Summary of Exercises

SANJAY K. JAIN
National Institute of Hydrology, Roorkee

This manual contains details about following exercises:

- Image processing
- Reservoir sedimentation
- Flood studies

All exercises will be done on ERDAS Imagine 8.5. In exercise on Image Processing conversion of segment file to polygon file will be done on ILWIS 3.0. Exercises will be done for following areas:

Exercise	Area
Image processing	Haridwar, Uttarakhand
Reservoir Sedimentation	Ghataprabha reservoir, Karnataka
Flood studies	Gai basin, Dhemaji district, Assam

In the Image Processing exercise, toposheet scanning, toposheet rectification, image rectification, extracting study area and supervised classification for obtaining land use map for the study area will be done.

In the exercise on Reservoir Sedimentation, the waterspread area of reservoir for different dates will be computed. Elevation information from field and waterspread area computed in the exercise will be used in computing volume. The volume will be compared with that computed from hydrographic survey for same period. Sedimentation rate will also be computed.

In the exercise on Flood Studies, flood inundation mapping will be done and inundation area will be computed. The inundation map will be compared with the image of non flood period.

Data for the exercise are stored in following directories:

Exercise	Directory
For ERDAS Imagine 8.5	
Image processing	C:\training\haridwar
Reservoir Sedimentation	C:\training\ghatares01
Flood studies	C:\training\flood
For ILWIS 3.0	
Image processing	C:\training\ILWIS

PREPARATION FOR EXERCISES ON ERDAS IMAGINE 8.5

It is useful to set preferences for efficiently working with software. Following preferences will be set before each exercise:

- Default data directory
- Default output directory
- MSS Red band Default

Default data and output directories for each exercise are as follows:

Exercise	Default data and output directories to be set
Image processing	C:\training\haridwar
Sedimentation	C:\training\ghatares01
Flood	C:\training\flood

Note: drive letter in the above table can be different from above. Please verify on your computer.

Set default data and output directories:

1. In ERDAS Imagine 8.5 panel, use Session- Preferences menu to open Preference Editor dialog box.

2. Category User Interface and Session is shown as highlighted.

3. In Default Data Directory text box, enter the default data directory for the exercise.

4. In Default Output Directory text box, enter the default output directory (same as that for default data directory) for the exercise.

Set FCC band combination

5. Scroll down (use scroll bar on the right) to MSS Red Band Default text box and enter value **3**.

6. Click Global Save button.

7. Click Close button.

EXERCISE: IMAGE PROCESSING (ERDAS/ILWIS)

1. Scan a topo sheet on the scanner and save as tif-file
2. Open tif file in the ERDAS Imaging software. (select file type as tif in ERDAS)
3. To fit the toposheet in the viewer, use right mouse button in the viewer and select fit image to window.
4. Geo-correct the toposheet with the help of Data Preparation process (Details in Annexure I).
5. This Geocoded toposheet will be used to correct satellite data
6. Prepare AOI with the help of Geo coded toposheet and AOI tool (Details in Annexure II).
7. Import satellite data from CD supplied from NRSC, Hyderabad (Details in Annexure III).
8. Subset the scene with the help of inquire box and extract the area that covers the area of interest
9. *If the study area is covered in more than one scene then perform mosaicing process and make it one.*

10. *Before mosaicing registration of two scenes is necessary*
11. Geo-referenced the image/ *mosaic image* with geocoded toposheet (with the help of GCPs) (Details in Annexure IV)
12. Using AOI mask the study boundary from the image to get the study area.
13. The extracted image can be classified using supervised classification (details in Annexure V).

ANNEXURE I

STEPS INVOLVED IN GEOREFERENCING OF SCANNED TOPOSHEETS

1. Click the DATAPREP icon. This will display the data preparation popup menu.

2. Select Image Geometric Correction to open Set Geo Correction input file dialog box.

3. Select From Image File radio button. Click "input image file" icon to open "Input Image File" dialog box.

4. Change "File of Type" to TIFF (*.tif) and click OK. Click OK again.

5. The toposheet is displayed in the viewer and Geometric model dialog box is opened.

6. Select Polynomial and click OK.

7. Geo Correction Tools and Polynomial model properties dialog box appear. In Polynomial model properties click close.

8. GCP tool reference set up dialog box appears. Select Keyboard only radio button and click OK.

9. Reference map information dialog box appears.

10. Click on Add/change map projection to get Projection Choose dialog box.

11. Click on the Custom Tab and set the information on follows:

    Projection Type: Geographic (Lat/Lon)

    Spheroid Name: Everest 1956

    Datum : Indian (India, Nepal)

Click OK

12. In the Reference Map Information dialog box entered projection details are shown.

13. Click OK to get two windows, namely GCP tool and Magnifier window.

Note: You may see approximate statistics dialog box. Click OK three times.

14. In GCP Tool, Click Create GCP icon.

15. Take the mouse cursor into the viewer. You can see the cursor will turn as '+' in the viewer. Click at the selected GCP (in this case, at the intersection of latitude and longitude graticule).

16. In the Viewer GCP will be displayed and annotated as "GCP #1". X input & Y input values will be filled in the GCP tool Cell Array.

17. In the Cell Array, in X ref column, type value of longitude in degree (e.g. 77.75) and in Y ref column type value of latitude in degree (e.g. 30.5). Use space bar for entering minutes with degree (e.g. 77°45′ will be entered as 77 45, the value will be converted to 77.75 in terms of degree).

18. In GCP tool Click the first button (toggle fully automatic GCP editing mode) to make it OFF. The icon is used for predicting the points, which is not needed presently.

19. In the same way create other GCPs.

20. After creating save the points by clicking File/Save Input As and File/Save Reference As.

21. Reference points will be saved in the file (*.gcc)

22. Click on set automatic transformation matrix icon to calculate RMSE error which could be

seen on top right of GCP tool.

23. Go to Geo correction Tools.

24. Select Display Model Properties icon (first icon)

25. Select Projection tab. Click Add/Change Projection.

26. Projection Chooser dialog box is opened.

27. Select Projection Type as polyconic, spheroid on Everest 1956, Datum as Indian (India, Nepal), longitude of central meridian as (longitude of centre point of area of interest i.e. 77:52:30 E), latitude of origin of projection as (Centre point i.e. 30:07:30 N), False Eastings at Central Meridian as 500000 and click OK.

28. Click OK.

29. Reference point reprojection warning dialog box is opened. Click yes. In Verify save on close dialog Click No

30. You will see the X ref and Y ref value will be changed to meter units in the GCP tool.

31. In Geo Correction Tools, select display resample image dialog icon.

32. Resample dialog box is opened.

33. In the output file, type the output file name, e.g. trect.img and click OK.

34. When the process is over click OK in the process bar.

35. Open the output file (trect.img) in a viewer.

36. You can verify the output file by clicking on Utility/inquiry cursor in the viewer. And place the cross hair on the known location and you can see the longitude and latitude values. In the top left cover list box change map to lat/lon. You can cross check this value with the known values which has to be very close to each other.

ANNEXURE II

STEPS INVOLVED IN EXTRACTING AREA OF INTEREST

Steps in ERDAS Imagine 8.5

a) Create vector map of area of interest

1. Open geocoded toposheets in single viewer

2. In Viewer #1, use File- New- Vector Layer menu to open create a New Vector Layer dialog box

3. Enter file name

4. Click OK (twice), a New Arc Coverage layer Option window is opened

5. Click OK, a Vector tool box opens

6. In Viewer, select Vector- Enable Editing menu, a Message box is opened

7. Click OK

8. In Vector tool box, select Place a Line Feature in the Coverage icon

9. In Viewer, draw perimeter of an area of interest (Click to place a point in a line and double click to close the line). The area of interest could be watershed, administrative boundary or any other area.

10. Click Close Top layer icon to open Verify Save on Close window.

11. Click Yes.

b) Export vector map to arc interchange format

12. In ERDAS IMAGINE 8.5 panel, click Import icon to open Import/ Export dialog box.

13. Click **E**xport Radio button

14. From Type dropdown list, select Coverage to Arc_Interchange

15. For Media dropdown list, select file

16. In Input file catalog, select input vector file created above

17. Enter output file name with E00 extension, e.g. hari.e00.

18. In keyboard, press Enter key.

19. Click OK (Thrice)

20. Click Close.

Steps in ILWIS software

Run ILWIS software

c) Import arc interchange file in IL WIS

21. In ILWIS 3.4 Open window, Use File- Import- Map menu to open Import dialog box

22. In Import Format dropdown list, select ARC/info.e00 interchange format.

23. In directory list box, catalog of files with extension e00 is displayed.

24. From this catalog, select e00 file created in step b). The file will be highlighted.
25. In Output Filename textbox, enter the name of the output file.
26. Click OK button.

d) Create coordinate system

27. In ILWIS 3.4 Open window, use File- Create- Coordinate system menu to open Create Coordinate system dialog box
28. Enter name of the coordinate system file.
29. Click Coordsystem Projection radio button.
30. Click OK to open Coordinate system Projection dialog box
31. Click Projection button to open Select Projection window.
32. In the dropdown list, Select polyconic projection
33. Enter parameters of the polyconic projection as follows:

False Easting	500000
Central meridian	77 52 30 E
Central Paralle l	30 07 30 N

34. Click Ellipsoid button to open Select Ellipsoid window.
35. In the dropdown list Everest (India 1956)
36. Click Datum button to open Select Datum window.
37. In the dropdown list Indian (India, Nepal)
38. Click OK

e) Change property of imported segment file

39. In ILWIS 3.4 Open catalog, click the imported segment map
40. Click Properties icon to open Properties of Segment Map dialog box
41. In Coordinate System dropdown list, select the coordinate system created above.
42. Click OK

f) Creating polygon map

43. In ILWIS 3.4 Open catalog, right click the segment map
44. Click Edit to open Segment Editor
45. Select menus File- check segment-

    Self overlap

    Dead ends

    Intersection

    To open Check Segments dialog box. Click OK to check the segments and take suitable actions to rectify the error.
46. Repeat step 45 until all errors are rectified.
47. Use File- Polygonise menu to open Polygonize Segment Map dialog box.

48. In polygon Codes, click unique identifier radio button
49. Enter output polygon file name
50. Click OK (twice) to create and display the polygon map.

g) Export polygon to shape file

51. In ILWIS 3.4 Open, use file- Export to open Export dialog box
52. In directory catalog, select the polygon map name
53. In Format dropdown list, select Arcview shape file .SHP
54. Enter output filename
55. Click OK

Steps in ERDAS Imagine 8.5

h) Repair coordinate system of the shape file

56. Open shape file in the Viewer
57. In Viewer, click Information Icon to open VectorInfo dialog box
58. In Vector Info, use Edit- Add Coverage Projections menu to open Define Projection Parameters of the Cover dialog box
59. Click Edit projection parameters button to open Projection Chooser dialog box.
60. Click custom tab
61. In Projection Type dropdown list, select Polyconic
62. In Spheroid Name dropdown list, select Everest 1956
63. In Datum Name dropdown list, select Indian (India, Nepal)
64. Enter projection information as follows:

Longitude of Central Meridian	77:52:30 E
Latitude of the Centre of the Origin	30:07:30 N
False Eastings at cetntral Meridian	500000

Press OK (twice)

i) Create AOI

65. In Viewer, use AOI- Tools menu to open AOI tool box
66. In AOI tool box, Use Select AOI Elements tool
67. In Viewer, click inside the area of interest polygon. The color of selected polygon will change to yellow.
68. In Viewer, use AOI- copy selection to AOI menu to create AOI.
69. Polygon boundary will be shown as dotted line.
70. Use File- Save- AOI Layer As menu to open Save AOI As dialog box
71. In Save AOI As text box enter AOI file name.

70. In Keyboard, press Enter key.
71. Click OK

j) Subset geocoded image file using AOI
(Note: Geocoded file provided with exercise will be used)

72. In ERDAS IMAGINE 8.5 panel, click DataPrep icon to open Data Preperation popup menu.

73. Select Subset Image menu to open Subset dialog box.

74. Enter Input (11feb97_r.img) and output file names.

75. Click AOI button to open Choose AOI dialog box.

76. In Select an AOI Source, click AOI file radio button.

77. Click OK.

78. In the Select the AOI File text box, enter the AOI file name.

79 Click OK (thrice).

80. Open the output file in the Viewer to examine it.

ANNEXURE III

STEPS INVOLVED IN IMPORTING SATELLITE DATA

1. In ERDAS IMAGINE 8.5 panel, click Import icon to open Import/ Export dialog.

2. In Type dropdown list, select Generic Binary.

3. In Media, select File

4. In Input file, go to CDROM. Open Product1 folder and select imagery.L-3 file

5. Click OK

6. Enter output file name

Read number of scan line and pixels in the data file

7. Click Data View button.

8. Enter offset value as 180.

9. In the Keyboard, press Enter key.

10. The content of the Data View window is updated.

11. Note down first two values, e.g. 23984 and 6480. The values indicate number of data lines and number of pixels respectively. Data lines are related to number of scan lines as follows:

Scan lines= Data lines/ number of bands

In case of IRS LISS- II and III data

Scan lines= Data lines/ 4

e.g. scan lines= 23984/4= 5996

12. Close the window

Alternately, the number of line and pixels can be read from the cover of the CDROM supplied by NRSC.

Import the image data

13. Click OK, to open Import Generic Binary Data dialog.

14. Enter values, e.g.

File Header	540
Image Record Length	6480
Line Header Bytes	0
# Rows	5996
# Cols	6480
# Bands	4

15. Press Preview button

16. A preview image is imported

17. A Viewer is opened with Preview image displayed in the Viewer.

18. In the Viewer, use Utility- Inquire Box menu to open outline of an Inquire box in the Viewer
19. An Inquire Box window is also opened . In the window, ULX, LR X, ULY and LRY are displayed.
20. The box can be reshaped by dragging the sides or corners of the box.
21. In Import Generic Binary Data window, click Import Options button
22. An Import Options window is opened.
23. Click From Inquire Box button
24. ULX, LR X, ULY and LRY values are copied from the inquire box in the Viewer.
25. Press OK.
26. Press OK.
27. Press OK.
28. Close Inquire Box window
29. In the Viewer, open the imported image.

ANNEXURE IV

STEPS INVOLVED IN GEOREFERENCING OF SATELLITE IMAGE

1. Click the DATAPREP icon. This will display the data preparation popup menu.

2. Select Image Geometric Correction to open Set Geo Correction input file dialog box.

3. Select From Image File radio button. Click "input image file" icon to open "Input Image File" dialog box.

4. The FCC is displayed in the viewer and Geometric model dialog box is opened.

5. Select Polynomial and click OK.

6. Geo Correction Tools and Polynomial model properties dialog box appear. In Polynomial model properties click close.

7. GCP tool reference set up dialog box appears. Select Image Layer (New Viewer) radio button the option and click OK.

8. Reference Image Layer dialog box appears. Select the image file name and press OK.

9. Reference Map Information dialog appears. Current reference image projection information is displayed in the window. Press OK to close the window.

10. Five windows, namely GCP tool, Geo Correction Tools, reference image and two Magnifier windows are opened.

Note: You may see approximate statistics dialog box. Click OK three times.

11. In GCP Tool, Click Create GCP icon.

12. Take the mouse cursor into the viewer. You can see the cursor will turn as '+' in the viewer. Click at the selected GCP in the input image viewer. Also click corresponding GCP in reference image viewer (displaying toposheet).

13. In the Viewer GCP will be displayed and annotated as "GCP #1". X input, Y input, X Ref. and Y Ref. values will be filled in the GCP tool Cell Array.

14. In GCP tool Click the first button (toggle fully automatic GCP editing mode) to make it ON (icon seen as depressed). The icon is used for predicting the points, which is needed presently.

15. In the same way create other GCPs. Total control point error could be less than 3 pixels (75 m).

16 After three points are input, if a new GCP is created in input image/ reference map window, the corresponding GCP in the reference map/ input image is automatically computed using available transformation matrix from existing GCPs and the computed GCP is placed in other viewer as well as X and Y values for that map/ image are placed in GCP tool window. The position of the GCP in the other window is corrected if needed manually by picking the GCP with

17. After creating save the points by clicking File/Save Input As and File/Save Reference As.

18. Reference points will be saved in the file (*.gcc)

19. In Geo Correction Tools, select display resample image dialog icon.

20. Resample dialog box is opened.

21. In the output file, type the output file name, e.g. irect.img. Enter output cell size X and Y as 24 and 24 m and click OK.

22. When the process is over click OK in the process bar.

23. Open the output file (irect.img) in a viewer.

24. Display both the toposheet and image in a viewer. Use Utility- Swipe menu to verify the correctness of image geo correction.

ANNEXURE V

STEPS INVOLVED IN SUPERVISED CLASSIFICATION

In this exercise supervised classification of IRS LISS-III images. The exercise will be used to classify the image in to classes, namely forest, crop, fallow, barren and sand.

In supervised classification, basic steps require selecting training sets from image, selecting band combinations to be used for classification and classifying the image.

1. Run ERDAS Imagine 8.5.
2. Set preferences for the session.

Selecting signatures

3. Go to the Viewer #1 window.
4. Click open layer button. In "select layers to add" dialog box, select file name e.g. 11feb97_rs.img.
5. In ERDAS IMAGINE 8.5 panel, Click Classifier icon to open Classifier popup menu.
6. Select Signature Editor menu to open a Signature Editor dialog box.
7. Go to Viewer#1 select menu AOI- Tools to open AOI tools.
8. In Viewer #1 use Zoom icon to zoom to a theme, e.g. flood.
9. In AOI tool box, select Create polygon AOI tool.

10 GO to Viewer#1.

11. Create a polygon for a theme, e.g. forest (click to create points in the polygon boundary and double click to close the polygon). The polygon remains selected. (To deselect a polygon click outside the polygon to deselect and to select a polygon click inside the polygon)
12. Go to the Signature Editor dialog box
13. Click Create new signature from AOI icon. This reads the signature from image and adds it to the signature editor as Signature # 1 by populating columns in the Signature Editor Cell Array.
14. Under Class Name column in the Cell Array Click to Class 1 and type new class name e.g. forest. From Keyboard press Enter.
15. Add more signatures using procedure described in steps 10 to 14.
16. Click Display Mean Plot Window icon to open Signature Mean Plot window.
17. Click Switch between single and multiple signature mode and then click Scale Chart to Fit Current Signatures icons to plot all the signatures in the Signature Mean Plot window.
18. Press Display Statistics icon to open Display Statistics window and view the statistics for the selected signature in the window.
19. Under column "> ", click a Cell Array to make the signature the current signature (Symbol ">" appears at that Cell Array).
20. The Display Statistics changes to display the current signature.
21. Click Close button to close the Display Statistics window.

Supervised classification

22. In Signature Editor window, Click Edit- Layer selection menu to open Layers to select dialog.

23. Click layer # 1, and shift- click layer # 2 and 3 to select layers 1 to 3 to use in the classification.

24. Click Classify- Supervised menu to open Supervised Classification dialog box.

25. Enter output file name and press OK button. The image will be classified and thematic map will be stored in the output file.

Recode the thematic map

After classification, the thematic map contains several classes for each theme. Using recode operation, multiple classes for same theme are assigned one class value.

26. In ERDAS IMAGINE 8.5 panel, click Interpreter icon to open Image Interpreter popup menu.

27. Select GIS Analysis- Recode menu to open Recode dialog box.

28. Enter input and output file names.

29. Press Setup Recode button to open Thematic Recode window.

30. In the Thematic Recode table, enter recode values under New Value column, e.g. for thematic classes, namely forest, crop, fallow, barren and sand enter values 1 to 5 respectively. The Class Names can be seen by scrolling the table using scroll bar at the bottom of the table.

31. Press OK to close Recode dialog box.

32. Press OK to complete recode.

Compute area

33. Go to Viewer # 1.

34. Open the recoded image.

35. Open Attribute Editor.

36. Click a Color in the Cell Array and select New Color to Change color of a thematic class.

37. Use Edit- Add Class Name menu to add class names

38. Use Edit- Add Area Column menu and class areas. Class area is computed automatically using this operation for each thematic class.

Compare visually the classified map and FCC

39. Go to Viewer # 1

40. Open the image.

41. In Select Layer to ADD window click Raster Option tab

42. Remove check in the Check Box in front of Clear Display.

43. Use Utility- Swipe menu to swipe FCC over the classified map and compare the two.

Editing the thematic map

44. Use Raster- Tools menu to open Raster tool box
45. Select Create Polygon AOI tool.
46. In the Viewer, create an AOI.
47. Select Recode Area tool.
48. A Recode table in opened.
49. Under New Value column in the table, enter recode values.
50. Click Apply button.
51. Repeat steps 45 to 50 for several areas.
52. Click Close button to close the Recode table.
53. Close Raster Tool Box.
54. In Viewer, use Close Top layer icon to close AOI layer.
55. Click No.
56. Use Close Top layer icon to close image.
57. Click Yes.

58 Click Yes. This will close the image and save the edit in the image.

EXERCISE: RESERVOIR SEDIMENTATION

In this exercise, sedimentation of Ghataprabha reservoir will be studied using remotely sensed data. Using this technique, sedimentation in the reservoir can be studied between reservoir water elevations, namely MDDL to FRL. Normalized Difference Water Index (NDWI) will be used for delineating water spread area. Cone formula will be used for estimating reservoir volume.

Three models are created using ERDAS Imagine Modeler for reservoir waterspread delineation using NDWI technique. Similar models can be created for other ratio based techniques, e.g. NDVI etc. Along with models other operation are done on the data and the resulted thematic maps. Sedimentation computations are done in spreadsheet software.

NDWI is a ratio image of green to near infrared band, normalized to have value between -1 to 1. NDWI value is high for water compared to other objects and thus using this ratio water can be identified. Higher NDWI value for water compared to other objects can be explained by spectral signature. In visible bands, the transmittance is high and absorption is less. Nearly all NIR radiation is absorbed by water. Thus, reflectance of water increases for wavelength from blue to NIR bands resulting in positive high values for water.

Data to be used are listed in the table below:

Satellite	Sensor	Path/Row	Date
IRS 1 D	LISSIII	96-61	28 Oct., 2000
IRS 1 D	LISSIII	96-61	22 Nov., 2000
IRS 1 D	LISSIII	96-61	11, Jan., 2001
IRS 1 D	LISSIII	96-61	05, Feb. 2001
IRS 1 D	LISSIII	96-61	02, Mar, 2001
IRS 1 D	LISSIII	96-61	21, Apr, 2001

The models are created for following operations:

- Create NDWI
- Recode NDWI using a threshold
- Recode clump for reservoir

Model to create NDWI

1. In ERDAS IMAGINE 8.5 panel select Modeler icon to open Spatial Modeler popup menu.
2. Select Model Maker menu to open New-Model dialog box and Model Maker tool box.
3. Use tools in the Model Maker tool box, namely raster objects and function and connect them, as per picture shown in Fig. 1.
4. Double click an element in the New-Model to open it.
5. Open raster object (top and bottom) and tick the tick box for Prompt User For File Name at Run Time
6. In Data Type dropdown list for bottom raster object, select Float Single.
7. Open middle two raster objects and tick the tick box for Temporary raster only

8. Open three Function and enter formula as follows:

    1. $n1_prompt_user(1)-$n1_prompt_user(3)
    2. $n1_prompt_user(1)-$n1_prompt_user(3)
    3. $4_memory/$5_memory

9. Use File- SaveAs menu to save the model.

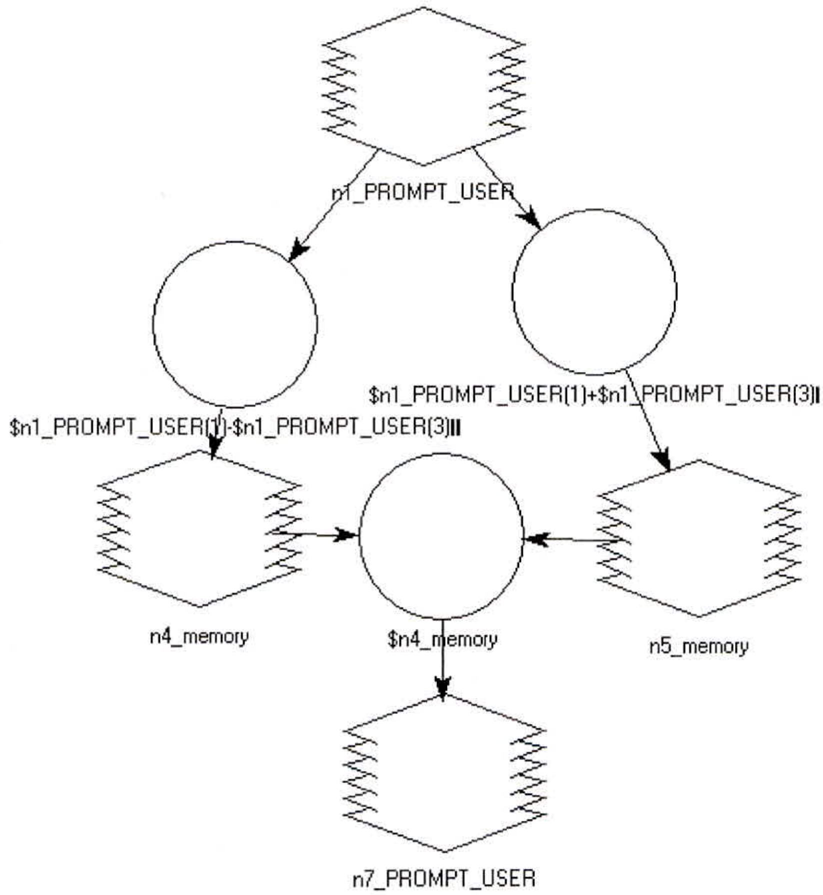

Fig. 1 NDWI model

Model to recode NDWI

The model is used to recode NDWI image using a threshold value. The values in NDWI image higher than the threshold are recoded to "water" class and the remaining values are coded to non-water class. The threshold is obtained using another procedure prior to running this model.

1. In ERDAS IMAGINE 8.5 panel select Modeler icon to open Spatial Modeler popup menu.

2. Select Model Maker menu to open New-Model dialog box and Model Maker tool box.

3. Use tools in the Model Maker tool box, namely raster objects and function and connect them, as per picture shown in Fig. 2.

4. Open raster object (top and bottom) and tick the tick box for Prompt User For File Name at Run Time

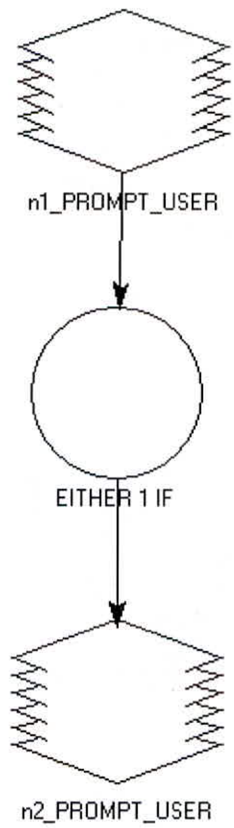

Fig. 2 Recode model

5. In Data Type dropdown list for top raster object, select Float Single.

6. In File Type dropdown list for bottom raster object, select Thematic respectively.

7. Open Function

8. In function, select Conditional from the dropdown list and select following function

Either <arg 1> if (<test>) or <arg 2> Otherwise

9. In the function window, the above function will be displayed.

10. Replace arg1 and arg2 with 1 and 2 respectively.

11. Replace <test> with a condition as follows:

$n1_prompt_user>0.25

12. Use File- Save As menu to save the model.

Model to recode clump of reservoir waterspread

The thematic map obtained from NDWI is clumped. Clump operation assigns separate values for each contiguous area. The clump for the reservoir is required to be recoded to obtain the thematic map for reservoir water spread.

The model is similar as the above model except the step 9 is as follows:

9. Replace <test> with a condition as follows:

$n1_prompt_user==1023

Reservoir waterspread area delineation

With required models ready, steps as given below are used to delineate the waterspread area of the reservoir from the satellite images:

1. Compute NDWI
2. Select NDWI threshold
3. Recode NDWI image
4. Clump recoded map of NDWI
5. Recode clumped map

Compute NDWI

1. In ERDAS IMAGINE 8.5 panel select Modeler icon to open Spatial Modeler popup menu.

2. Select Model Maker menu to open New-Model dialog box and Model Maker tool box.

3. Use File- open to open the NDWI model created above.

4. Use Process- Run to run the model.

5. The model prompts for input (satellite data) and output files (NDWI).

Select NDWI threshold

6. In Viewer #1, open FCC.

7. Click open file icon and click NDWI file name.

8. Click Raster Option tab, tick the tick box for clear display (It allows both image to be displayed in same Viewer)

9. In display as dropdown list, select Pseudo Color.

10. Click OK to display NDWI image.

11. Use Raster- Attribute menu to open Raster Attribute Editor table.

12. Set color blue for NDWI values greater than a threshold.

13. Use Utility- Swipe to check correctness of the threshold. In required, change the threshold. The threshold will be greater than 0.2 in general.

Recode NDWI image

14. In ERDAS IMAGINE 8.5 panel select Modeler icon to open Spatial Modeler popup menu.

15. Select Model Maker menu to open New-Model dialog box and Model Maker tool box.

16. Use File- open to open the rec model created for recoding NDWI image (if needed change the threshold).

17. Use Process- Run to run the model.

18. The model prompts for input (NDWI image) and output files (recoded map of NDWI).

Clump recoded map of NDWI

19. In ERDAS IMAGINE 8.5 panel select Interpreter icon to open Image Interpreter popup menu.

20. Select GIS Analysis- Clump menu to open Clump dialog box.

21. Enter input (recoded map of NDWI) and output file names (Clump map).

22. In the Connected Neighbors dropdown box, select 4.

23. Press OK to clump the recoded map of NDWI.

Recode the clump map

24. In Viewer # 1 open FCC and clump image.

25. Use Utility- Swipe menu to locate the reservoir.

26. Use navigation icons, namely zoom in, zoom out and pan to navigate to the reservoir.

27. Use Inquire Cursor icon to inquire clump value for the reservoir waterspread clump.

28. In ERDAS IMAGINE 8.5 panel select Modeler icon to open Spatial Modeler popup menu.

29. Select Model Maker menu to open New-Model dialog box and Model Maker tool box.

30. Use File- open to open the rec-clump model created for recoding clump map (if needed change the recode value).

31. Use Process- Run to run the model.

32. The model prompts for input (clump map of recoded NDWI) and output files (reservoir waterspread map).

Statistics of recoded clump map

33. In Viewer #1, open recoded clump image.

34. Use Raster- Attribute menu to open Raster Attribute Editor table.

35. In the Cell Array, under Histogram column read the value in the row number 1.

36. Multiple the value obtained above with the size of a pixel, namely 0.0235 m X 0.0235 m, to obtain waterspread area in sq. km.

EXERCISE: FLOOD STUDIES

In this exercise flood inundation mapping will be done for a part of Gai basin in Dhemaji district of Assam. Three images for flood period and one image for non- flood period are provided. Image of August 1998 will be classified using supervised classification. Classes namely Flood, land and cloud will be created in the classified thematic map.

Steps are same as that given in Annexure V in the exercise for Image Processing (ERDAS/ ILWIS) will be used. In step 30, the classes in the supervised classification will be recoded with, namely flood, land and cloud given values 1, 2 and 3 respectively

EXERCISE: EXTRACTING CONTOURS FROM SRTM DATA

1. Download SRTM version 4 data (zip format) from internet.

2. Reproject the data in UTM coordinate system.

Note: UTM zone no. for your area of interest is required beforehand. For example, longitudes 72°- 78° have UTM zone 43. UTM Zone number increases eastward.

3. Subset the image and export in GRID format.

4. Generate contours and compare them with topographic map.

5. Display Narmda canal map on the contour map.

a. Reproject SRTM data

1. Follow steps 1-5 of Annexure I (steps involved in georeferencing of scanned toposheet).

2. Select Reproject and Click OK.

3. Geo Correction Tools and Reproject model properties dialog box appear.

4. In Reproject model properties dialog box, click Projection tab.

5. Click Add/ Change Projection button to open Projection Chooser dialog box.

6. Click Custom tab.

7. Select following projection parameters:

   Projection Type: UTM

   Spehroid: WGS 84

   UTM Zone: 43

8. Follow steps 31- 35 of Annexure I (steps involved in georeferencing of scanned toposheet). In step 33, also enter output cell size X and Y as 90 and 90 m.

9. Subset the SRTM data for a rectangular area of interest (use file sub01.aoi).

b. Extracting contours

10. Open arcview 3.1

11. ArcView GIS Version 3.1 and Welcome to ArcView GIS Windows are opened.

12. Click OK.

13 Click NO.

14. A View window is opened.

Select desired extension

15. In View window, use File- Extensions menu to open Extensions dialog box.

16. Tick the tick button Spatial Analyst extension

17. Click OK

Open SRTM data in the View window

18. In View window, use View- Add Theme menu to open Add Theme dialog box.

19. In Directory text box, enter the directory path (or use navigator to reach the directory path).
20. In Data Source Type dropdown, select Grid Data Source.
21. In the catalog, select the desired file, e.g. sub01.
22. Click OK.
23. The file will be listed in the Table of Content (TOC).
24. In TOC, tick the toggle button placed on the left of the file name
25. The file is displayed (becomes visible) in the View.

Inspect theme property

26. In View, use Theme- Properties menu.
27. Inspect the theme properties.
28. Click OK.

Create contours

29. In TOC, click SRTM theme name, e.g. sub01 to make it active.
30. Use Surface- Create Contours menu, to open Contour Parameters dialog box.
31. In contour interval text box, enter a contour interval in m, e.g. 5.
32. Click OK.
33. A contour map is created and listed in TOC.
34. Make the contour theme visible in the View (Please see steps 24- 25).

Change the contour symbology

35. In View, click the contour map in TOC to make it active.
36. Use Theme- Edit Legend menu to open Legend Editor dialog box.
37. In Legend Type drop down list, select Unique Value.
38. In Values Field dropdown list, select Contour.
39. In Color Ramp drop down list, select Mineral.
40. Click Apply.
41. Close the Legend Editor.

Open toposheet

42. Open toposheet (46e) GRID data
43. Steps are same as that in 18-25, except step 20.
44. In the Data Source Type dropdown, select Image Data Source.
45. In TOC, click and drag the layer 46e to stack it above SRTM file, namely sub01.
46. Make the SRTM map active.

47 Click Identity icon.

48. Click in the map, on a contour to inspect its value in SRTM DEM.

Open canal map

49. To display canal data (shape file narmdac) use steps same as that in 18- 25 except in the step 20, in Data Source Type dropdown, select Feature Data Source.

Save Contour map

50. Make contour map active (similar as step 29).

51. Use Theme- Convert to Shapefile manu.

52. Click OK.

53. Click No.

Save project

54. Use File- Save Project menu to open Save Project As dialog box.

55. Enter project name.

56. Click OK.

STEPS TO DOWNLOAD SATELLITE DATA AND SRTM DATA FROM INTERNET

Satellite data

Satellite data, e.g. Landsat ETM+ and MSS etc. can be downloaded from Global Land Cover Facility, University of Maryland, USA. Data are orthorectified and have UTM map projection (with WGS 84 datum).

Site: http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp

1. Map Search or Path/Row Search can be used.

2. Under Sensor click ETM+

3. Under Require click Orthorectified.

4. Enter start and end Path and Row e.g. 146, 40, 148, 42 (Rajasthan is covered by Path 146 to 150 and Rows 40- 44)

5. Click Submit Query

6. In Status, Number of scenes, e.g. 9 will be displayed

7. Click Preview and download, a scene list is displayed.

8. Clicking at an ID e.g. 038- 859 for scene 147- 042 (scene on east of Arawali and below Jaipur) scene can be previewed.

9. Click Download.

10. A list of individual band data tif files (zipped) is displayed.

11 Download required bands, e.g. bands 2 to 5 can be downloaded (size of each band data is nearly 30 MB).

SRTM Version 4 data

Data can be downloaded in tiles of 5° X 5°. Data have geographic map projection (lat- lon) with WGS 84 datum.

Site: http://srtm.csi.cgiar.org/SELECTION/inputCoord.asp

1. Click a tile in the map display. (Clear area can be used to reset selection)

2. Click on Click here to begin search box to display Description, Location and Image of tile/s.

3. Click Data download (FTP) icon.

4. Data in GeoTiff format (zipped file) will de downloaded.