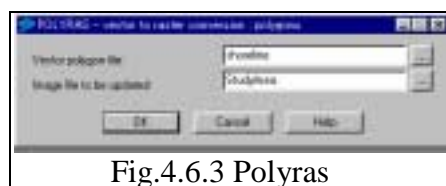


Fig.4.6.3 Polyras

4.6.4 POINTVEC

POINTVEC converts raster points into a vector point file. All non-zero cells are considered points and will become vector points with identifiers equal to the data value in the cell (see Fig.4.6.4).

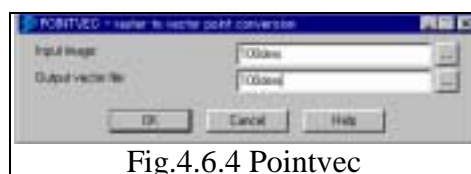


Fig.4.6.4 Pointvec

4.6.5 POLYVEC

POLYVEC vectorizes IDRISI polygon images. Options exist to produce vector polygon files, vector arc files and vector point files of polygon locators from a raster polygon image. (see Fig.4.6.5)



Fig.4.6.5 Polyvec

5 DATA ENTRY

5.1 DATAEDIT

EDIT provides an ASCII text editor for creating and editing text files (see Fig.5.1).

User can begin entering data into the EDIT window or text files can be retrieved from the File/Open menu for editing. Once edited, files can be saved

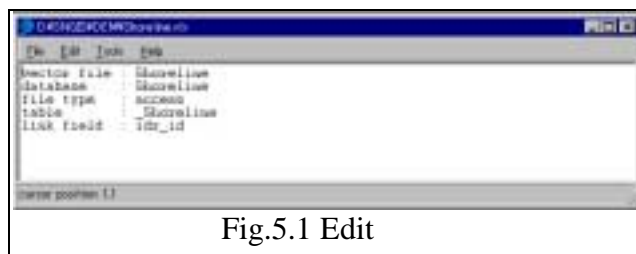


Fig.5.1 Edit

with any extension. EDIT is useful for creating and editing all IDRISI text file formats, including macro files (.iml), values files (.avl), decision support files (.dsf), pairwise comparison files (.pcf), correspondence files (.cor), reference system parameter files (.ref), spectral curve files (.scf), sensor band files (.sbf). Although EDIT can be used to create

and edit collection files, Collection Editor should be used for raster group files (.rgf), signature group files (.sgf), vector group files (.vlx), and time series files (.ts).

5.2 ASSIGN

ASSIGN creates new images or vector files by linking the geography of features defined in the input file with attributes defined in an attribute values file (see Fig.5.2).

ASSIGN requires to indicate whether raster or vector data.

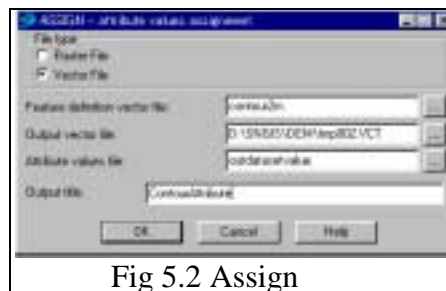


Fig 5.2 Assign

Enter the name of the input image or vector file which defines the geographic features. Specify the name of the output image or vector file and the name of the attribute values file.

An attribute values file consists of two columns of numbers, separated by one or more spaces.

The left column specifies the input values, and the right column specifies the data values to be assigned.

5.3 INITIAL

INITIAL creates a new raster image with the same user-defined value in each cell.

INITIAL requires to specify the spatial parameters of the image to be created (see Fig.5.3). There is a choice either to use copy spatial parameters from an existing image or to define spatial parameters individually. Then enter the name of the output image.



Fig.5.3 Initial

Choose the Output reference information button to enter the number of columns and rows of the output image, and the minimum and maximum coordinates in the X and Y dimensions. Specify the reference system you want to use and the unit distance. Click OK to return to the main dialog box. Finally, choose the Output documentation button to enter a title and value units.

5.4 UTMREF

UTMREF creates Reference System Parameter (REF) files specifically for instances of the UTM (Universal Transverse Mercator) grid referencing system(see Fig.5.4). These files will have an extension of ".ref". It

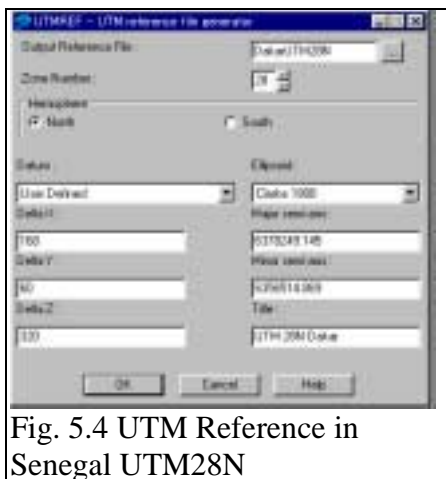


Fig. 5.4 UTM Reference in Senegal UTM28N

is only necessary to know the UTM zone and datum used by the reference system. The ellipsoid and DX, DY, & DZ values can be obtained from the datum table in Appendix 2 in IDRISI MANUAL.

Set up of the georeference file in IDRISI32 and Cartalinx.

Here is mentioned about the topic of UTM projection of the JICA study in Dakar Senegal. UTM parameters in the study area refers these in GeoConcept as follows :

Elipsoid ; Clark1880
 Dx ; -168
 Dy ; -60
 Dz ; 320

When to set up UTM in SENEGAL, use MetaData or Edit command.

Note: After entried Georeference parameter and the error happened, it needs to edit this file.

The point is two:

Adjut the column position compared with other UTM file.

Check the space among Delta X , Delta Y and Delta Z.

5.5 DATABASEWORKSHOP

DATABASE WORKSHOP provides IDRISI with an integrated relational database management system (see Fig.5.5). While it is not meant to replace an independent database management product, it does provide an extensive set of capabilities including the ability to:

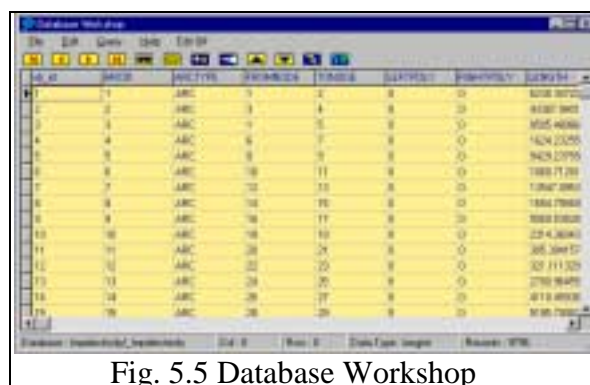


Fig. 5.5 Database Workshop

- read database files in ACCESS, and xBASE formats
- create database files in Microsoft ACCESS format
- add or delete fields
- filter the database using Structured Query Language (SQL)
- calculate expressions based on Structured Query Language (SQL)
- find specific records
- link the database to the map display
- create Boolean and autoscaled continuous display output
- export field values to attribute values files for use with ASSIGN
- import attribute values files created with modules such as EXTRACT

DATABASE WORKSHOP provides the ability to create, edit and analyze database files. From the perspective of IDRISI, database files are simply another form of values files, and thus carry a documentation file just like any other values file. If it doesn't already exist, a documentation file is automatically created when a database table is opened in DATABASE WORKSHOP.

Refer to the reference manual of IDRISI Database Workshop, Vector Collections and SQL against the use of DATABASE WORKSHOP for query and display.

Note that DATABASE WORKSHOP is always in a saved mode. Any changes user makes to the database are automatically saved.

6 DEM data processing

6.1 DEM data

DEM so called Digital Elevation Model is the surface model consisted by the elevation value at the corner point of grid cell on the map. DEM is also called grid cell data can calculate slope and aspect in each grid on the surface.

The study team produced DEM data based on 10 meter grid cell in the whole study area of the project. To select the suitable site for residential area in the urban area of Dakar region, DEM data of 100 meter resolution was produced by the resampling method and topographic analysis was done by this DEM data in IIMS.

Data analysis was done by IDRISI32 software and the project produced following thematic maps from DEM data analysis :

- Elevation map;
- Slope map;
- Aspect map;
- Contour map delineated automatically by contour module;
- Toposhape (Land form classification map);
- Stream map;
- Watershed map;

Refer the appendix about the algorithm of calculation of slope.

Data specification of DEM :

DEM data in IIMS is managed by the Band Interval Line format so called BIL format that constitute 2 byte short integer without the header information. The data structure of BIL format is shown in Fig.6.1.1 and Elevation map also is shown in Fig.6.1.2. The resolution of the original DEM data is based on the grid of 10 meter. The detailed data specification is shown in Table 6.1.

Table 6.1 Data specification of DEM

Data item	Specification
Data type:	16 BIT Short Integer Intel Type
File Type:	Binary
No of Columns:	4027
No of Rows:	2250
Reference system:	UTM ZONE- 28N,Clark1880
Reference unit :	10 m
Minimum X :	225330
Maximum X:	265600
Minimum Y:	1617500
Maximum Y:	1640000
Minimum Value:	-9
Maximum Value	105

Fig.6.1.1 The data structure of BIL format in DEM (N columns and M rows)

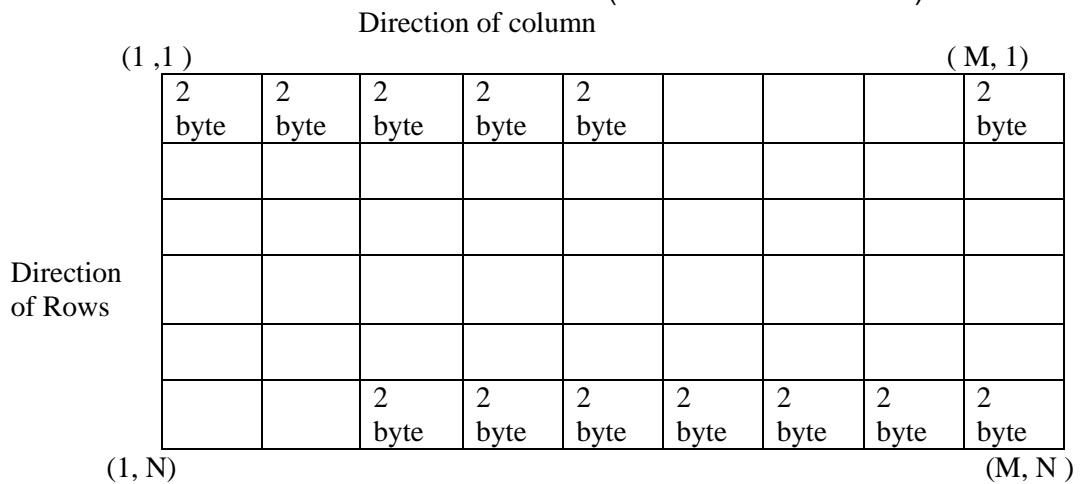
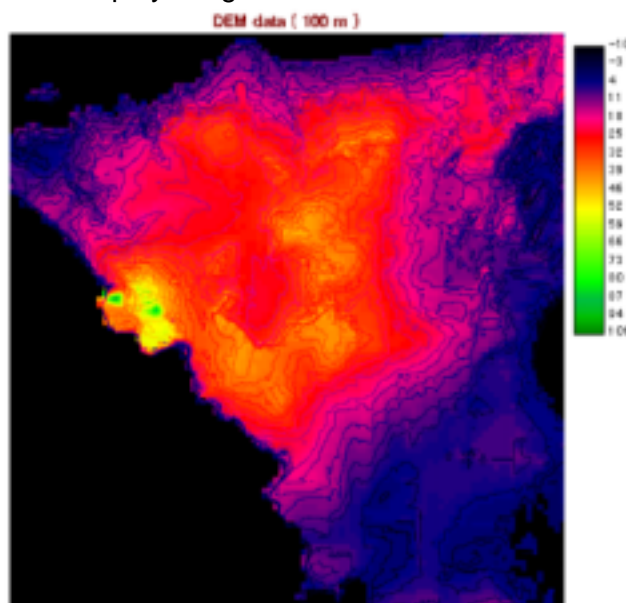


Fig.6.1.2 Example of display image of DEM



6.2 Operation method in IDRISI32

The following is the explanation of the series of the operation method about data import of DEM data, the production of contour map and so on.

6.2.1 Import of DEM

(1) Import of DEM data

Click the following module: “File->Import ->General Conversion Tool BILIDRIS” shown in Fig.6.2.1.

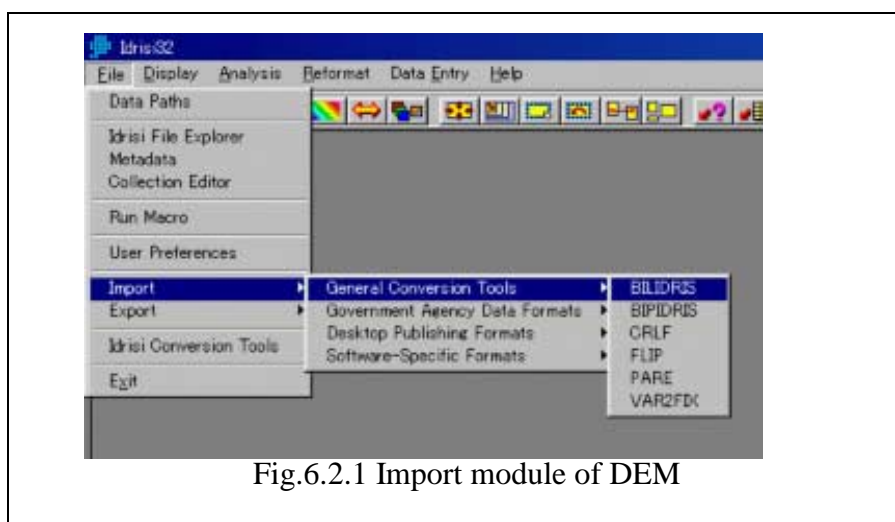


Fig.6.2.1 Import module of DEM

(2) Data entry of parameter(see Fig.6.2.2)

- Enter input file name
- Enter output file name
- Enter Number of Bands : Enter 1(one) band in this case.
- Select the option of ‘No header in the menu of File header info’
- Select the option of ‘16- bit Intel/VMS’ in Data Type.
If DEM is produced in UNIX workstation, select the option of 16-bit Unix/Motorola because of the different data position of byte address in 2 byte integer, which structure is reversed between the upper byte and the lower byte.
- Click the icon of Output Reference information and enter data parameter.
 - Enter the Number of columns
 - Enter the Number of rows
 - Enter the range of map coordinate of DEM
 - Enter the Minimum X coordinate
 - Enter the Maximum X coordinate
 - Enter the Minimum Y coordinate
 - Enter the Maximum Y coordinate
 - Select the Reference System: Plane is proposed.
 - Selection of the Reference Unit: Meters is proposed.
 - Click OK and start to import DEM.

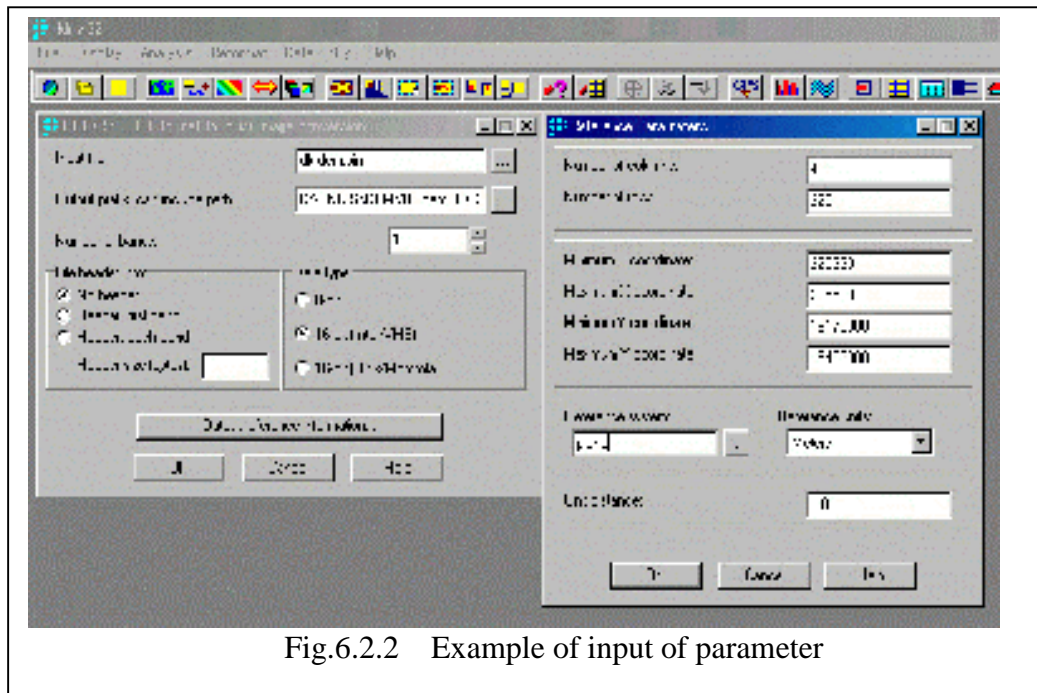


Fig.6.2.2 Example of input of parameter

(3) Rename of file name

BILIDRIS module add the 1 character at the end of file name automatically when to import, so select rename command and enter the new file name by the module of IDRISI file explorer shown in Fig.6.2.3.

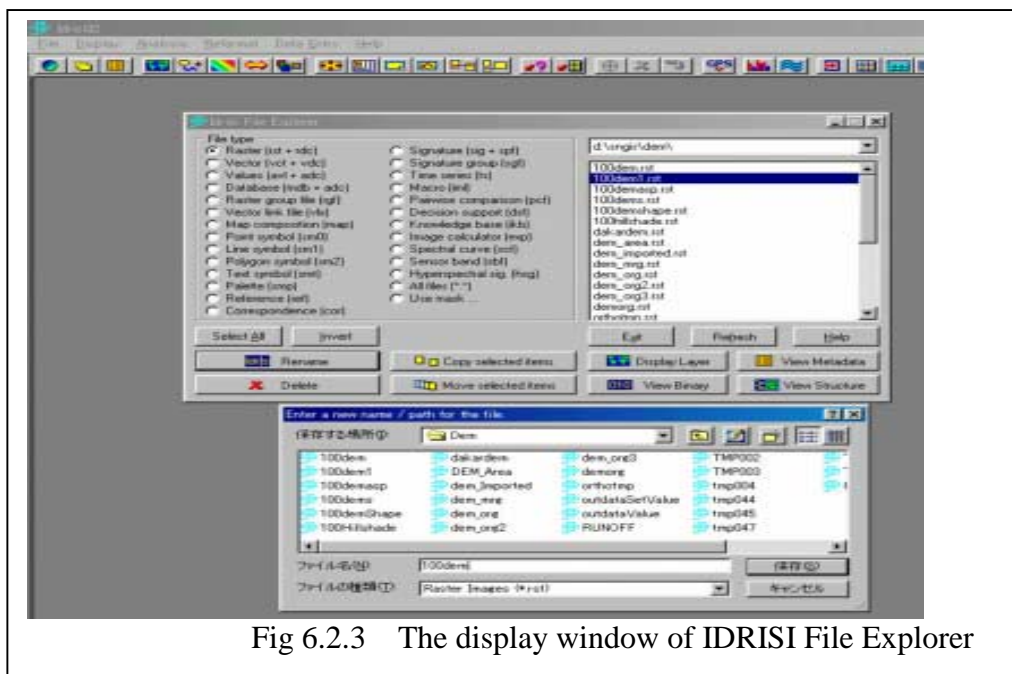


Fig 6.2.3 The display window of IDRISI File Explorer

6.3 Display of DEM by Display launcher

Use the display launcher module to display the raster image data of DEM and the vector data of contour data shown in Fig.6.3.1.

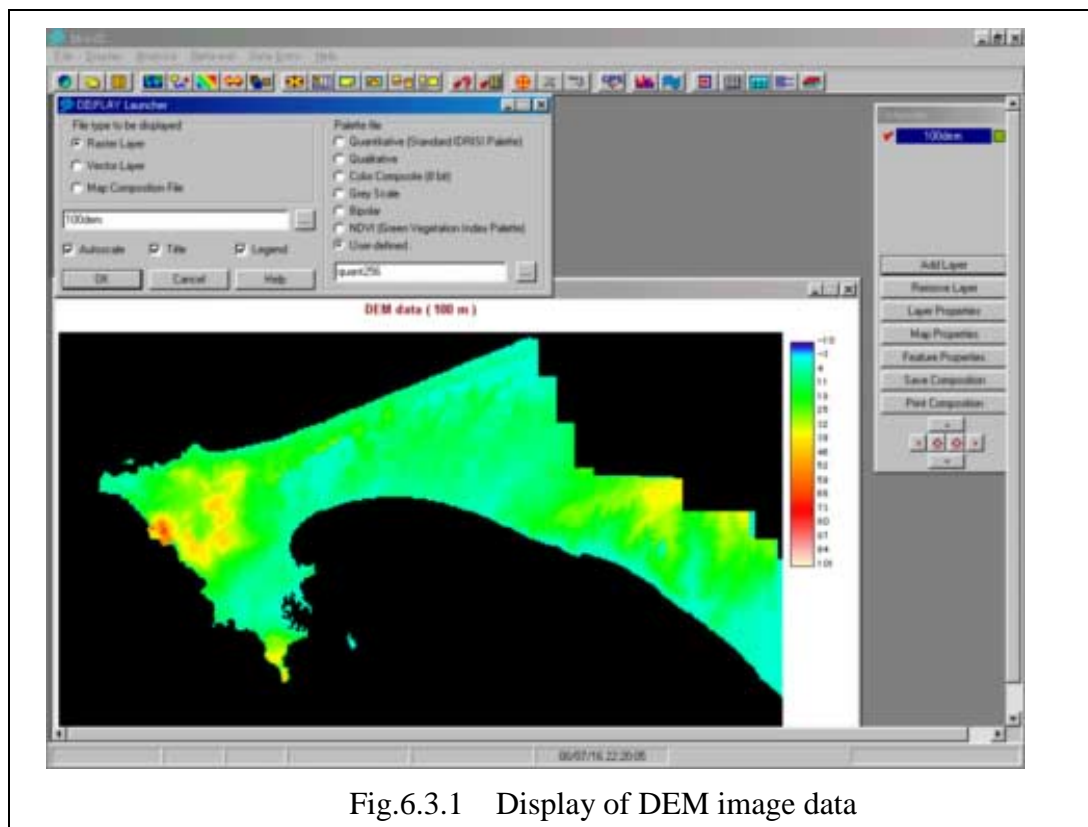


Fig.6.3.1 Display of DEM image data

6.4 Production of contour map

IDRISI32 provides the contour module from raster data of DEM automatically. The following is the procedure to produce contour.

(1) Selection of contour module

Click the contour module as following: “Analysis->Surface Analysis->Feature Extraction -> Contour”;

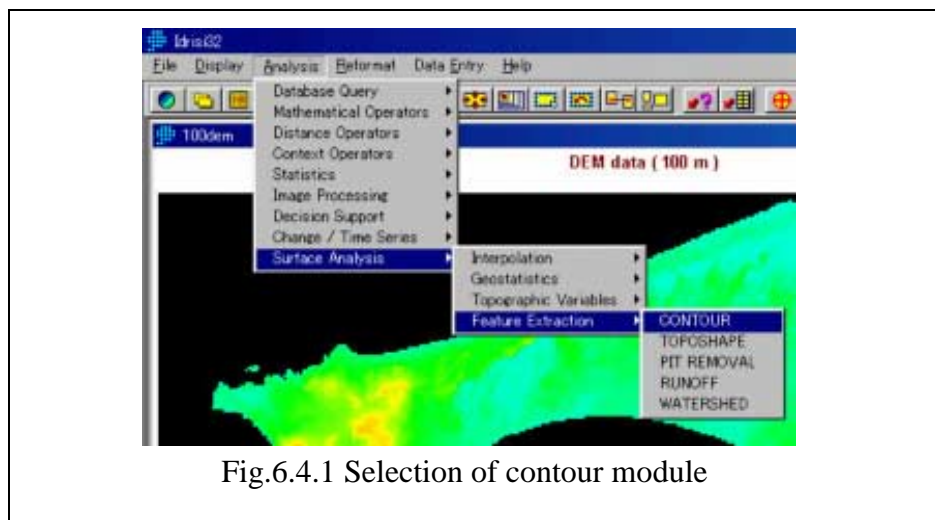


Fig.6.4.1 Selection of contour module

- (2) Data entry of parameter
- Enter Input DEM file name
 - Enter Output Vector file name
 - Enter the Minimum contour Value
 - Enter the Maximum contour value
 - Enter the Contour Interval
 - Enter the title
 - Click OK and execute

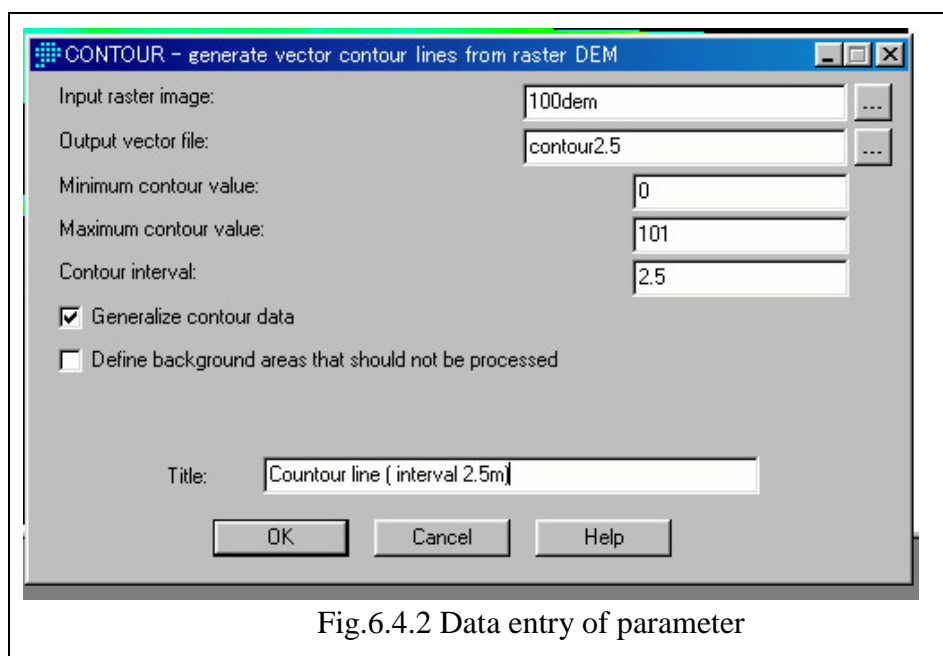


Fig.6.4.2 Data entry of parameter

(3) Display of contour

To display contour data on display, use the module of Display Launcher which module can display contour directly. Or display DEM of the raster with overlay of vector contour data by using the module of “add Layer” in Composer window shown in Fig.6.4.3.

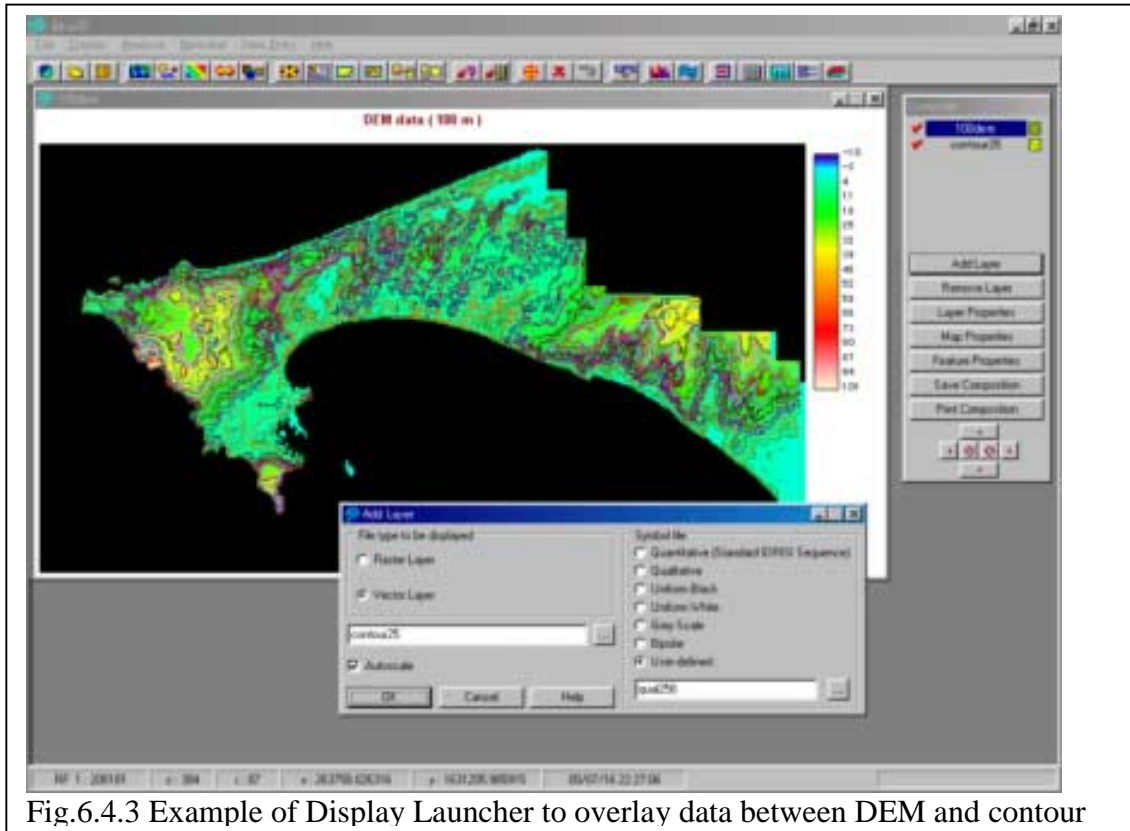


Fig.6.4.3 Example of Display Launcher to overlay data between DEM and contour

6.5 Slope and aspect

(1) Selection of Slope or Aspect module

Click the module as follows; “Analysis->Surface Analysis->Topographic Values ->Slope” shown in Fig.6.5.1.

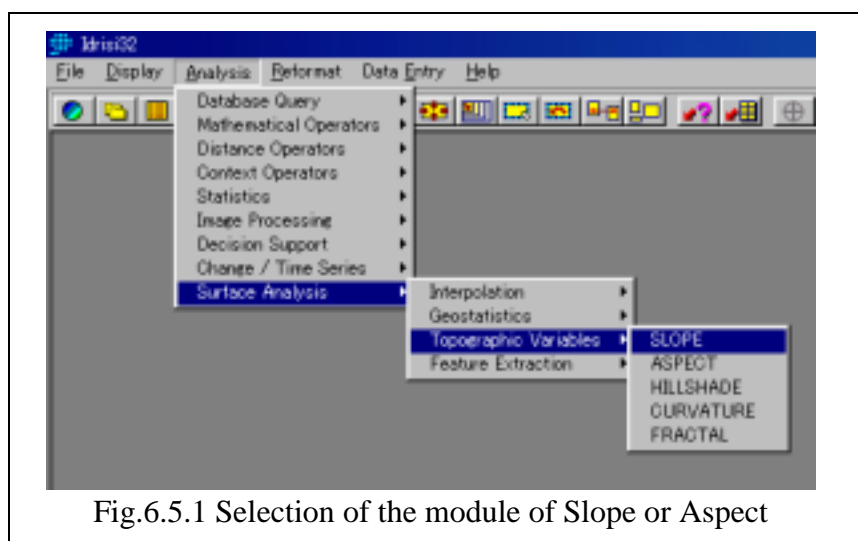


Fig.6.5.1 Selection of the module of Slope or Aspect

- (2) Data entry of parameter
- Selection of the module as follows; 'Slope', 'Aspect' and 'Slope and aspect';
 - Enter the Input DEM file name
 - Enter the Output file name
 - Enter the Slope Image file name
 - Enter the Aspect Image file name
 - Select the option of the calculation unit of slope whether degree or Percent
 - Enter the Conversion Factor
Enter the factor value against the elevation value of DEM. If DEM data is based on meter, enter one(1).
 - Enter the title
Enter the title of slope map or aspect map.

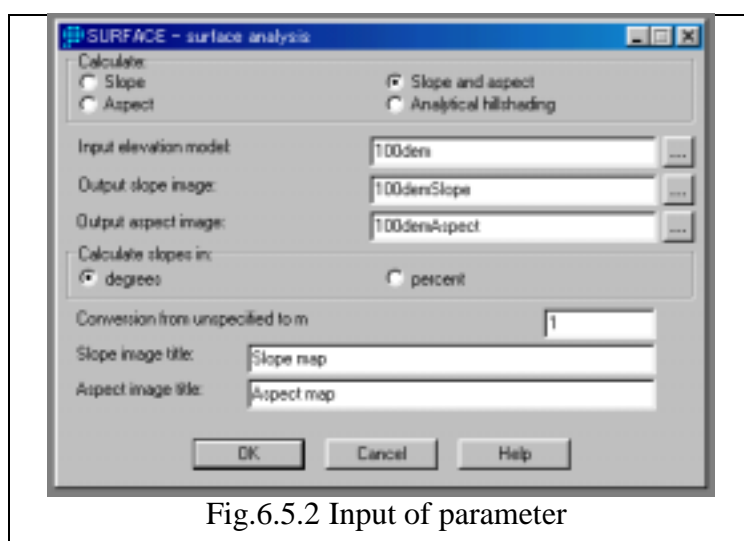


Fig.6.5.2 Input of parameter

Note of calculation method of slope and aspect in IDRISI32

SURFACE Notes (referred from IDRISI32 help)

1. SURFACE determines the slope for a cell based on the cell resolution and the values of the immediate neighboring cells to the top, bottom, left and right of the cell in question. This is known as a rook's case procedure. The slope is calculated as the resultant vector of the slope in X and the slope in Y, i.e.,

Where \tan_slope is the tangent of the angle that has the maximum downhill slope; left, right, top, bottom are the attributes of the neighboring cells; and res is the cell resolution.

\tan_slope multiplied by 100 produces the output as *percent* gradient.
 $\text{Arctan}(\tan_slope)$ produces the output in degrees.

$$\text{Tan_slope} = \frac{(\text{Right} - \text{left})^2}{\text{RES}^2} + \frac{(\text{Top} - \text{bottom})^2}{\text{RES}^2}$$

The slope, aspect and hillshading algorithms are described in the following text:
 Monmonier, Mark, 1982. Computer-Assisted Cartography: Principles and Prospects. Pages 76-80. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

2. Slopes are output in either decimal degrees or percents. Slope gradients in percents represent the tangent of the angle multiplied by 100. Therefore, a 45 degree angle = 100%, while a 90 degree angle will approach an infinite percent.

3. The aspect is the direction in which the maximum slope faces. Aspects are output in decimal degrees and use standard azimuth designations, 0 - 360, clockwise from north. In regions where the surface is perfectly flat with slope = 0, aspect is assigned a value of -1. The output data type is real.

6.6 Topographic analysis module of DEM

IDRISI32 provides various kinds of topographic data analysis module including non-pollution model of water resources application or the watershed analysis or soil erosion-modeling etc.

The team produced some thematic maps by using DEM as follows:

(1) RUNOFF

This is the thematic map to trace the water line to detect the lowest elevation of DEM data automatically in watershed (see 6.6.1).

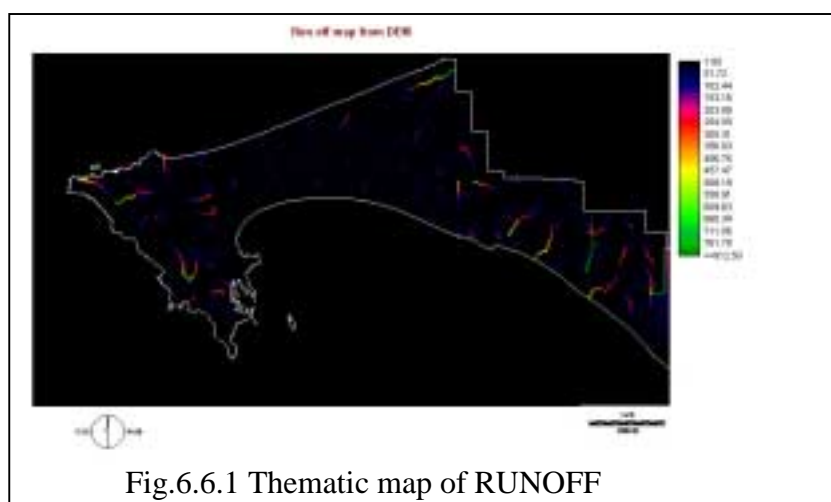


Fig.6.6.1 Thematic map of RUNOFF

(2) Watershed

This is the automatic extraction of watershed area from DEM data.

This module detects the watershed automatically according to the criteria to set up the minimum watershed.

This information is useful for the overlay to topographic map, Landform, facility map of utilities and the inundation.

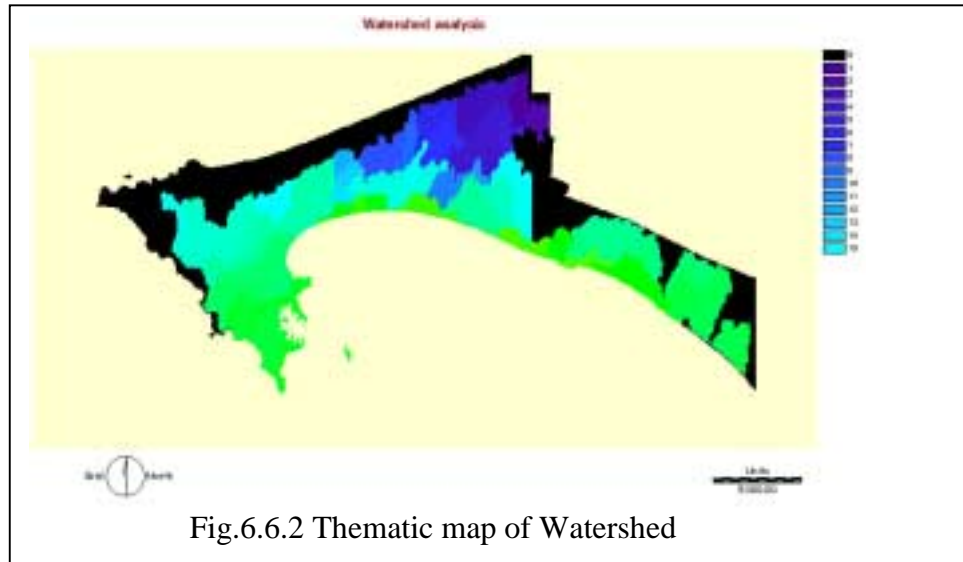


Fig.6.6.2 Thematic map of Watershed

(3) Toposhape

This is the thematic map to detect landform features automatically according to the calculation of the mathematics feature on surface(see Fig.6.6.3).

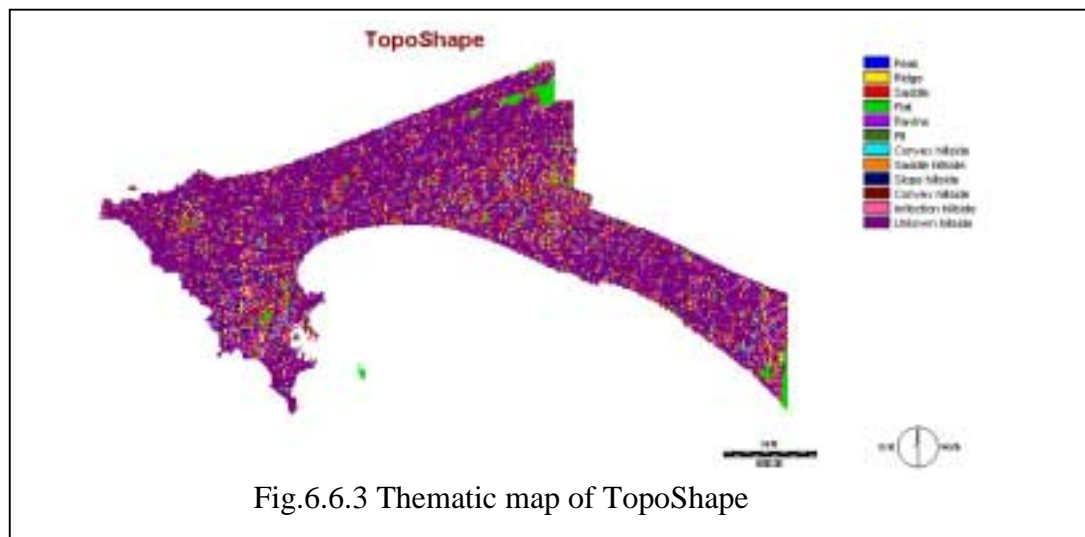


Fig.6.6.3 Thematic map of TopoShape

6.7 Overlay of DEM to extract the study area

Overlay is the useful command to mask the out of area, to extract the area and so on. IDRISI32 provides the overlay command for the raster data operation.

The next is the example to extract the study area. This method is used in many scenes to extract target area to overlay. User can apply this method to his or her data processing as much as possible.

- 1 Create the boolean image to extract area by calculator with logical expression.
For ex. $[Gstudy\ area] < 1$. Minus value is the sea area.

- 2 Select overlay command with the seven option.
The first image is the boolean image.
The second image is the data image for mask.
Enter output name and execute.

- 3 Select overlay command with the two option again.
The first image is the result in -2 step.
The second image is the boolean image in -1 step.
Enter output name and execute.

6.8 Resampling of DEM

Here is the introduction to extract DEM data using the existing DEM data in Dakar metropolitan area. If necessary the different resolution of DEM, use the resampling command with the correspondence file to control the georeference information.

Pay attention to the following things:

- The correspondence file is made by the coordinate at each four corner. The residual error is Zero.
- Resampling method uses the Nearest Neighbor method.
- Define the area and the resolution of DEM for the extraction DEM.
- Create the correspondence file.
- Select the command of Resampling.
- According to the window, enter input file name, output file name, the correspondence file name, sampling area and sampling method. And execute module.

Refer the manual about the detail operation.

6.9 Creation of DEM

There is two production methods to produce DEM data from topographic map as follows:

- DEM from the contour on map by the digitizing.
- DEM from the measurement by the stereo plotter

Data entry of contour map uses contour line and elevation point data and geodetic control point data for the numeric data. After digitized elevation data, the elevation data of DEM is calculated at the each grid by the interpolation method using surface model such as Triangle Irregular Network so called TIN. The methodology and interpolation method depends on the algorithm of software.

The following is the example of the production of DEM and there is some modules to be able to produce DEM in IDRISI32. The next is the method to use TIN.

- 1 Digitize the contour on topographic map.
- 2 Import vector data of contour to IDRISI32.
- 3 Create TIN by using TIN module
- 4 Select Surface Analysis->Interpolation TIN->TIN.
- 5 Calculate DEM by the interpolation module.
 - Create the vacant image file of DEM by the click of Initial module.
 - File type is Real or Integer.
 - Initialize value is -99.
- 6 Select Lineras command. This creates the raster data of DEM by the Vector Raster Conversion module.
- 7 Select TINSURF module to create TIN.
- 8 Convert the file type of DEM from Real to Integer by the convert command.
- 9 Process the mask of DEM by using the overlay command.

7 Reference

IDRISI32 Reference manual Clark University