APPLICATION OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS (GIS) FOR SITE-SELECTION OF HAZARDOUS WASTES DISPOSAL IN ARID AREAS

تطبيقات الاستشعار من البعد ونظم المعلومات الجغرافية في اختيار انسب الأماكن لدفن النفايات الخطرة بالمناطق الجافة

by

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الهيئة القومية للاستشعار من البعد وعلوم الفضاء

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Vice President of the GSAf (N. Africa)

Delivered by

Good morning ladies and gentlemen,

I would like to thank you for your interest in hearing the role of space and information technologies in hazardous waste management. I also thank the organizing committee for inviting the National Authority for Remote Sensing and Space Science of Egypt (NARSS) to participate and share the discussion during the present workshop.

Due to other urgent commitments, I apology for being not able to be with you in this very important workshop, but I wish you a very successful workshop and a fruitful discussion.

Mamdouh Abdeen


مقدمة
Introduction

What is Hazardous Waste ?

Wastes that are:

- Toxic
- Explosive
- Corrosive
- Flammable
- Eco-toxic
- Infectious

Where does it come from?

- Industry
- Agriculture
- Laboratories
- Households
- Mining
- Oil industry
- Clinics and Hospitals
- Military activities
- Public Services

What is Hazardous Waste ?

Toxic Wastes

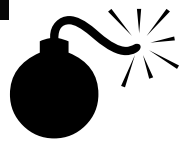
Toxicity of waste is varied according to:

- **Kind of waste**
- **Quantity of waste**
- **Exposure time**

Examples:

Wastes containing Mercury, Cadmium, Cyanides and Antimony

What is Hazardous Waste ?



Explosive Wastes

These include a wide variety of chemically reactive waste:

- **Wastes strongly react with water.**
- **Wastes form explosive mixture with water.**
- **Wastes, when mixed with water produce toxic fumes, gases, smoke**

What is Hazardous Waste ?

Corrosive Wastes

These include:

- **Wastes with 2>PH>12**

- **Wastes cause Steel corrosion**

  6.25 m/y

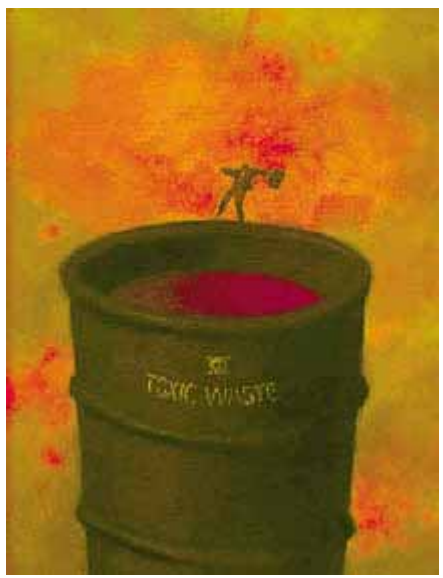
Examples: **Surfaces treatment solutions**

What is Hazardous Waste ?

Flammable Wastes

These include:

- **Liquid Wastes containing >24% Alc. With a Flash Point less than 60C**
- **Compressed gases**
- **Oxides and Pro-Oxides**
- **Wastes might ignite or flame at normal conditions.**



Examples: **expired organic solvents**

What is Hazardous Waste ?

Eco-toxic Wastes

Those wastes which

might left a permanent toxic effect on the ecosystem

What is Hazardous Waste ?

Infectious Wastes

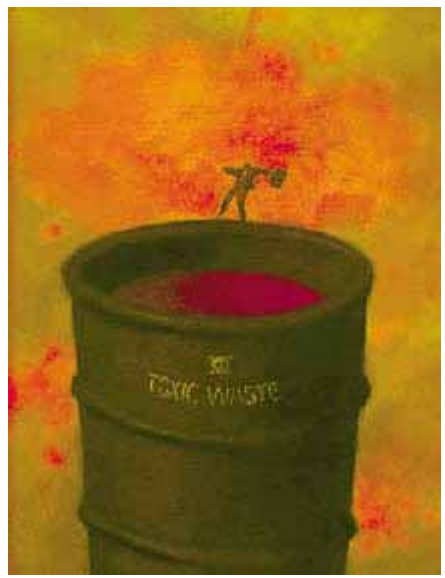
- **Those resulted from secretion, Puss, and Blood of patients and all other staff might contaminated in the operation room.**

- **It cause infectious and Bacterial diseases as Hepatitis and Typhoid**

Why is hazardous waste a problem?

When not managed Properly, it can cause:

- Severe health problems
- Poison land for decades
- Make local water unsafe
- Even cause death



Solution:
Remote Sensing and GIS

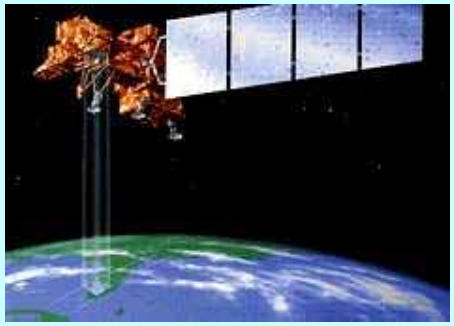
مفهوم تكنولوجيا الاستشعار من البعد

Definition of Remote Sensing Techniques

الاستشعار من البعد هو:

التكنولوجيا الذى يتم عن طريقها التعرف على الأهداف بدون لمسها وذلك باستخدام أجهزة تحمل على الأقمار الصناعية أو الطائرات

NOAA



Landsat

Spot

JERS

Remote sensing is the technology by which we obtain information about objects with out physical contact. The term is applied to the sensors carried out on satellites for gathering information about earth's surface, water and atmosphere.

أنظمة الاستشعار من البعد واستخداماتها
Remote Sensing Systems and Uses

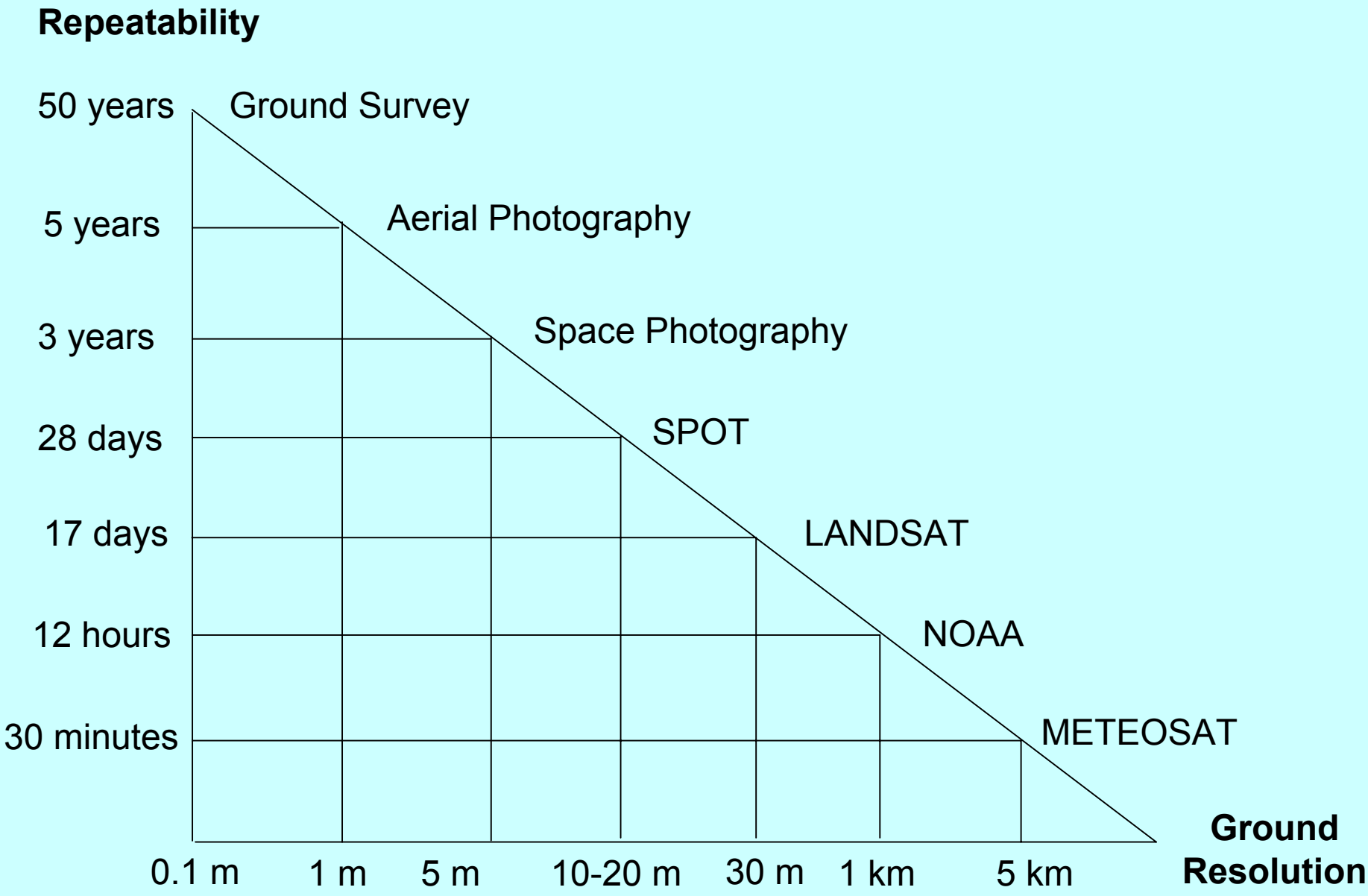
- أنظمة الاستشعار الضوئية Optical Remote Sensing
- أنظمة الاستشعار الحرارية Thermal Remote Sensing
- أنظمة الاستشعار النشطة (الليزر- الرادار)
Shortwave or Active Remote Sensing

اختيار بيانات الاستشعار عن بعد

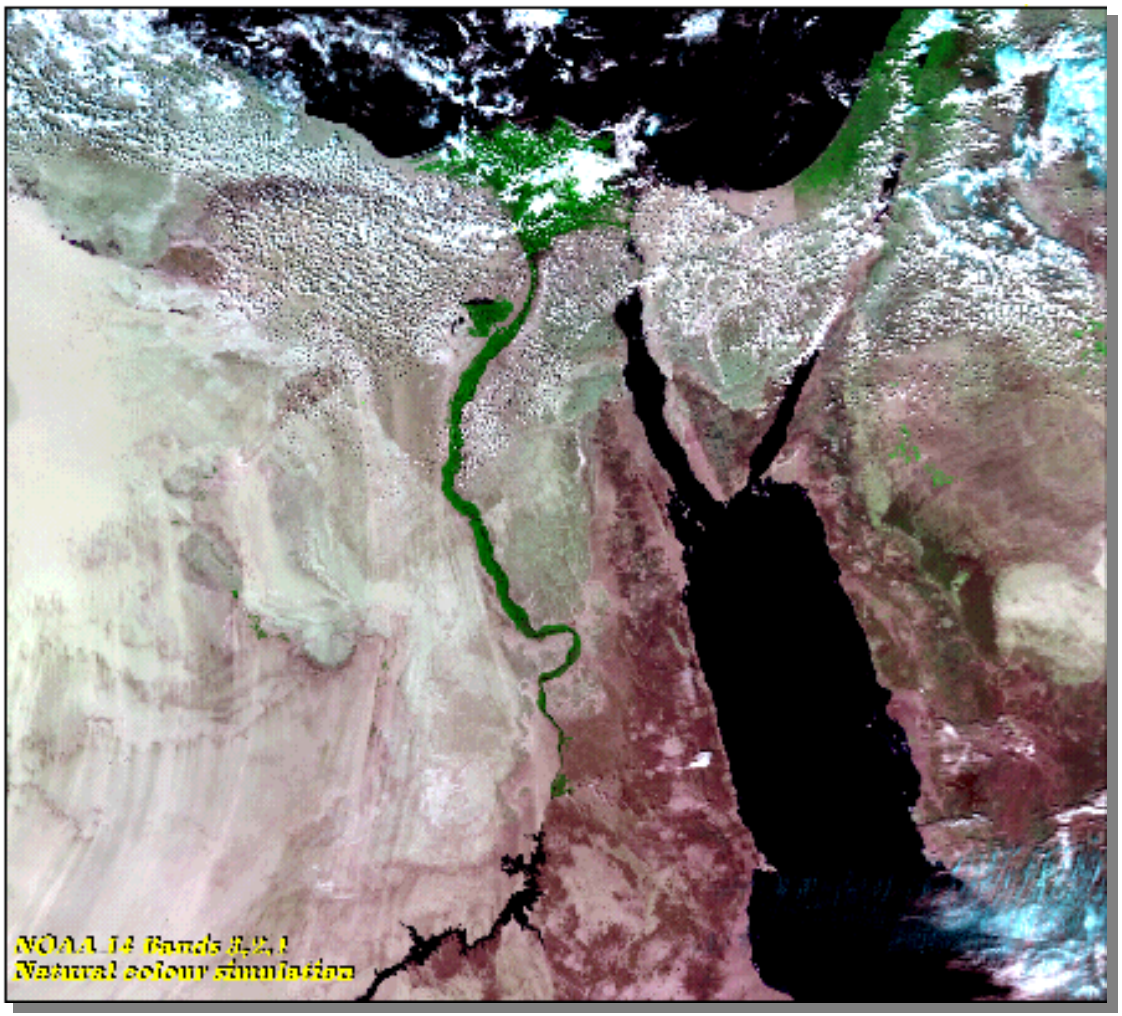
درجات وضوح مختلفة

Egypt, The Pyramids

Resolution and Repeatability of Remote Sensing Systems



اختيار بيانات الاستشعار عن بعد



Egypt

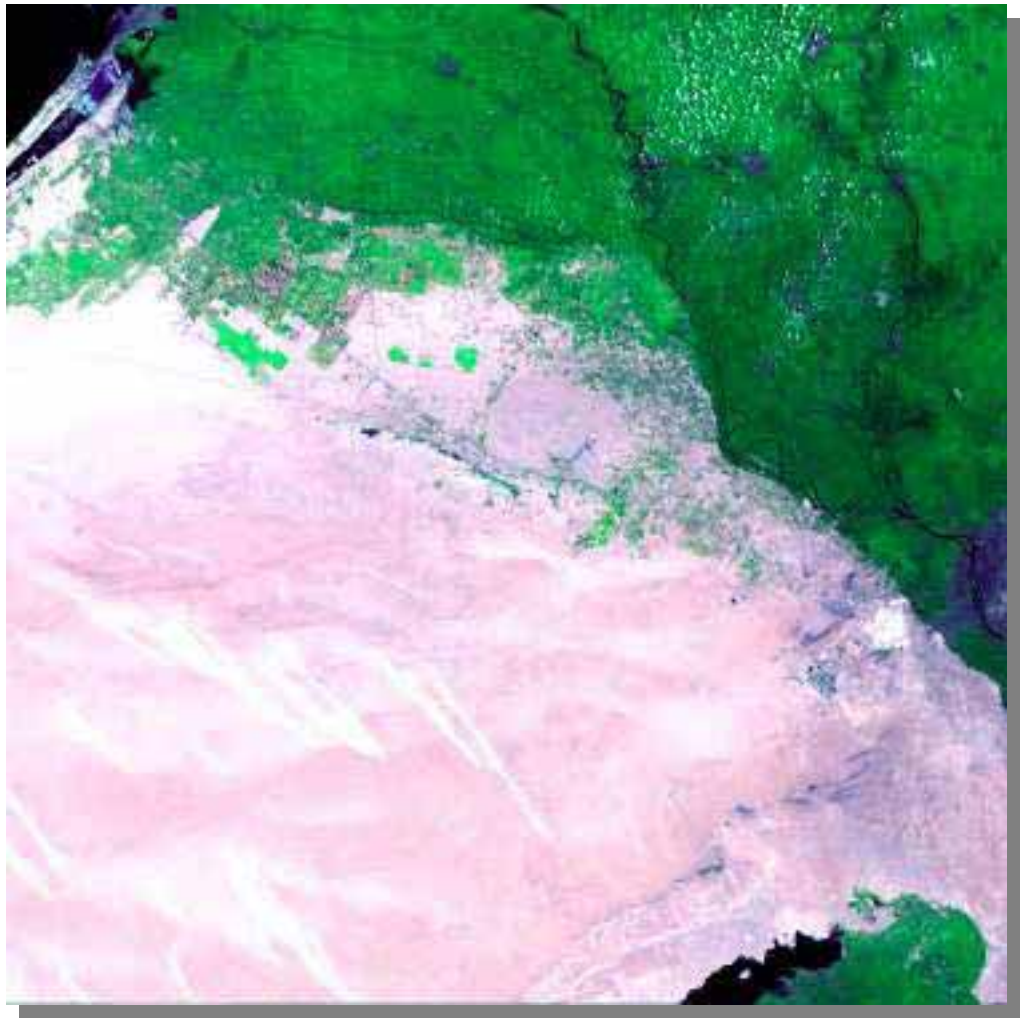
NOAA

- **Origin: USA**
- **Resolution:1.1x1.1 km (4bands)**
- **Temporal Resolution: Twice daily**
- **Scale 1:1,000,000**

Egypt, Alexandria

Landsat TM 5

- **Origin : USA**
- **Resolution: 30x30 m (7 bands)**
- **Temporal Resolution: Every 16 days**
- **Scale 1:100,000**



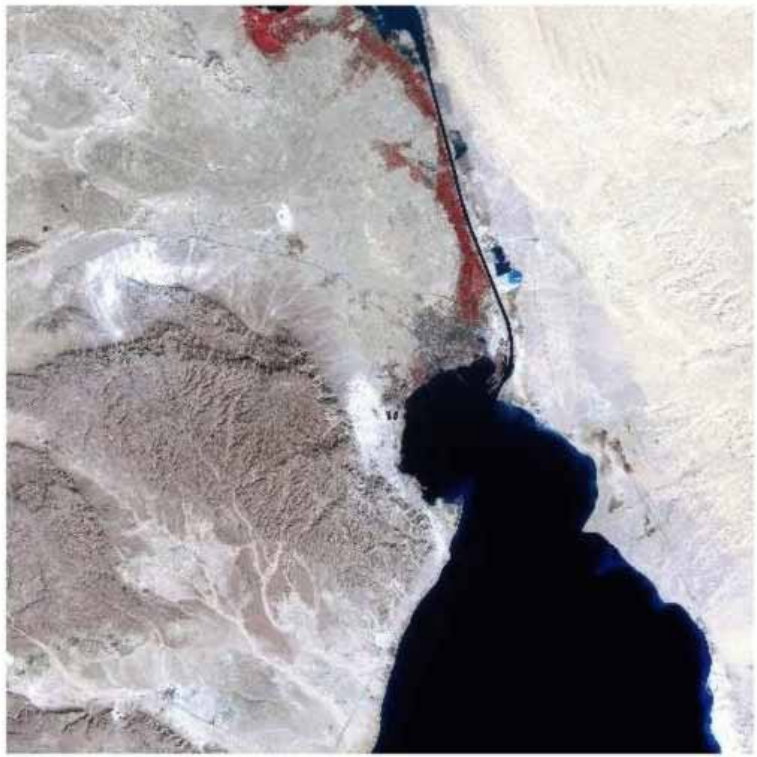
Egypt, The Pyramids

Landsat ETM 7

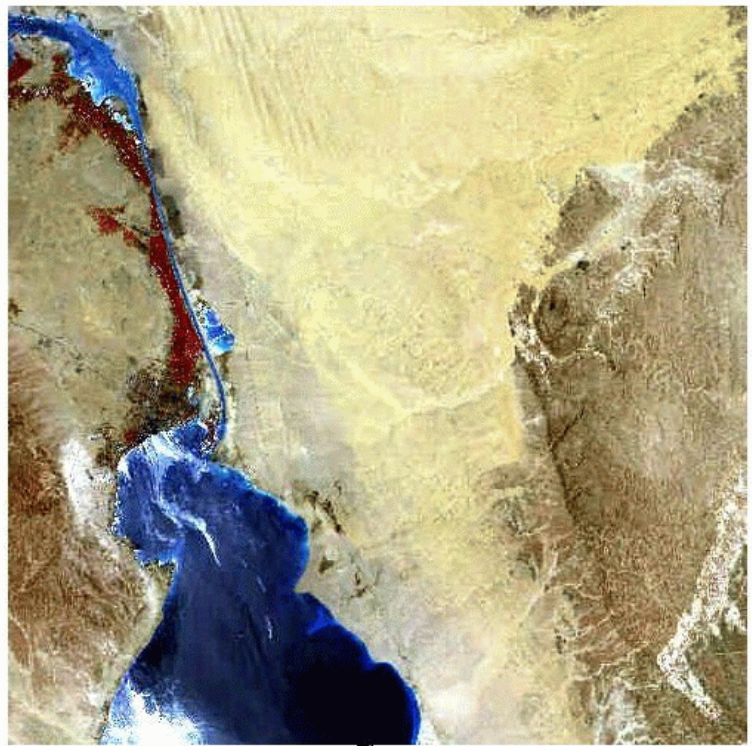
- **Origin : USA**
- **Resolution:**
  30x30 m
  (multispectral)
  15x15 m
  (panchromatic)
- **Temporal Resolution:**
  Every 16 days
- **Scale 1:100,000**
  1:50,000

Spot

SPOT Images



SPOT image teken on 11/21/1998, shows the clear water and the low concentration f suspended substances or chlorophyll in the Suez Gulf in winter due to the decrease in temperature.



Figure

Multispectrial SPOT image taken on 6/25/1998, in the visible and near IR bands, with 20 m resolution. The surface patterns and large area of susbended matter due to biological (chlorophyll) activities appear in white color North of Suez Gulf.

Origin:
France

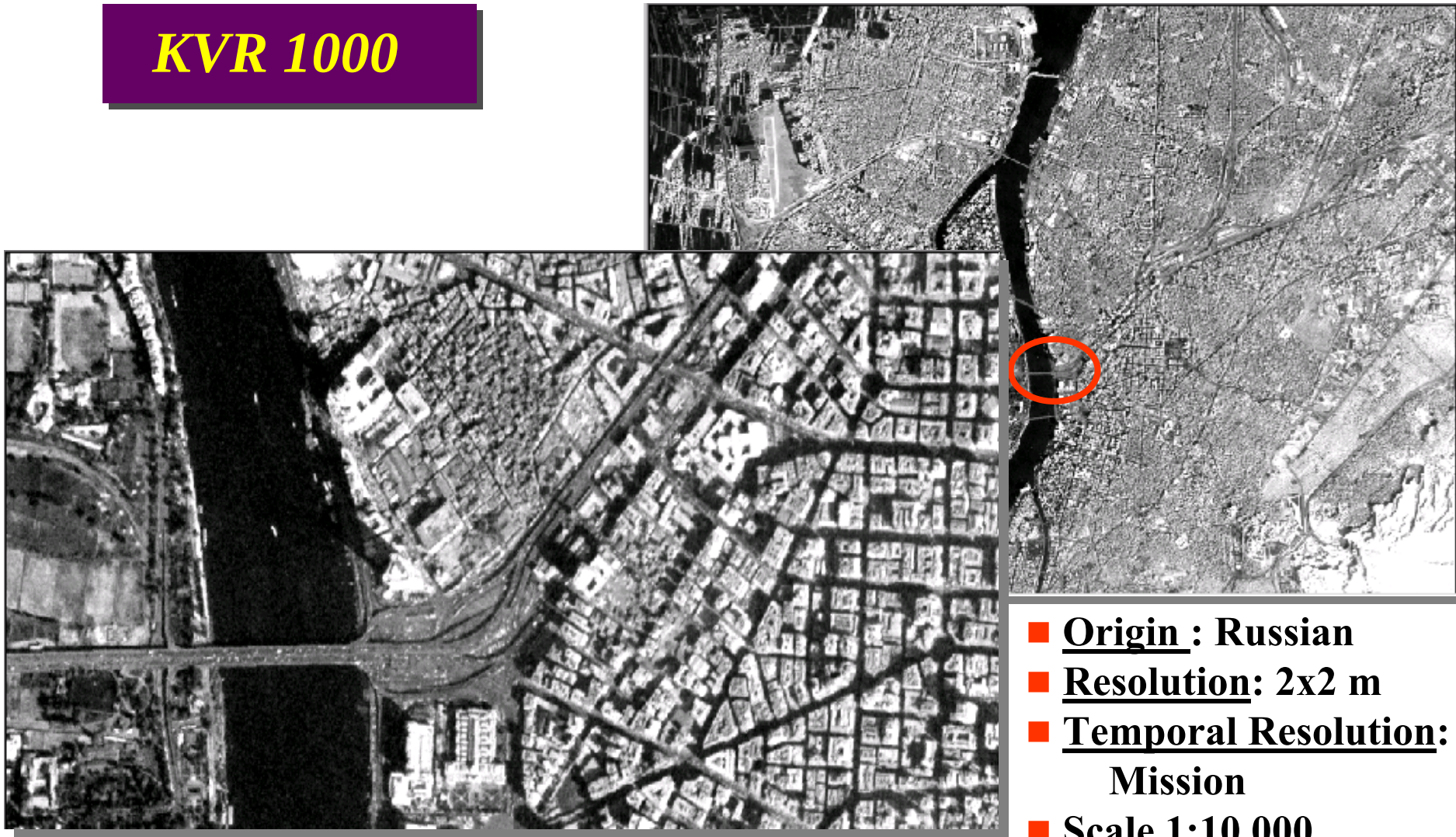
Resolution:
Multispectral 3 bands 15m x 15m
Panchromatic 10m x 10m

Scale 1:20,000

IRS_1D

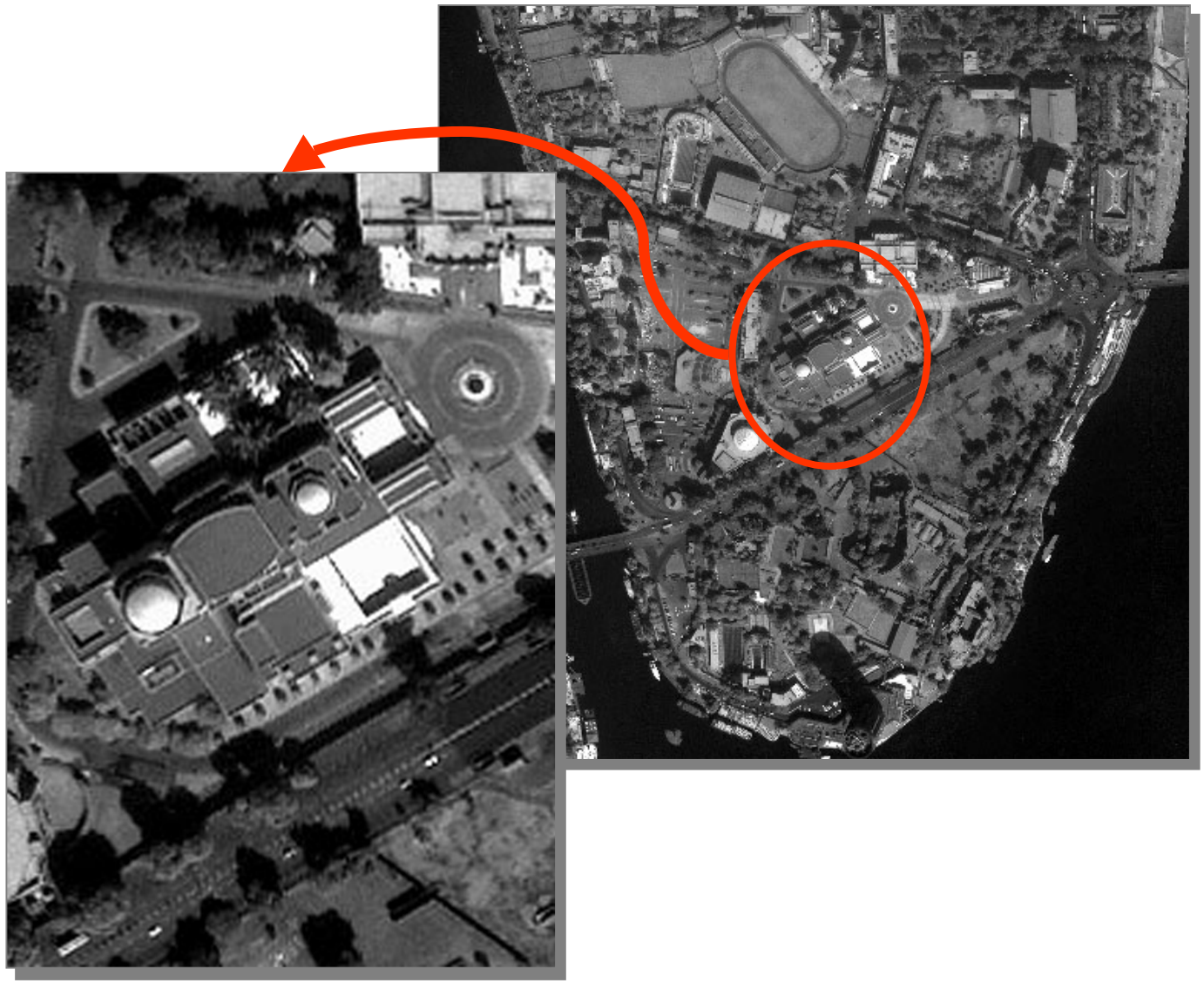
- **Origin : Indian**
- **Resolution:**
  5.8x5.8 m
- **Temporal Resolution:**
  Every 45 days
- **Scale 1:25,000**

KVR 1000



Egypt, Cairo

- **Origin : Russian**
- **Resolution: 2x2 m**
- **Temporal Resolution: Mission**
- **Scale 1:10,000**



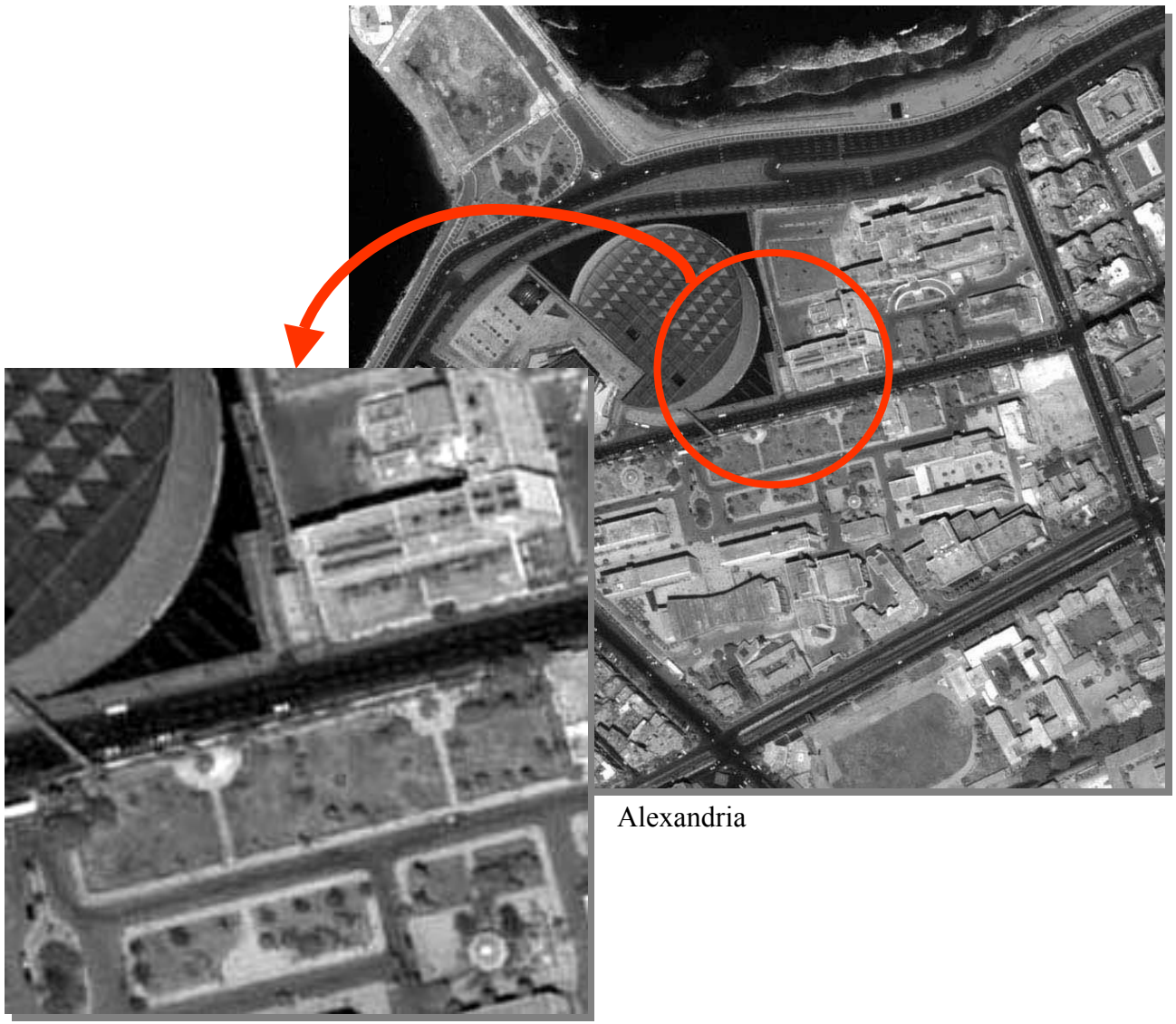
IKONOS

- **Origin : USA**
- **Resolution: 1x1 m**
- **Temporal Resolution: 11 days**
- **Scale 1:5,000**

IKONOS

- **Origin : USA**
- **Resolution: 4 x 4 m (4 bands)**
- **Scale 1:20,000**

QuickBird

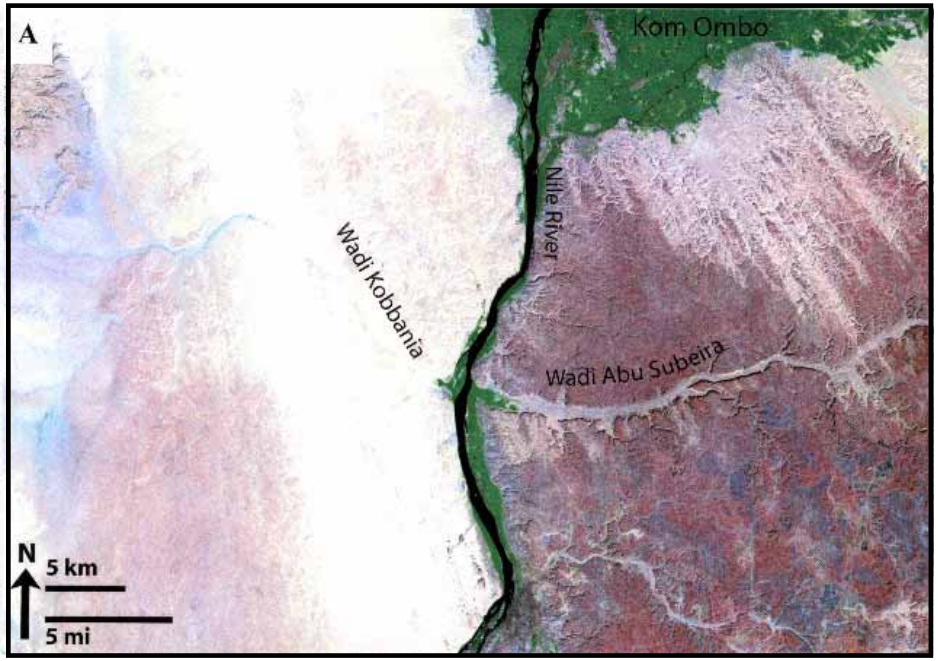


Alexandria

- **Nationality: USA**
- **Resolution:**
  0.7m x 0.7m
  Panchromatic
- **Temporal Resolution:**
  5 days
- **Scale 1:2,500**

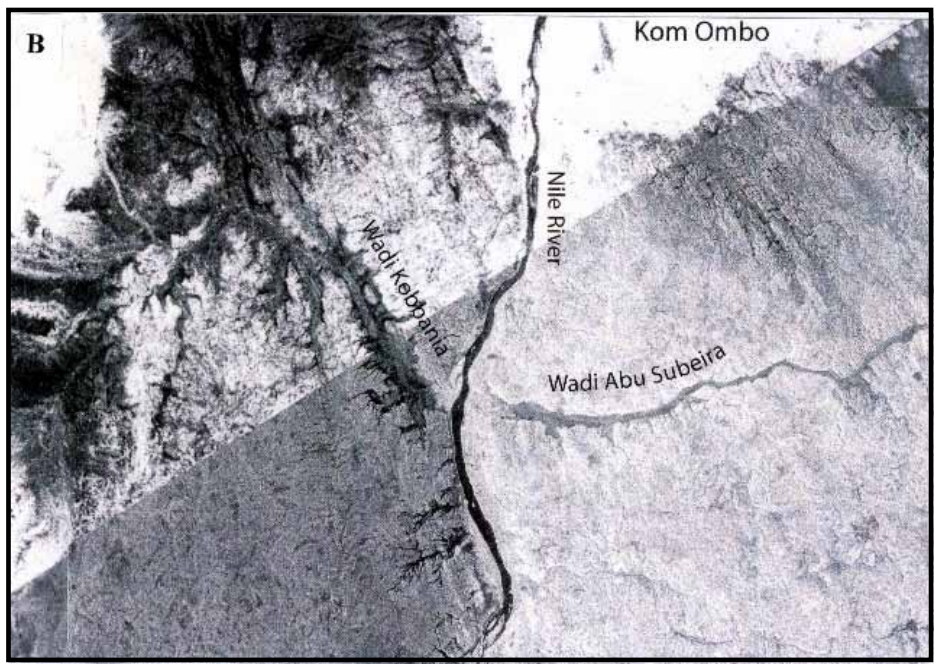
QuickBird

- **Origin : USA**
- **Resolution:**
  4m x 4 m
  (Multispectral)
  (4 bands)
- **Scale 1:15,000**



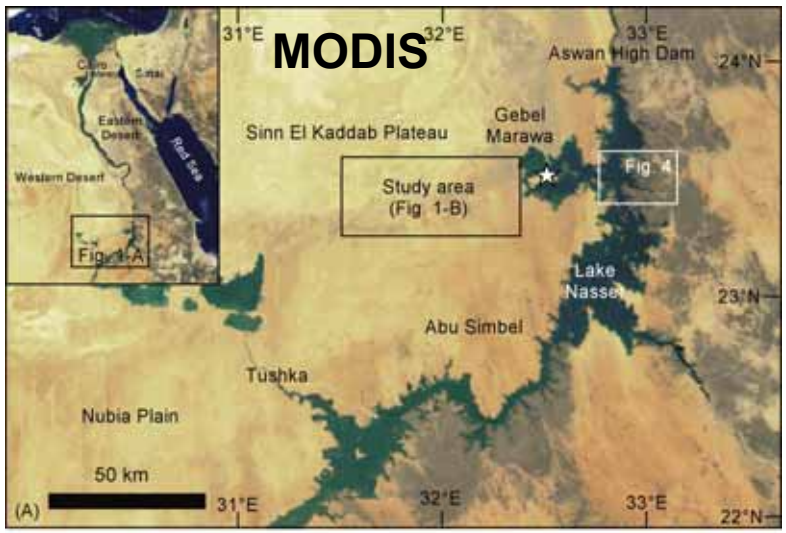
A- Optical Landsat TM Image of the Kom Ombo Area

B- SIR-C Radar Image of the Kom Ombo Area



Radar

Integration between different tools



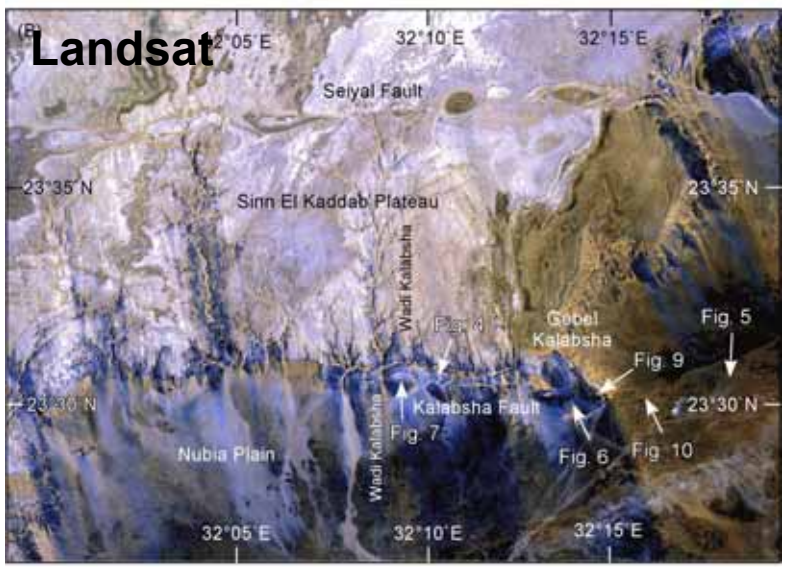
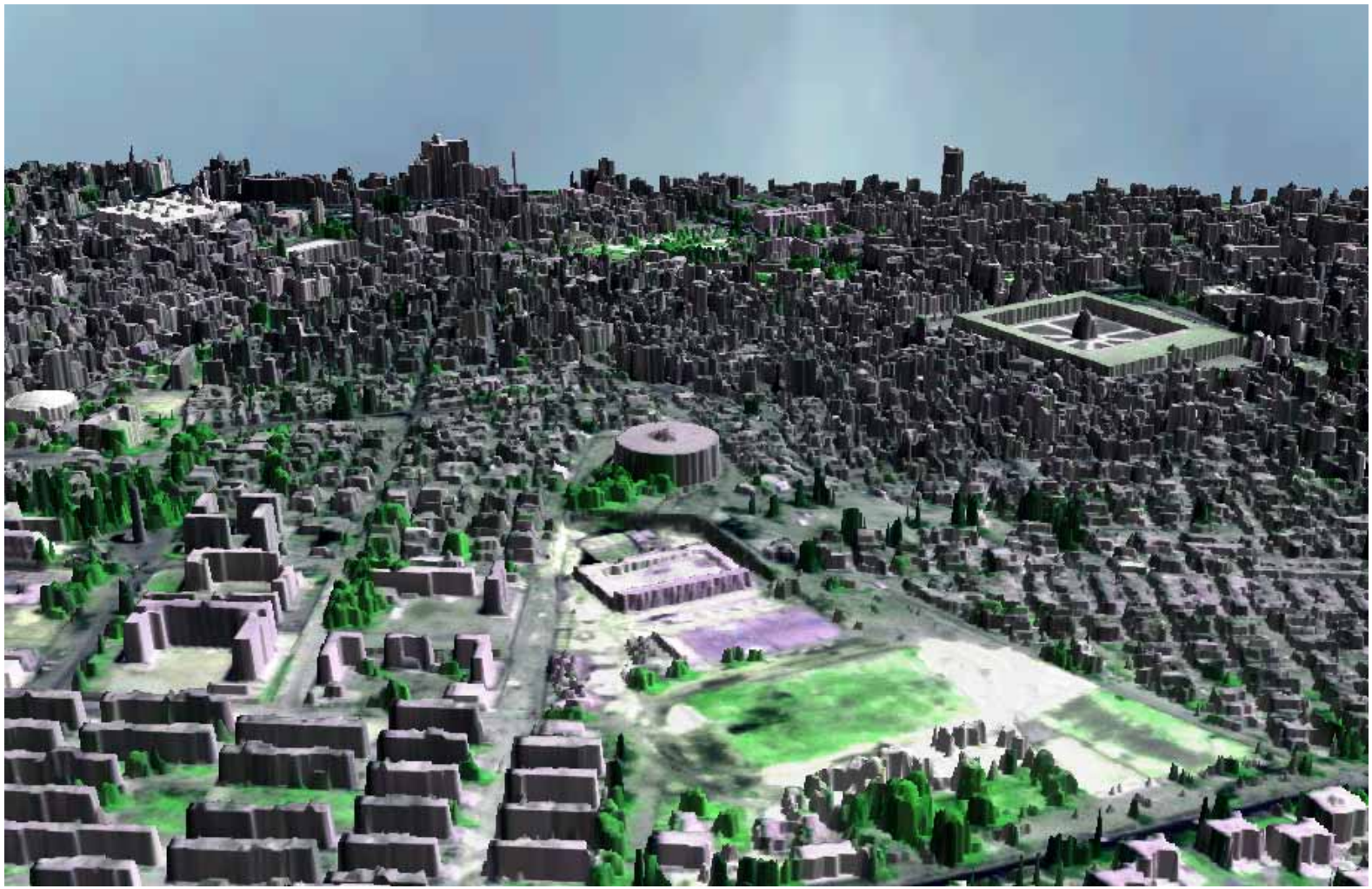
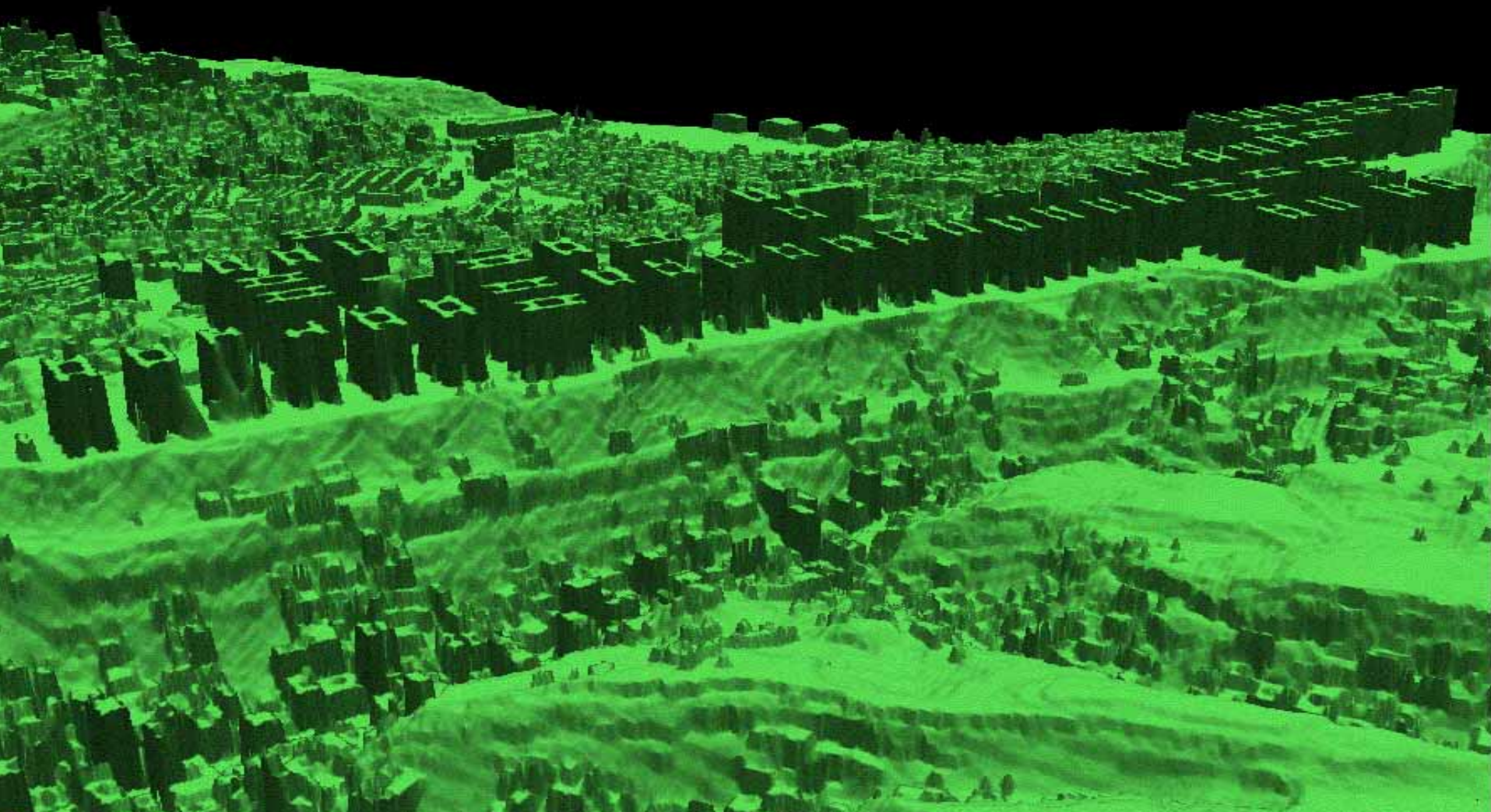


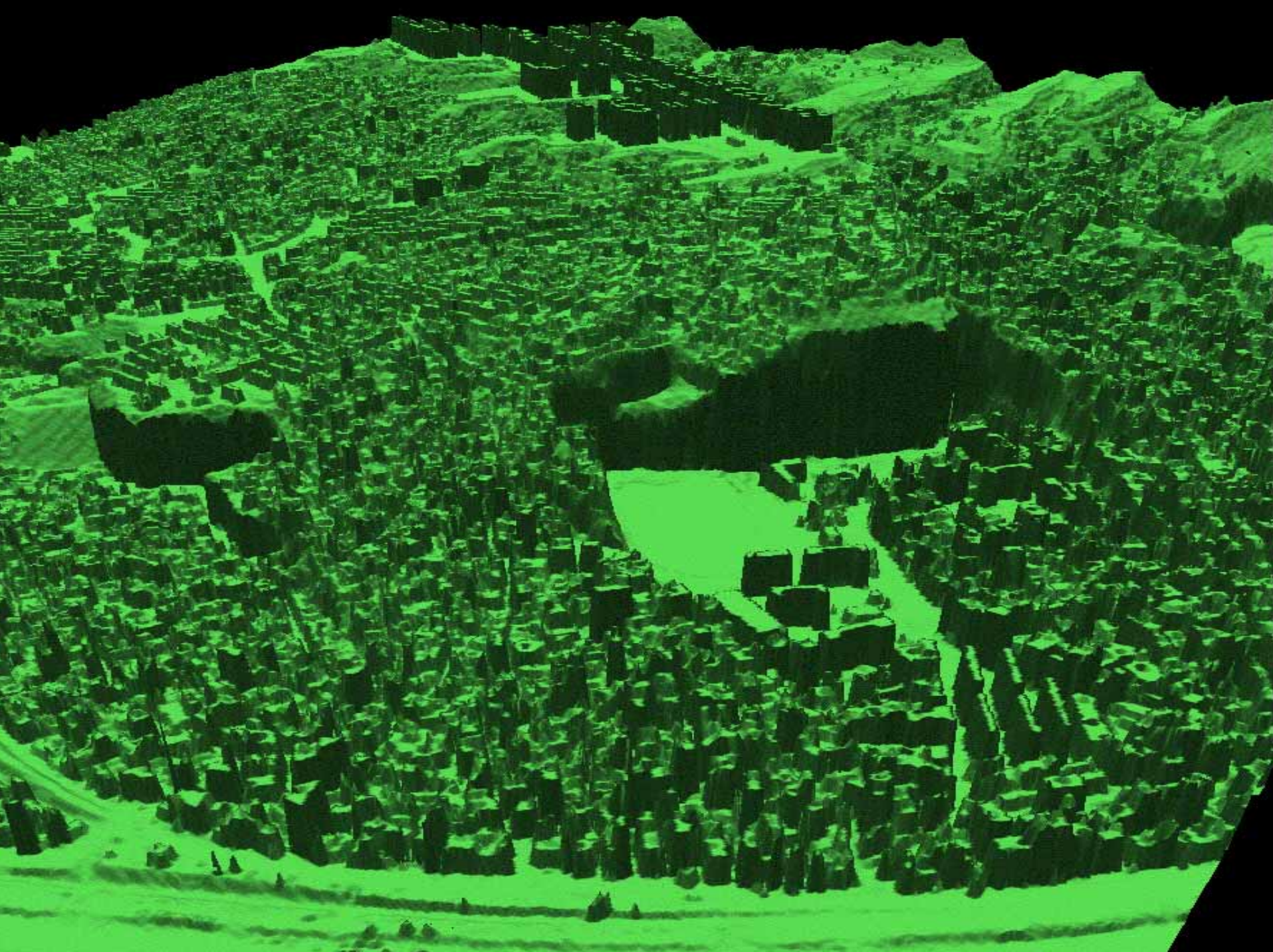
Fig. 1: A MODIS image (A) and a Landsat ETM image (B) showing the location of the studied part of the Kalabsha fault in the south Western Desert of Egypt. The star shows the focus of the 1981 earthquake.

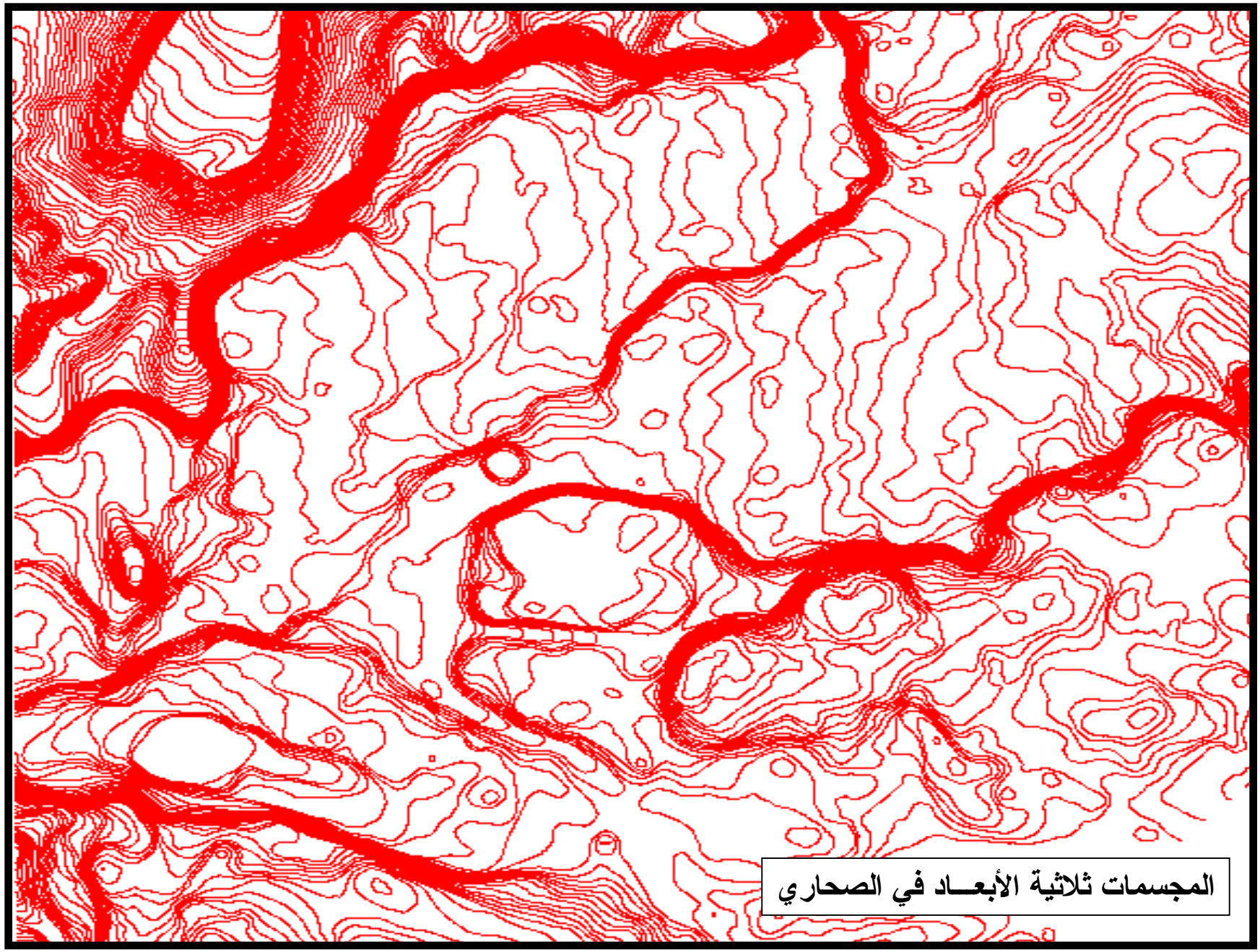
الصور ثلاثية الأبعـــاد فى المدن

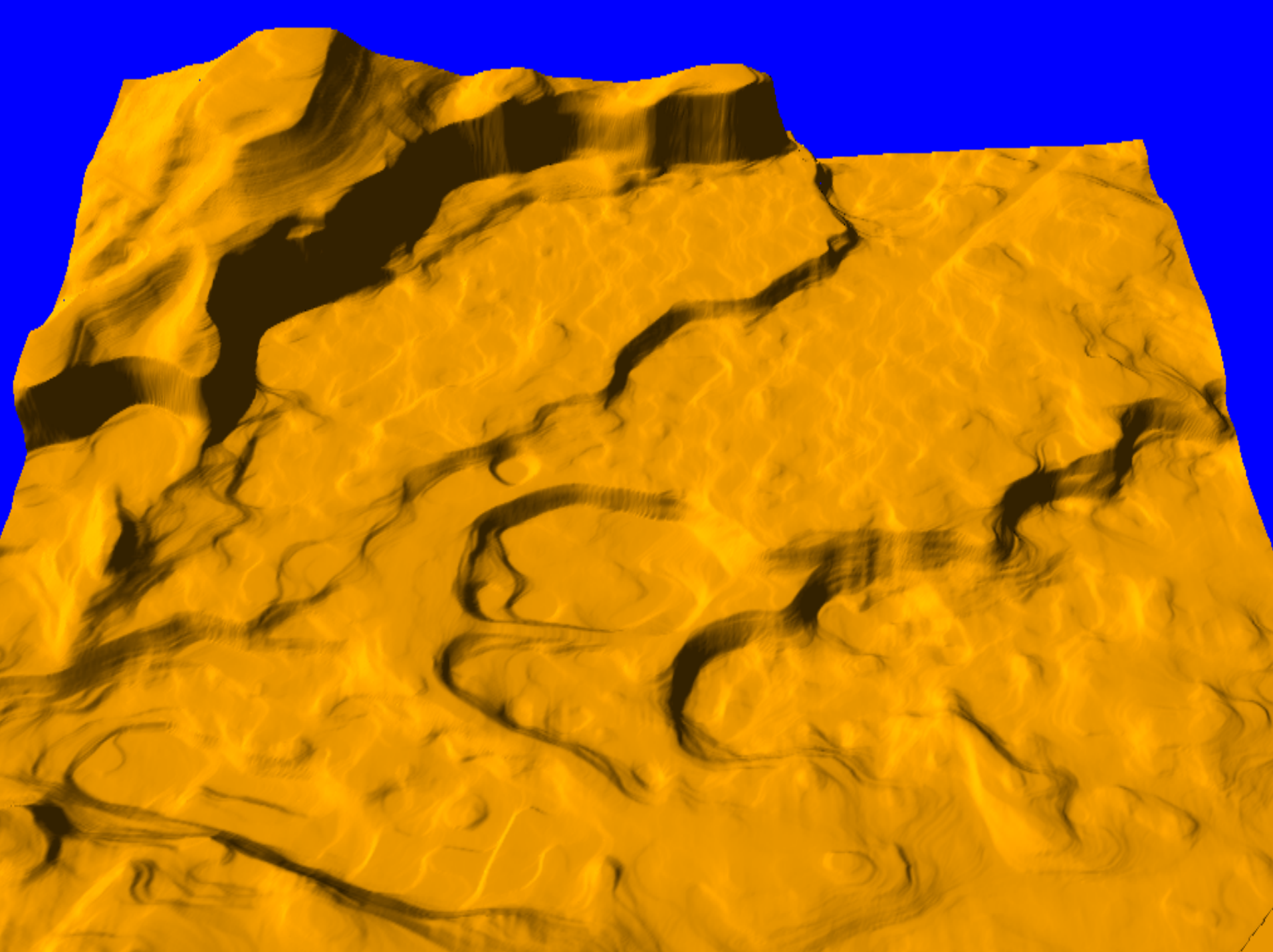


الصور ثلاثية الأبعـــاد فى المدن
منطقة منشأة ناصر بالقاهرة

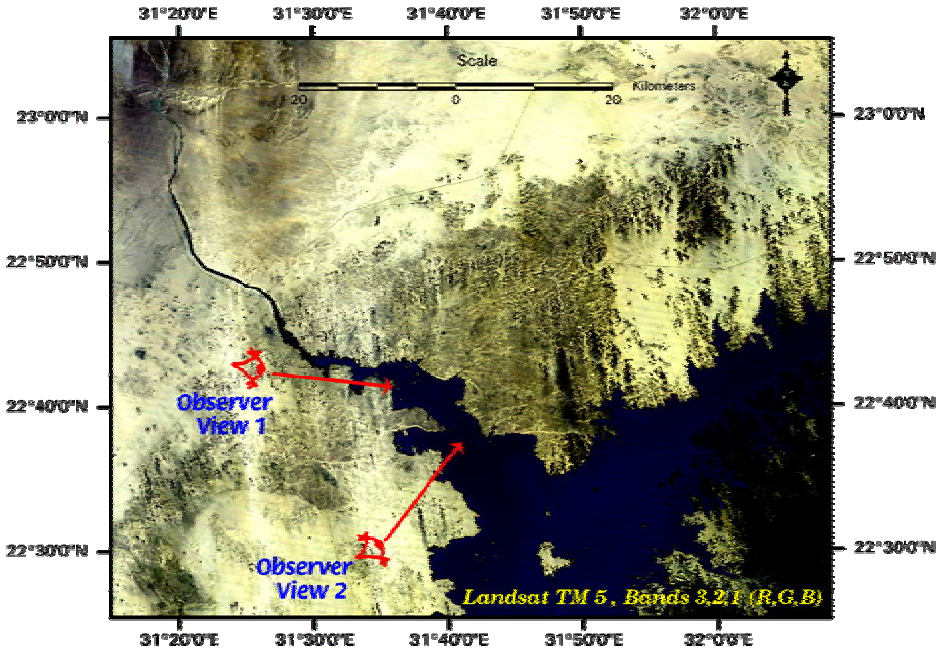


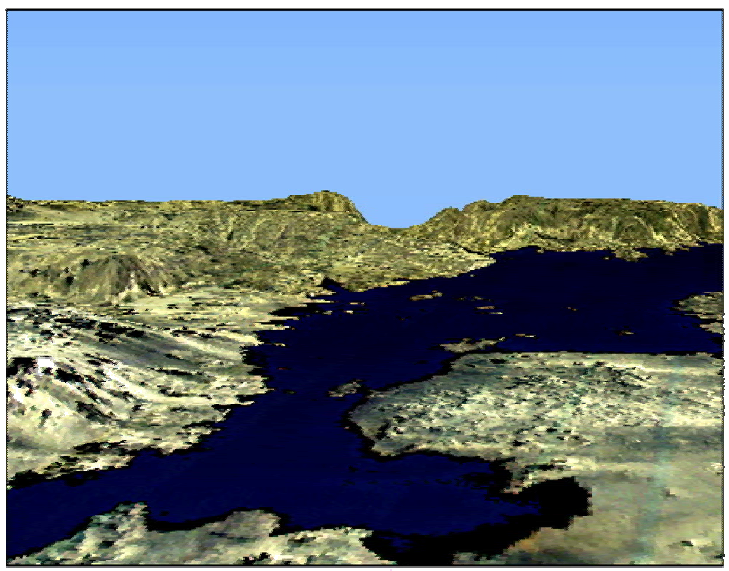



المجسمات ثلاثية الأبعـــاد في الصحاري

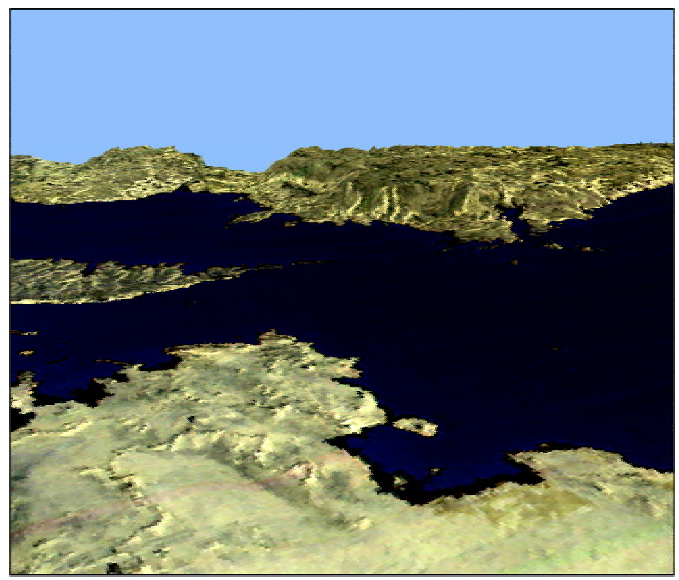


المجسمات ثلاثية الأبعـــاد في الصحاري





Perspective View 1

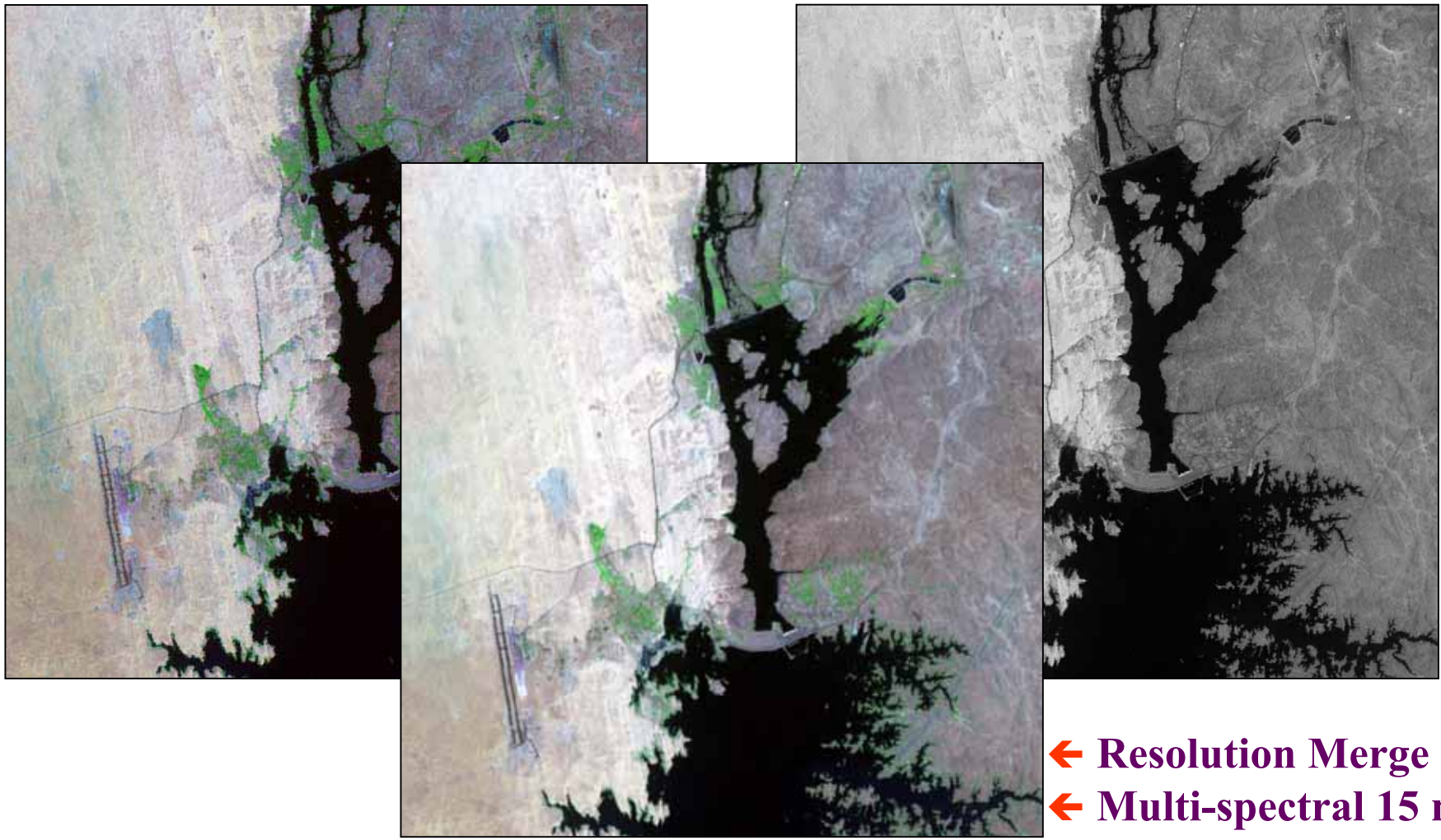


Perspective View 2

دمج درجات الوضوح

Landsat TM7
30 m

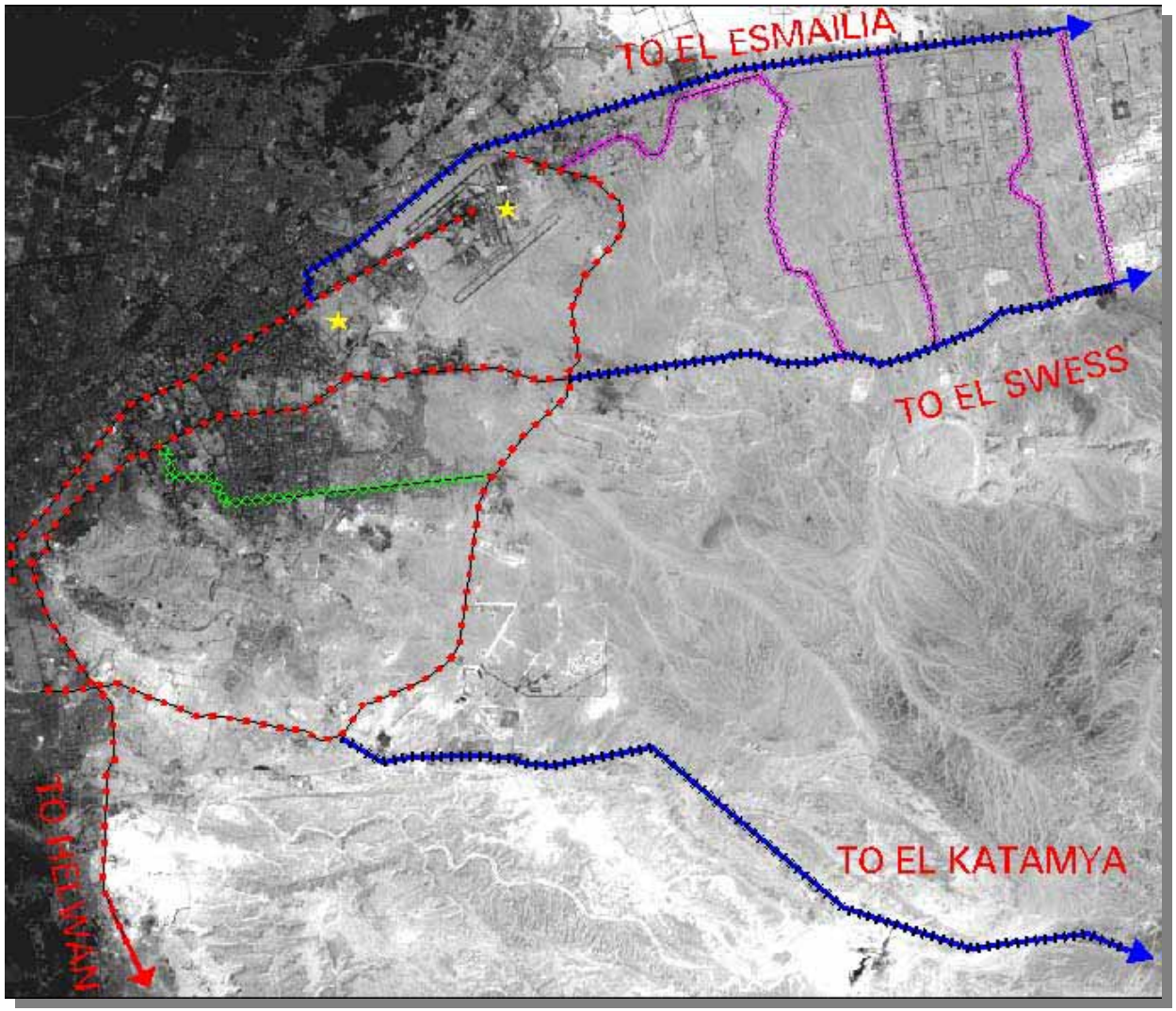
Landsat TM7
15 m



Resolution Merge

Multi-spectral 15 m

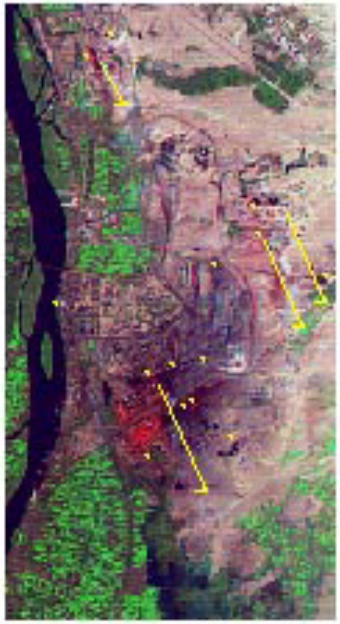
التعرف على المواقع وتحديث الخرائط



Egypt, New Cairo

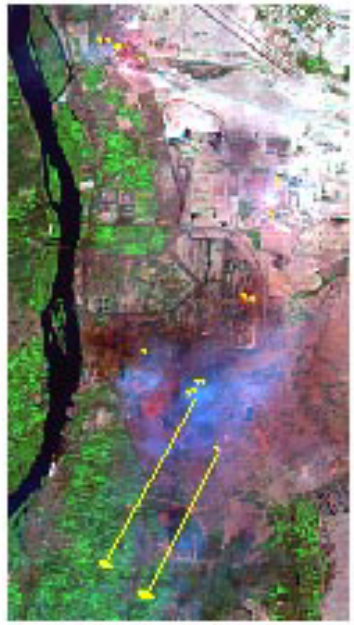
المتابعـــة البيئيـــة

POLLUTION MONITORING IN HELWAN

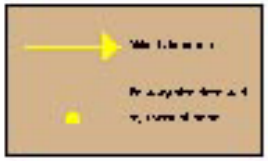


LANDSAT TM 5 (28 DEC 1992)

LANDSAT TM 5 (2 AUG 1994)



LANDSAT 7 ETM (8 NOV 1999)



THERMAL POLLUTION DETECTION

(6,7,2) BAND COMBINATION

Egyptian Satellite Coverage

مفهوم تكنولوجيا نظم المعلومات الجغرافية

Definition of Geographical Information Systems

GIS نظام المعلومات الجغرافي

A decision support system involving the integration of spatially referenced data in a problem solving environment.

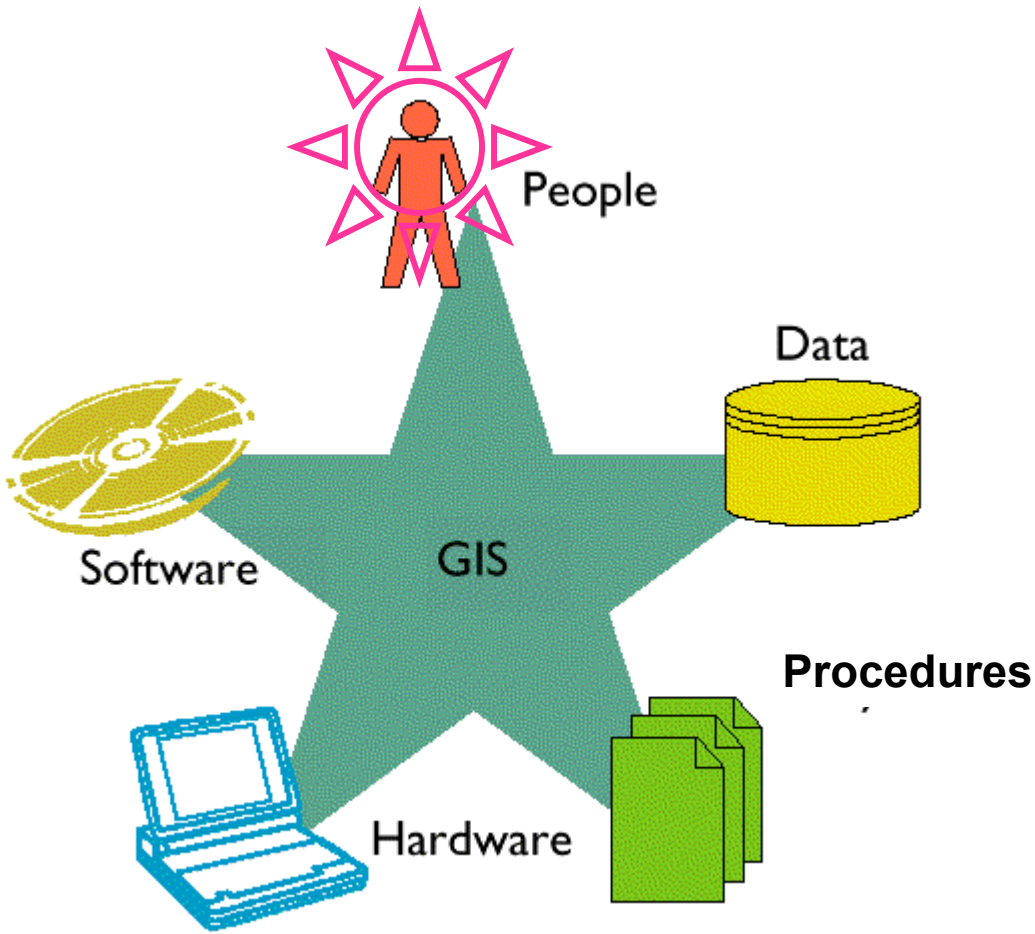
نظام لدعم اتخاذ القرار يشمل العديد من البيانات المكانية لحل مشكلة بيئية

The system is a computer-based tools for capturing, storing, retrieving, analysing and displaying data.

هذا النظام يعتمد على الكمبيوتر للحصول على البيانات وتخزينها واسترجاعها وتحليلها ثم عرضها بشكل مناسب

What is a GIS?

- An integration of five basic components



A

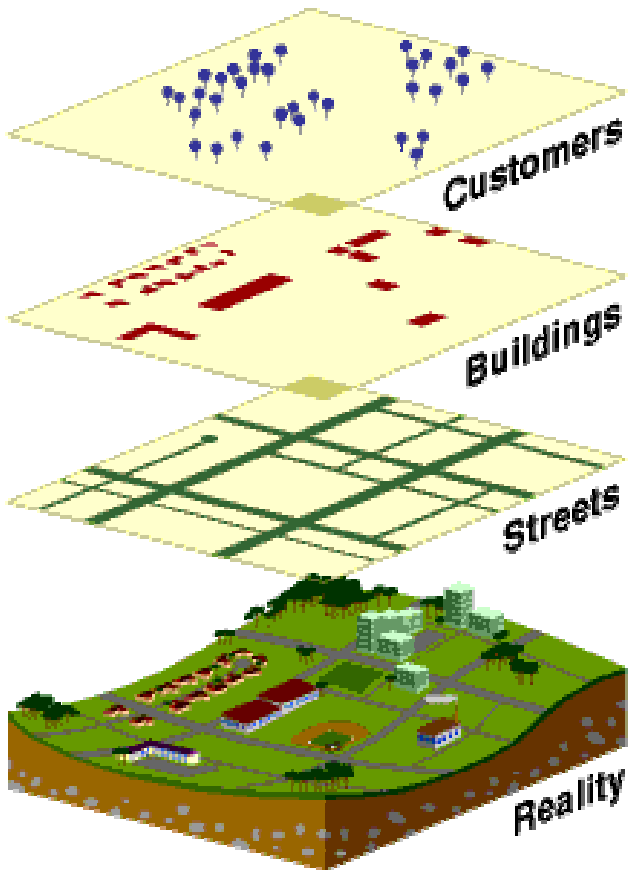
GIS functions

طريقة عمل نظم المعلومات

Capture
جمع البيانات

Store
تخزين البيانات

Query
استفسارات
وجدولة البيانات

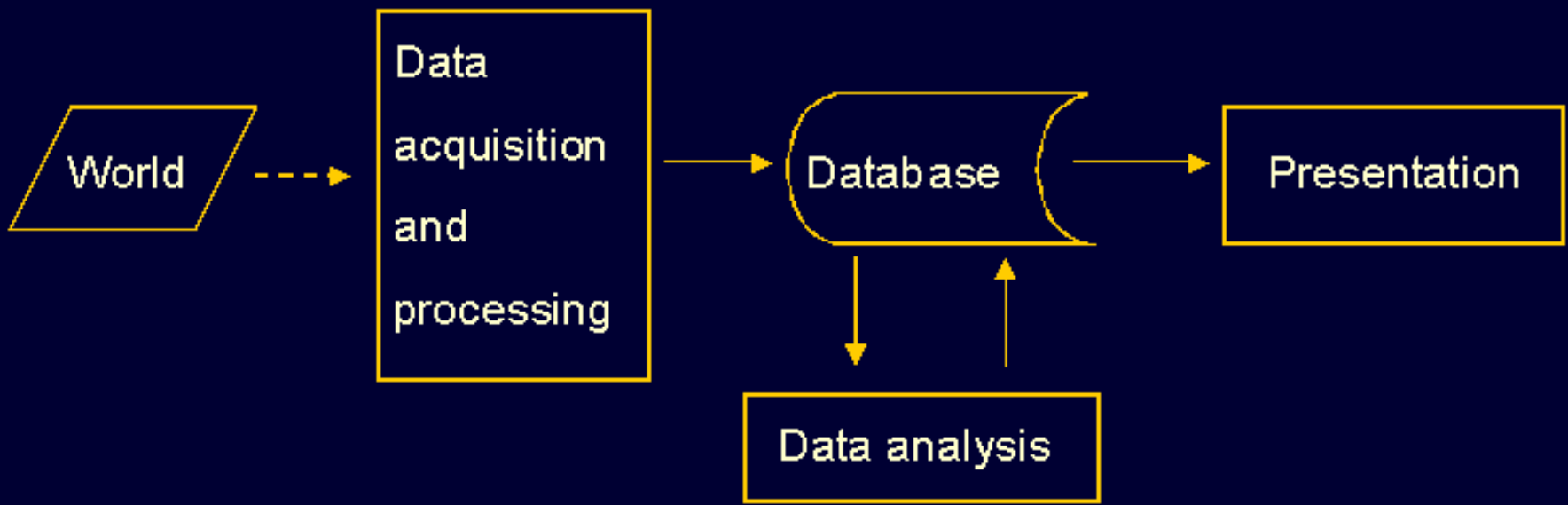


Analyze
تحليل البيانات

Display
عرض البيانات

Output
النتاج

GIS Process



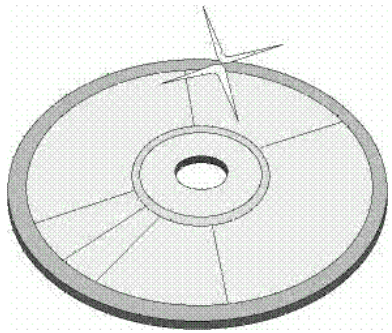
Data acquisition examples:

- field measurements
- statistical data
- cartographic data (maps)
- land surveying
- GPS
- remote sensing

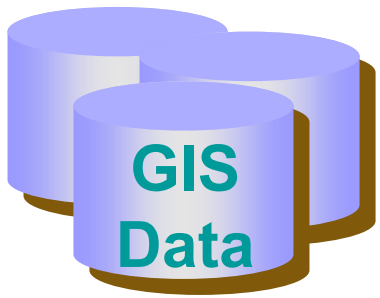
Remote sensing includes data processing and analysis.

Capturing data

Paper maps

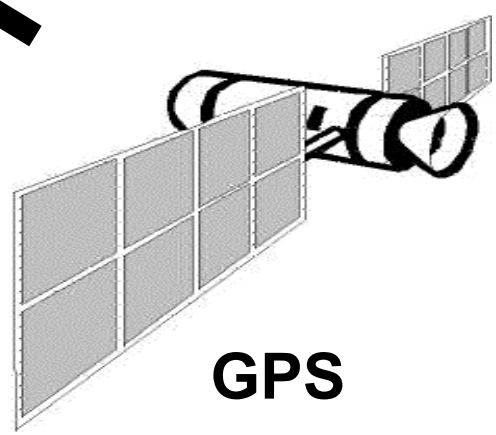


Digital data




```
480585.5, 3769234
483194.1, 3768432
485285.8, 3768391
484327.3, 3768565
483874.7, 3769823
```

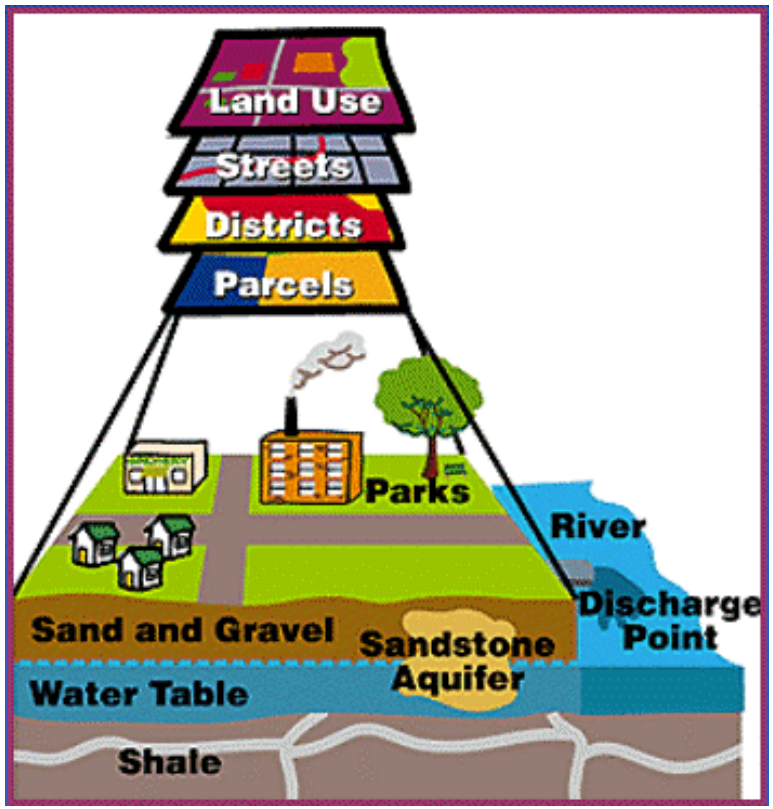
Coordinates



GPS

Organizing spatial data

- A GIS works with thematic layers of spatial data

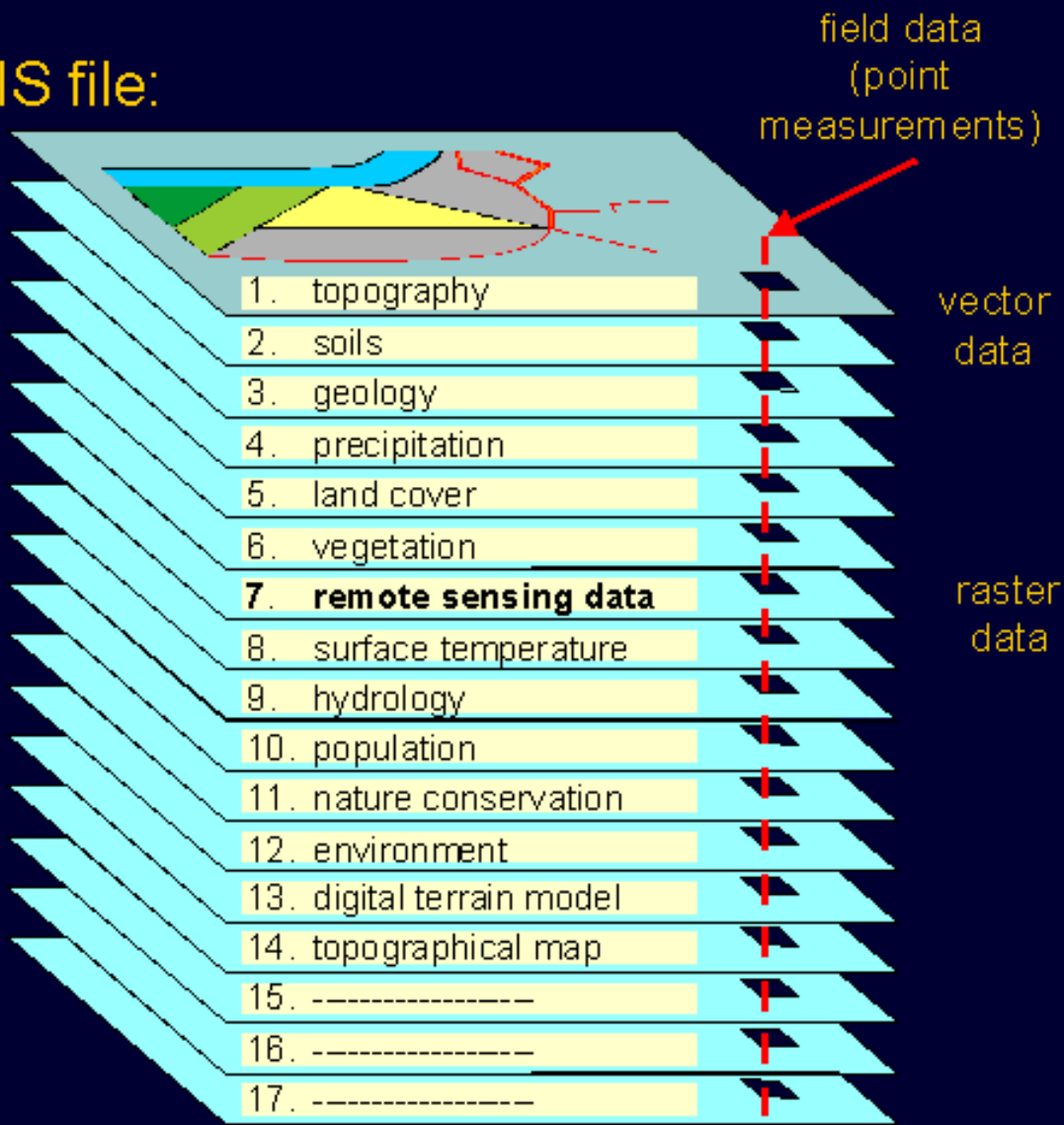


- Answer questions by comparing different layers of data

GIS Geographical Information System

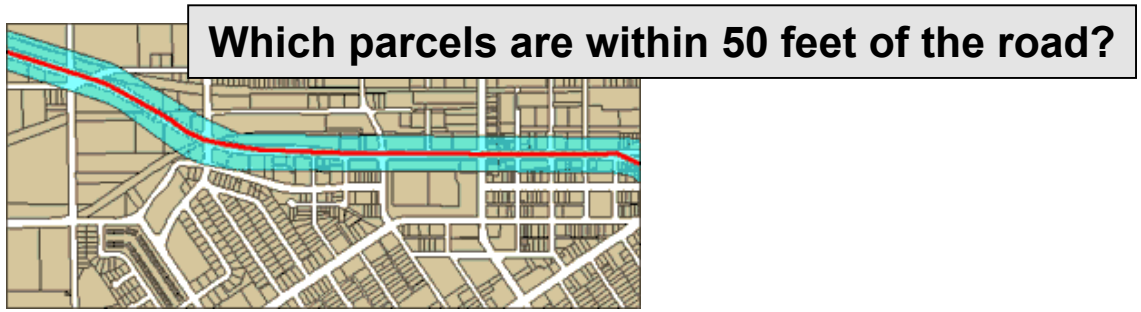
Well-considered combination of mutually referring **data sets** of various kinds of **position-bound thematic data** (database), software inclusive

Requirement:
the information layers match geometrically
==> OVERLAY STRUCTURE

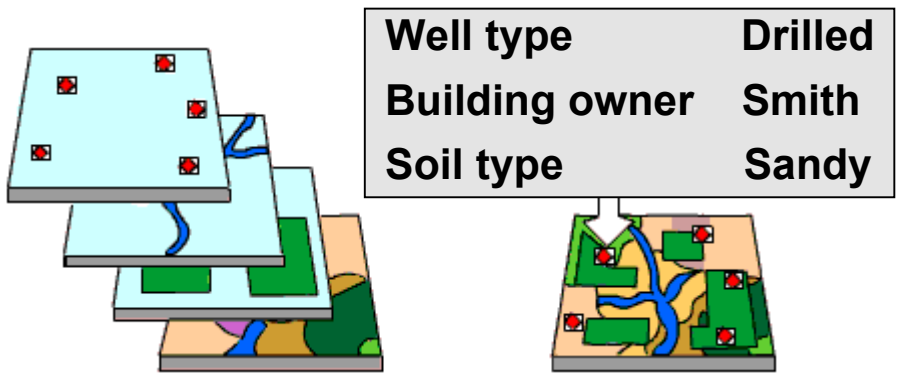


Data Analysis

- Proximity

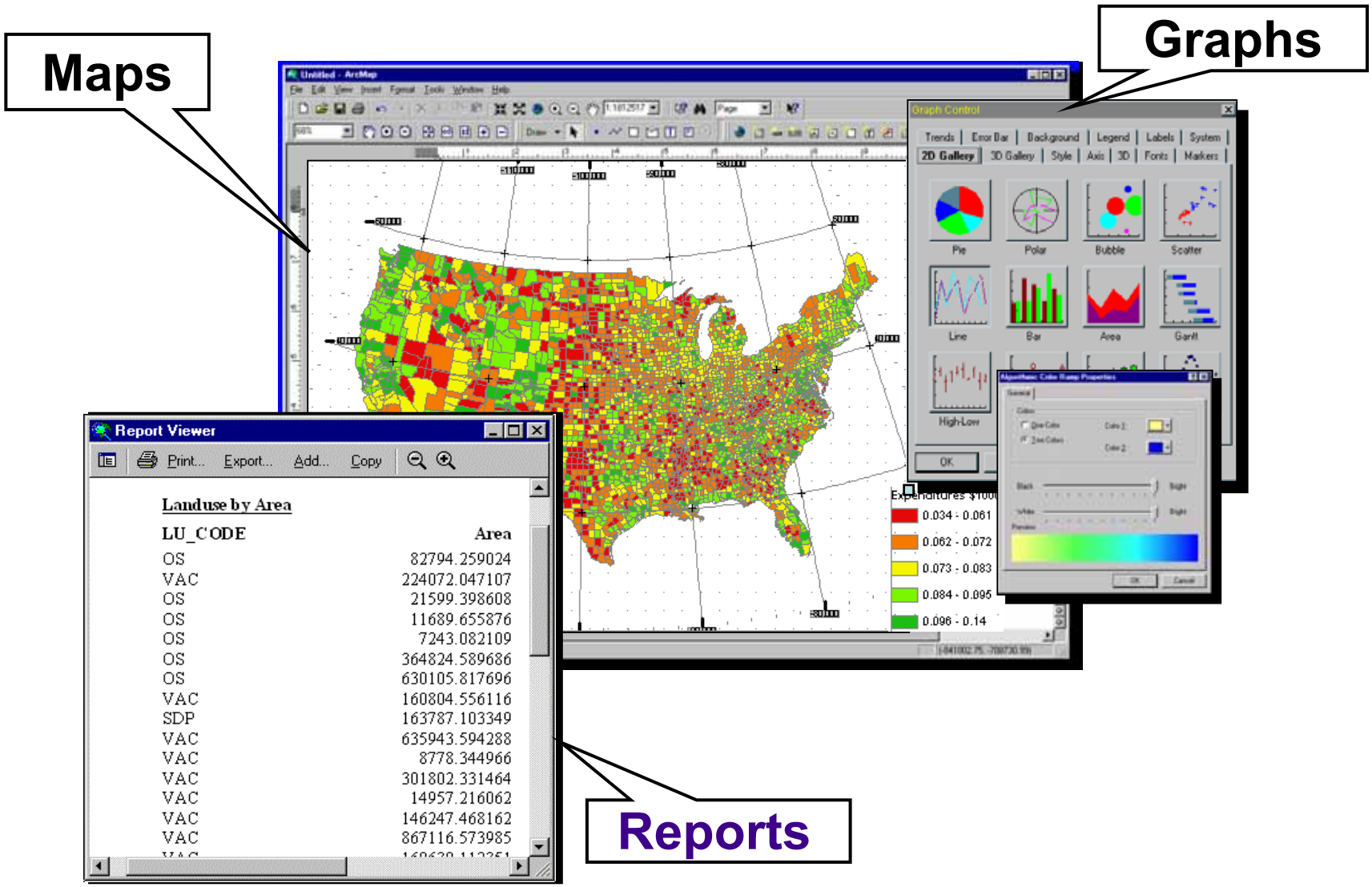


- Overlay



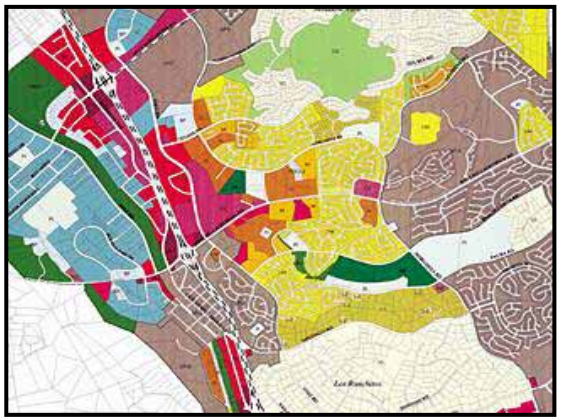
- Network

Display Data

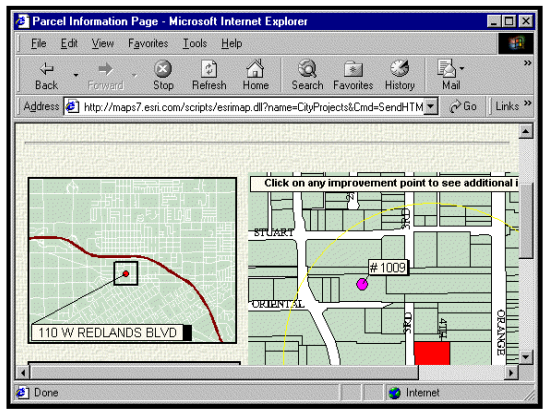


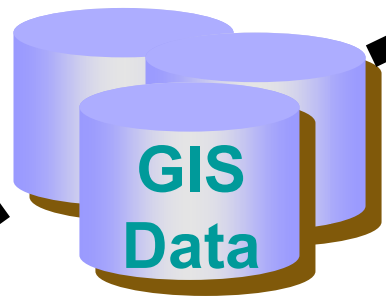
Data Output

Paper map

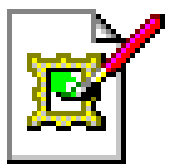


Internet



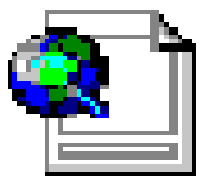


Image



florida.jpg

Document



Florida.mxd

تطبيقات نظم المعلومات الجغرافية لاختيار أنسب المواقع لدفن النفايات الخطرة

Application of geographic information systems (GIS) for site-selection of hazardous wastes disposal

Site Selection Criteria معايير اختيار الموقع

Input Layers المدخلات

1- Property Boundary

2- Distance from Airports

3- Distance from Schools and Dwelling

4- Distance to Primary Highways

5- Distance to Public Parks

6- Distance to Cities and Towns

7- Local Zoning and Land-use

8- Distance to Drinking Water Sources

9- Distance to Surface Water and Environmentally Sensitive Areas

a- Distance to Lakes and Ponds

b- Distance to Rivers or Streams

c- Wetlands d- Coastal Features

10- Biodiversity

11- Distance to Industrial Process Water

12- Floodplains

13- National Historic and Landmarks

14- Wild and Scenic Rivers

15- Endangered Species

16- Winter Range/Breeding Ground

17- Geology (Faults, unstable areas, karst areas, areas susceptible to mass movements , avalanche, soils

18- Distance and Capacity of the Site

Procedures خطوات العمل بالمشروع

1- حصر وجمع جميع البيانات المتعلقة بالمعايير المطلوبة لاختيار أنسب المواقع (في أي صورة)

Compilation of Relevant Data in All Forms (Maps, Reports, Tables, CD Digital)

2- تحويل جميع البيانات إلى بيانات رقمية وذلك بعمل digitizing للظاهرات المختلفة

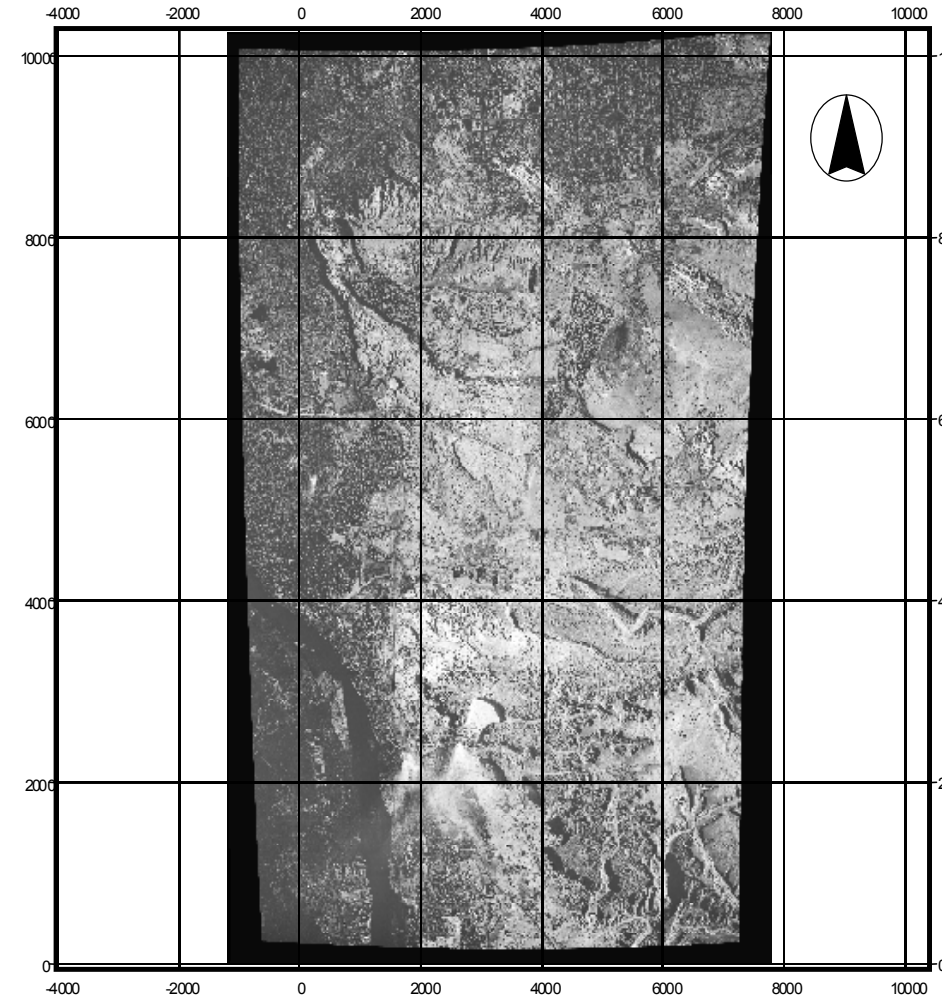
(urban areas, roads, utilities, topography, drainage, geology, structure,etc.)

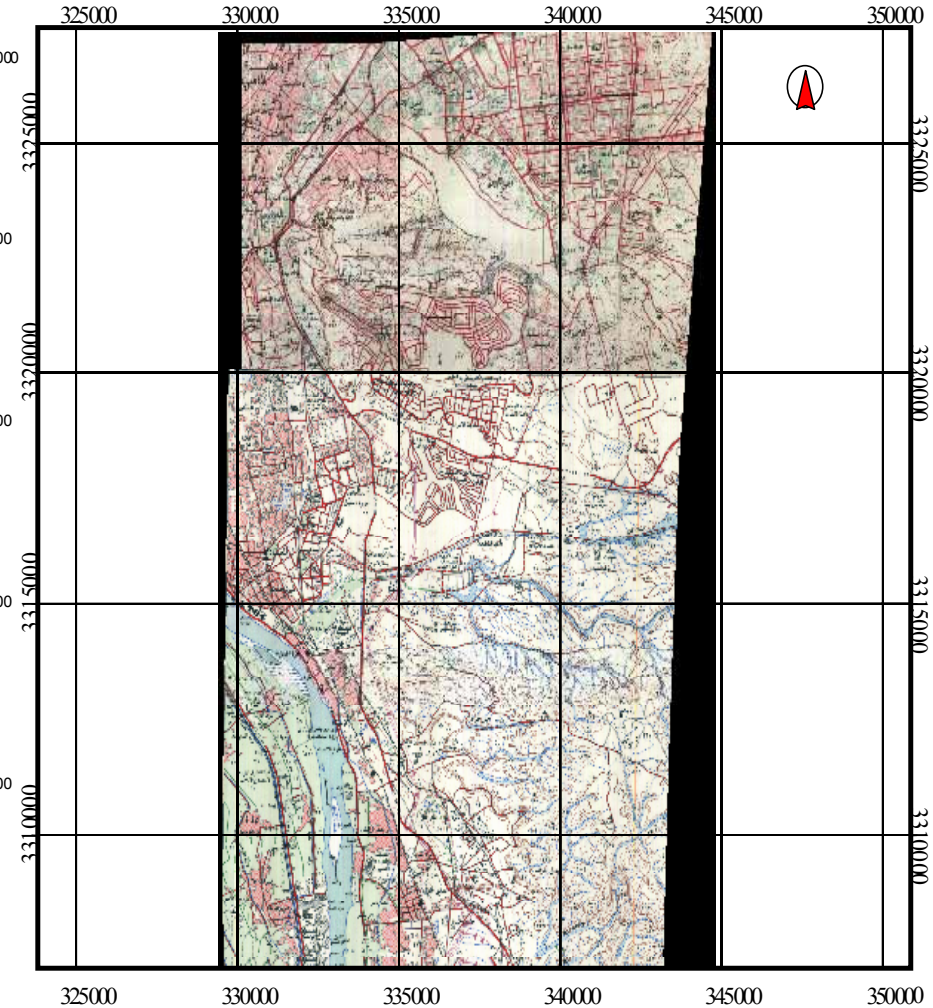
3- تحويل جميع البيانات الرقمية إلى GIS-ready Format

4- تحليل البيانات وعمل نموذج لاستبعاد المناطق الغير صالحة واختيار المناطق الصالحة مع إعطائها وزن للصلاحية

Ranking the Availability of the Different Sites for Hazardous Waste Disposal

Mokatam Area, Cairo



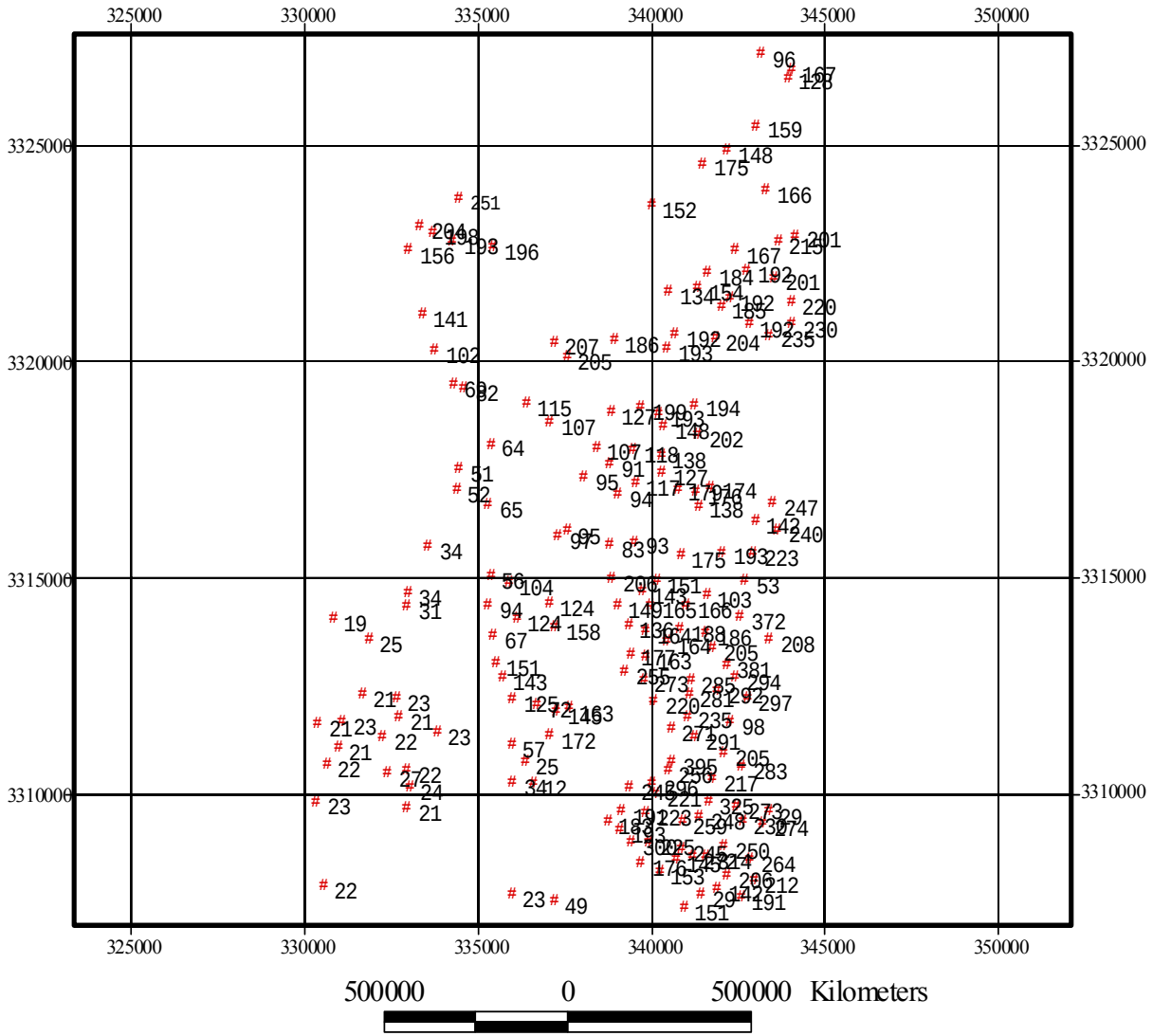


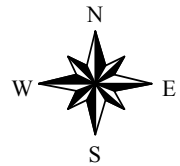
300000 0 300000 Miles

Aerial Photo

Topographic map

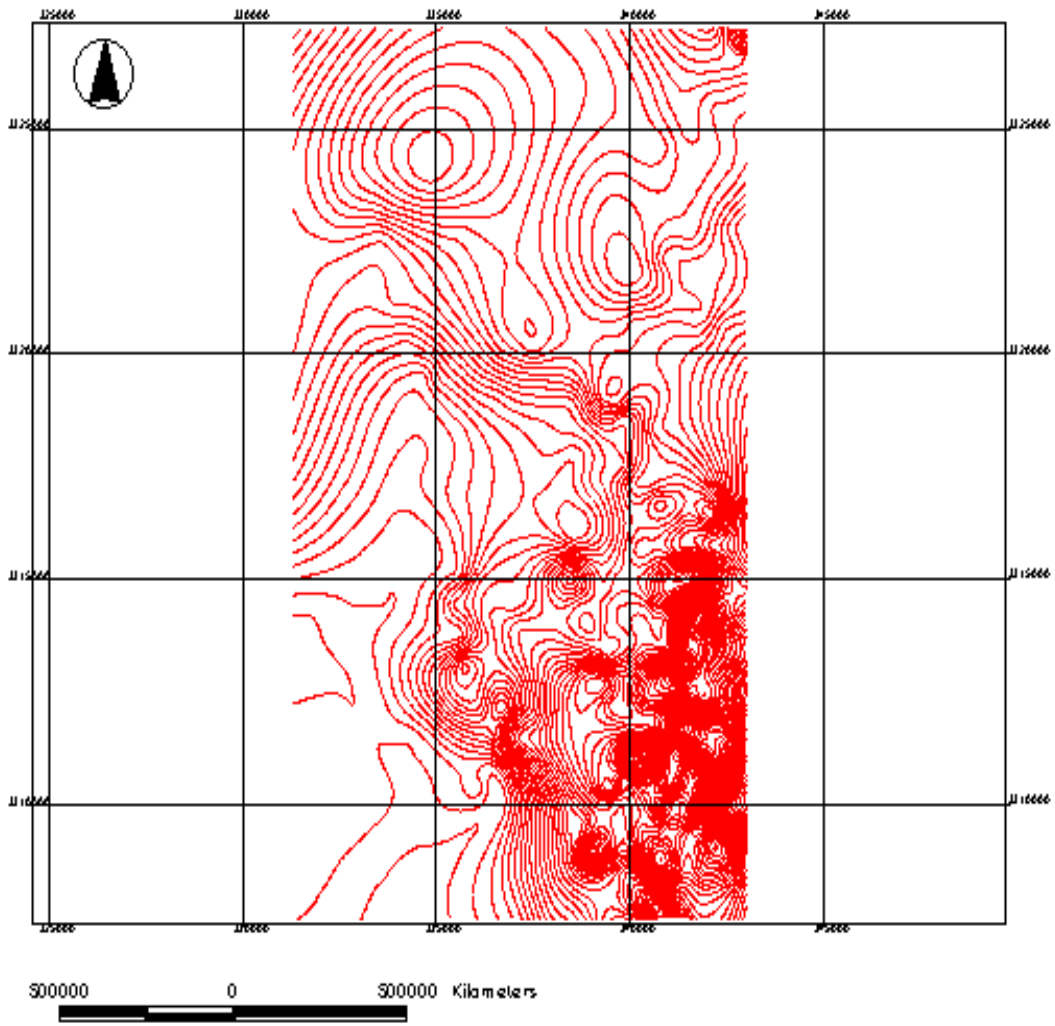
Eelevation point





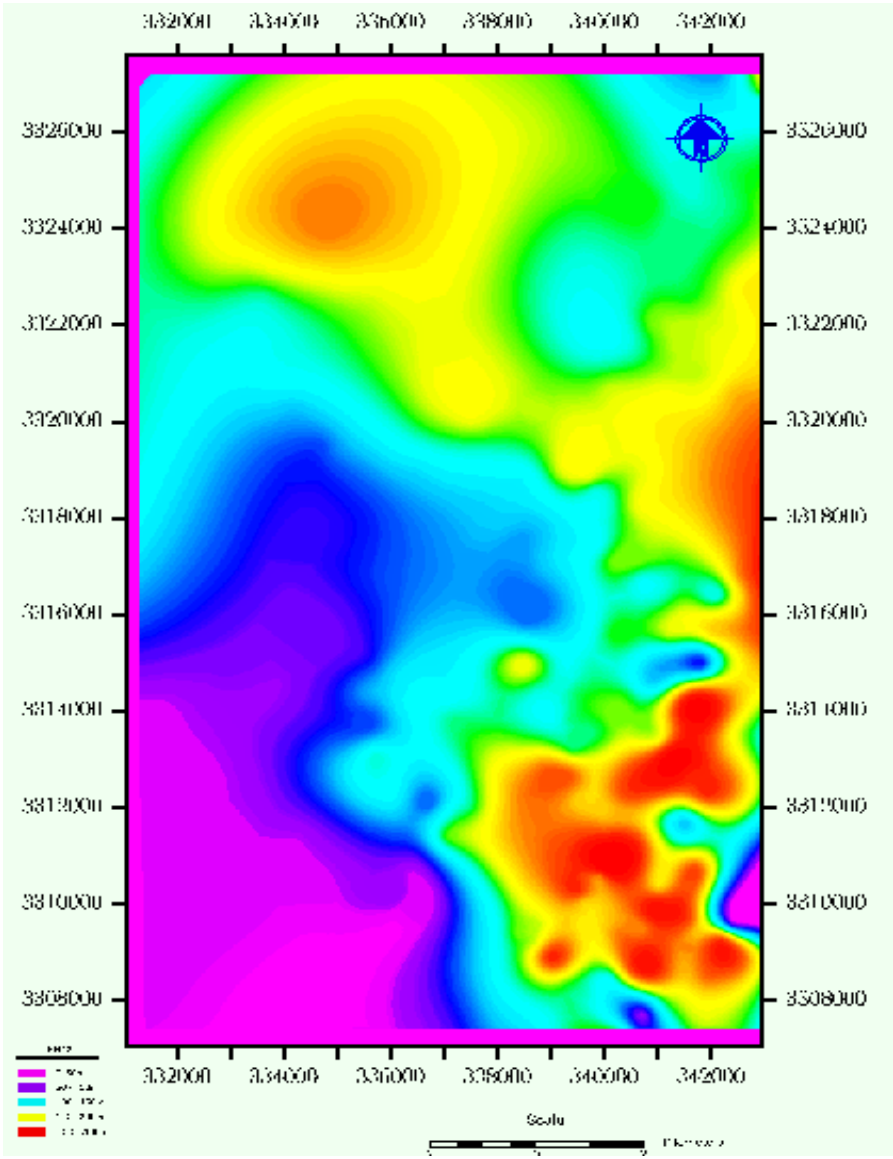
Elevation point

Convertion From Elev.points to contor lines

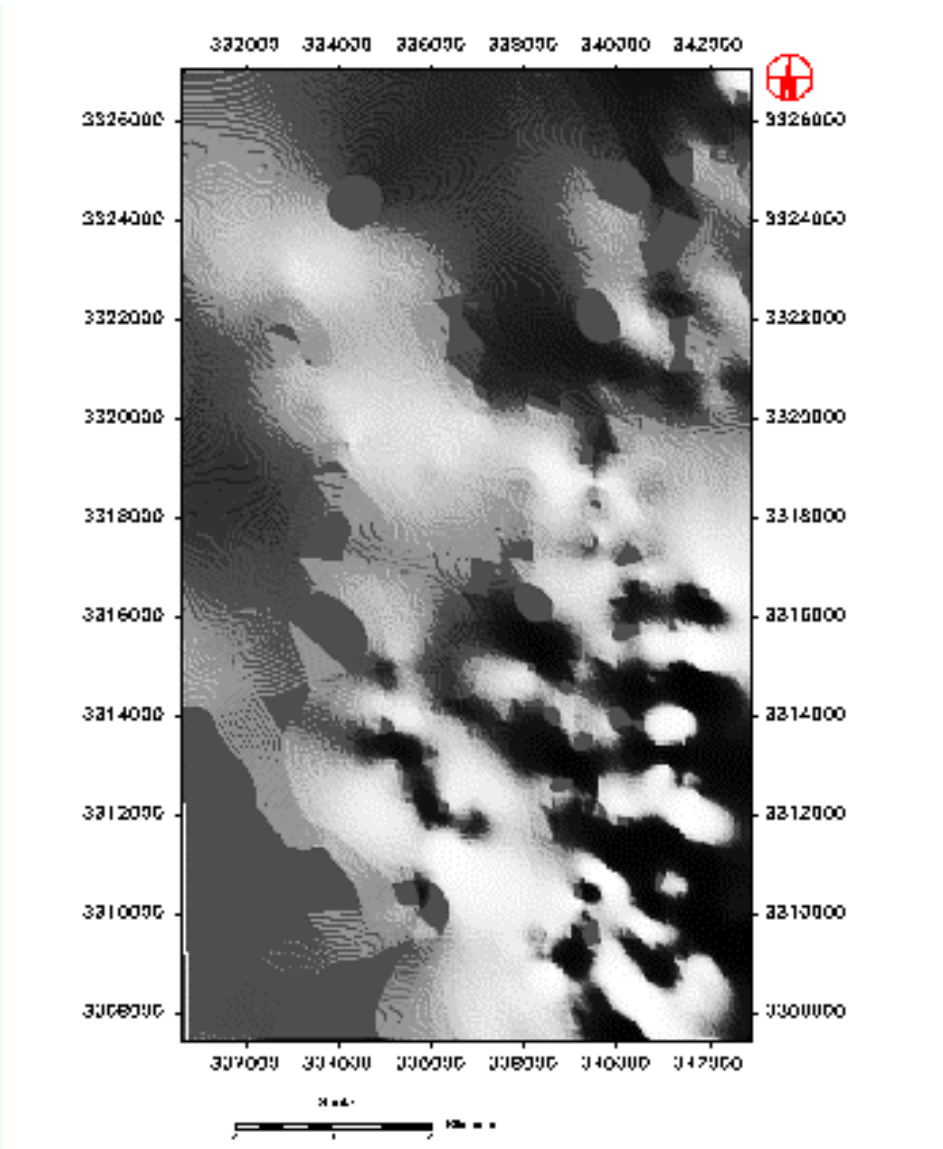


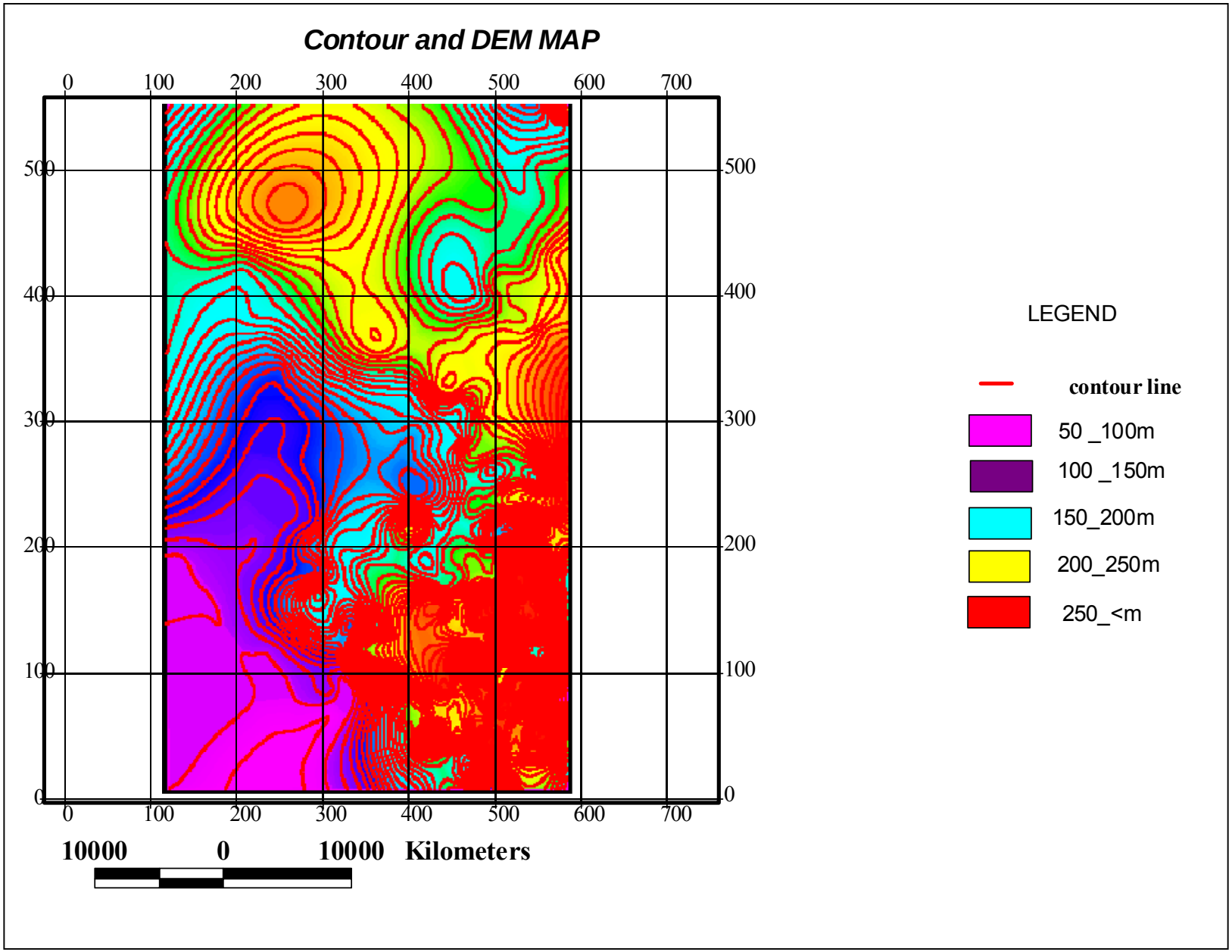
cotour line

DEM نموذج الارتفاعات الرقمي

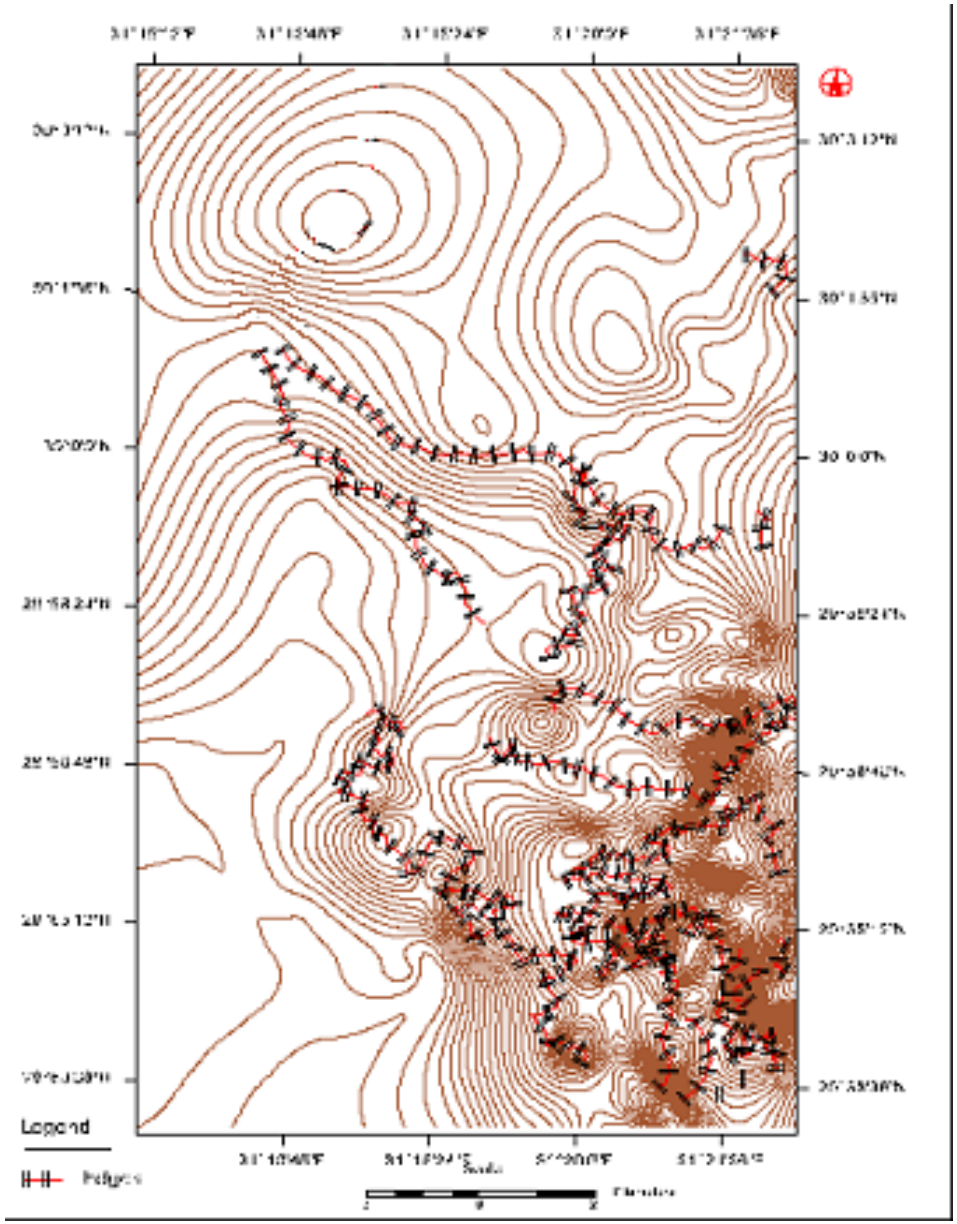


Shaded Relief Map

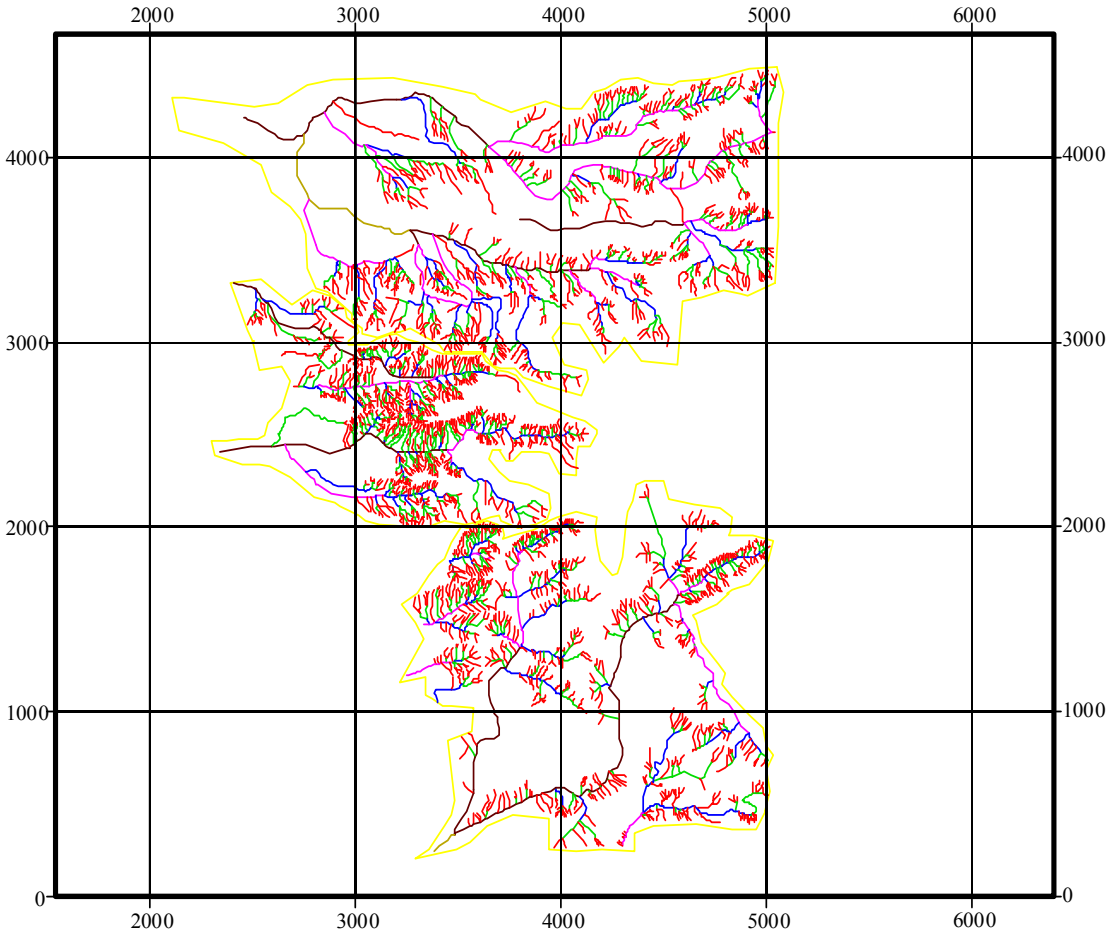


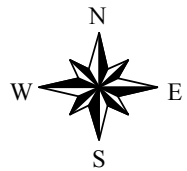

Contour and DEM MAP
0
100
200
300
400
500
600
700
10000
0
10000
Kilometers
LEGEND
contour line
50 _100m
100 _150m
150_200m
200_250m
250_<m

Edges map



DRAINGE PATTERN



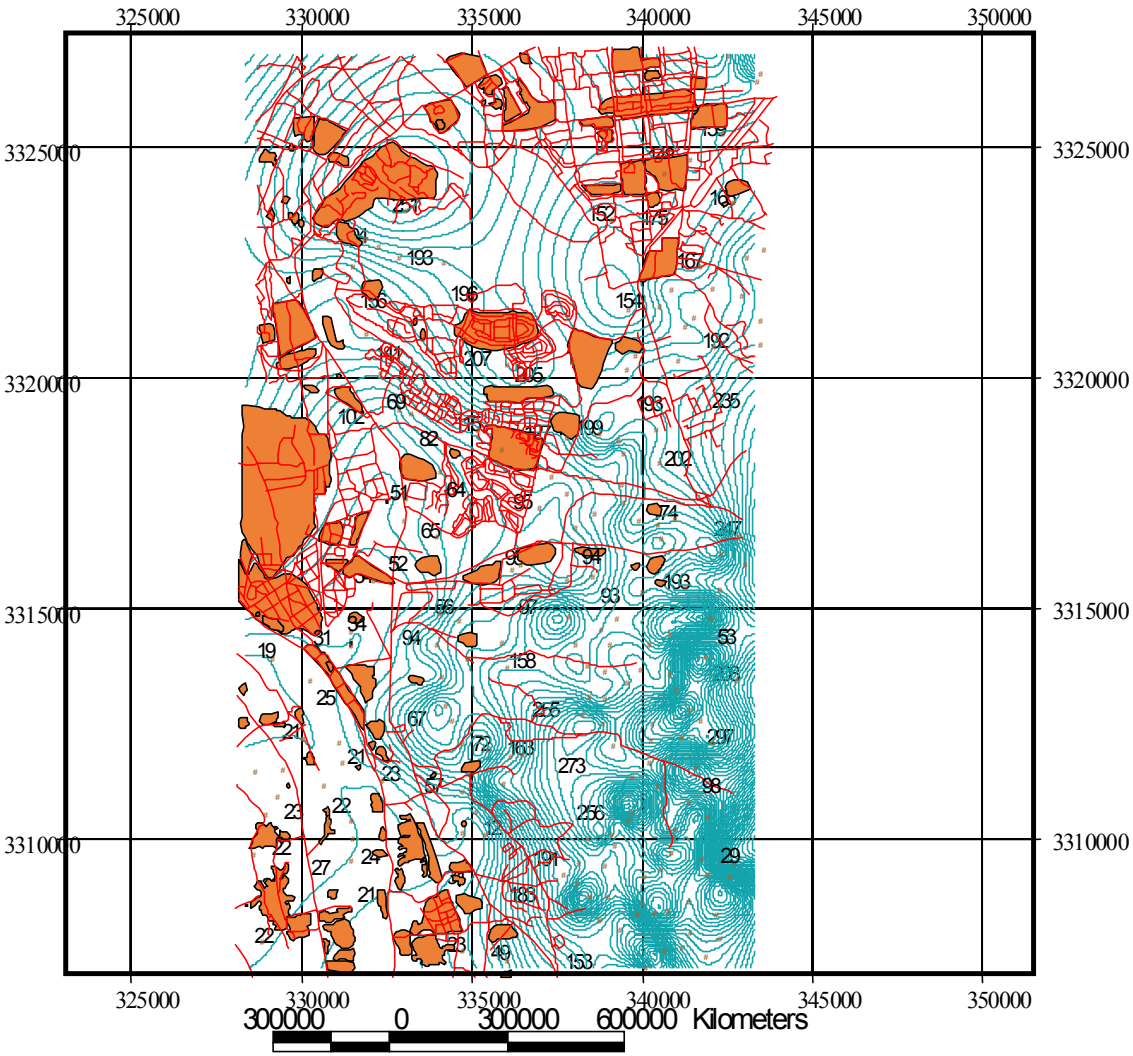


legend

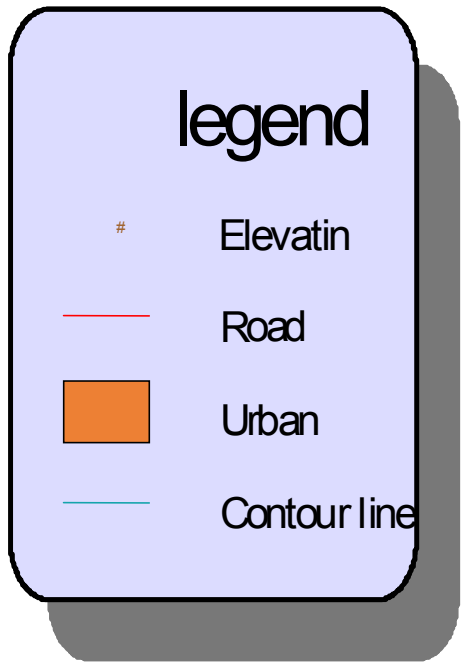
- order 1
- order 2
- order 3
- order 4
- order 5
- order 6

800 0 800 Kilometers

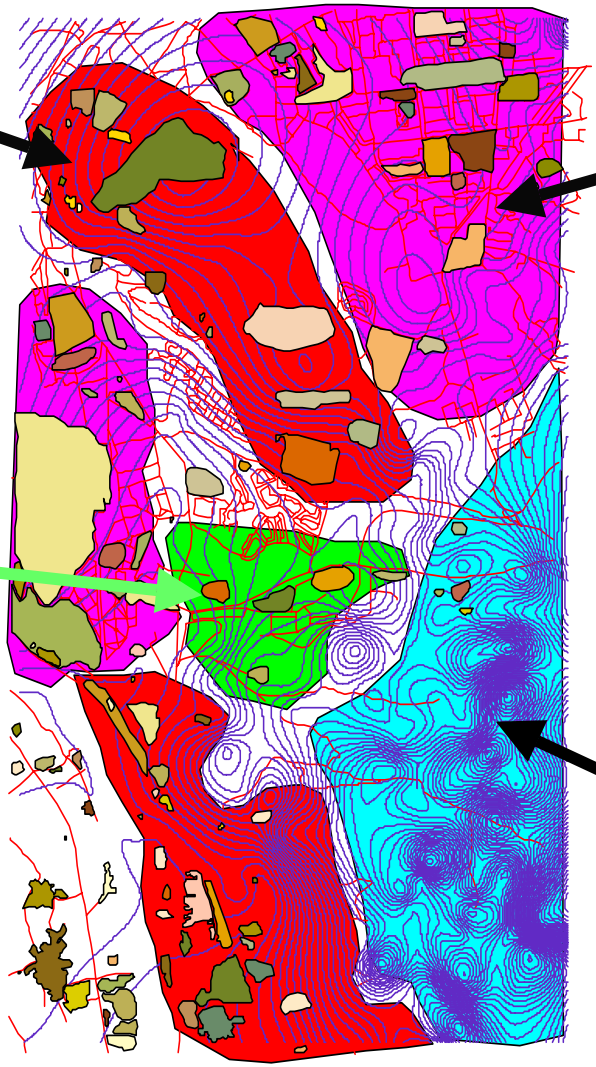
Urban Areas


325000
330000
335000
340000
345000
350000
3325000
3320000
3315000
3310000
300000 0 300000 600000 Kilometers


N
W
E
S


legend
Elevatin
Road
Urban
Contour line

RISK MAP



مناطق خطرة لوجودها
ا سفل نطاق الحواف

مناطق آمنة

منطقة صالحة للبناء

مناطق خطرة جداً لوجود الحواف ومصبات الأودية
والصد وع والإنكسارات

LEGEND

- URBAN
- Contour LINE
- Road

N

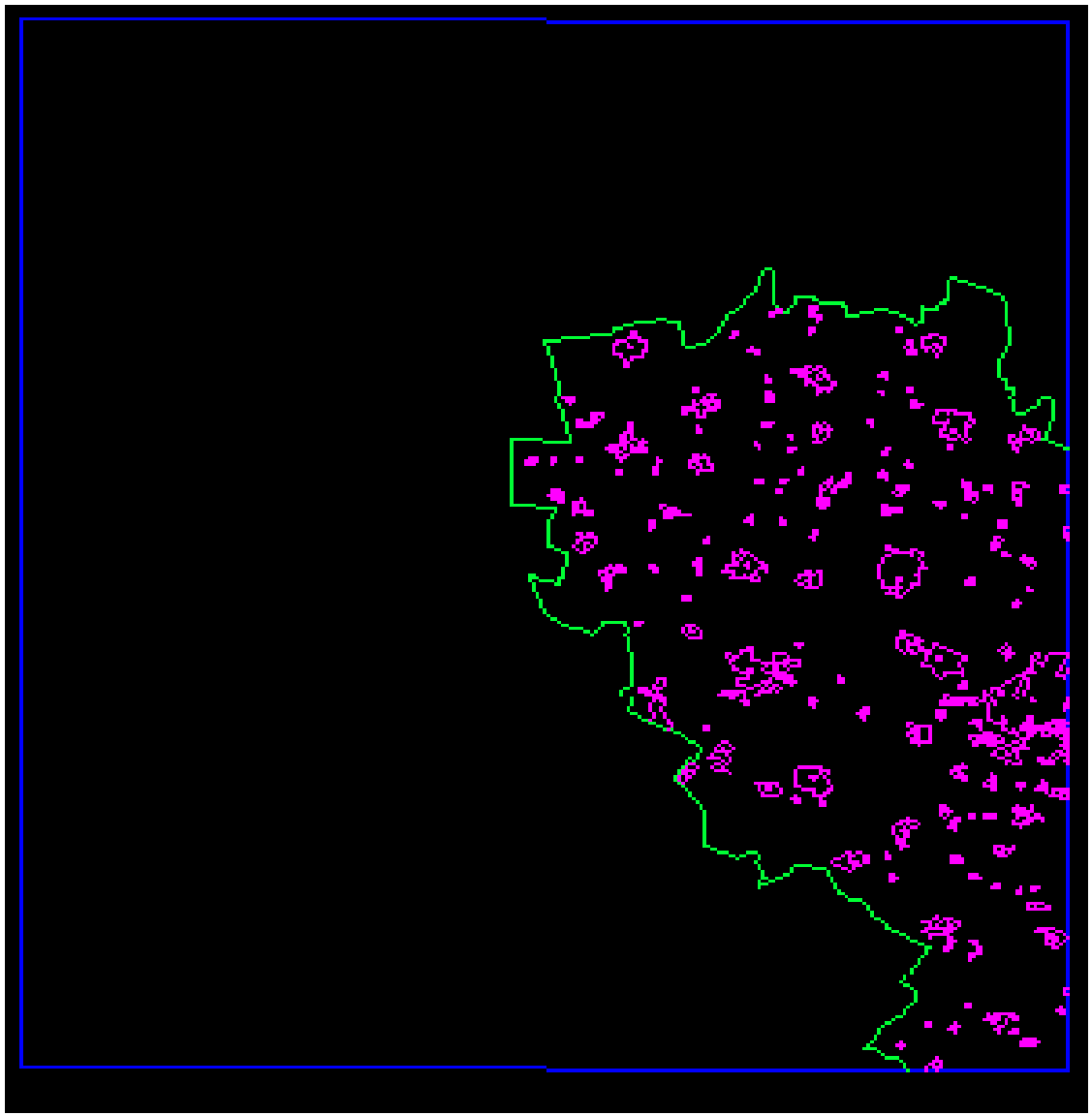
Danger

- AREA CAN BE DEVELOPED
- SAVE AREA
- V.DANGER AREA
- V.V.DANGER AREA

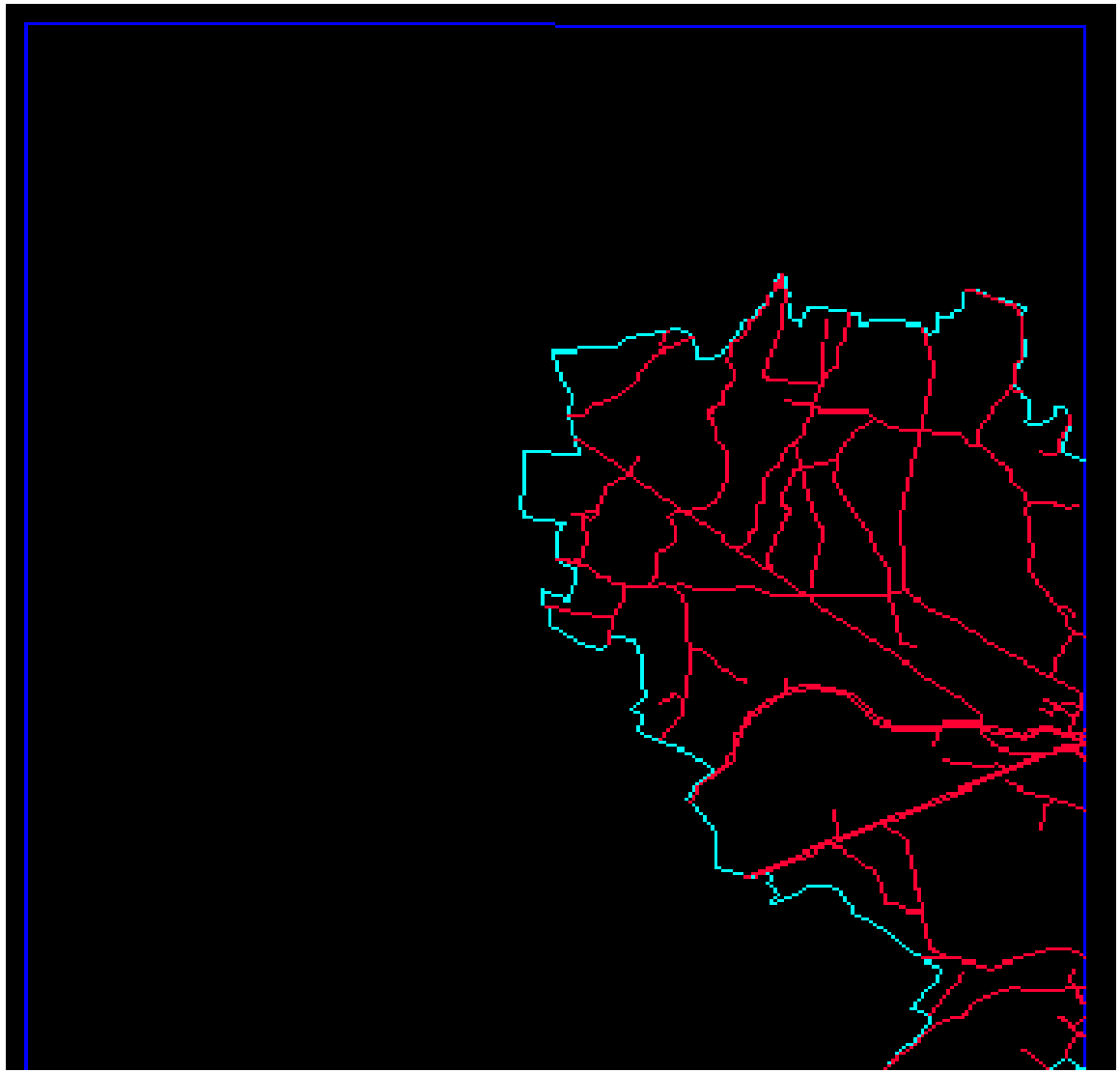
300000 0 300000 Kilometers

اولا :- من الخرائط الطبوغرافية يتم عمل طبقات layers

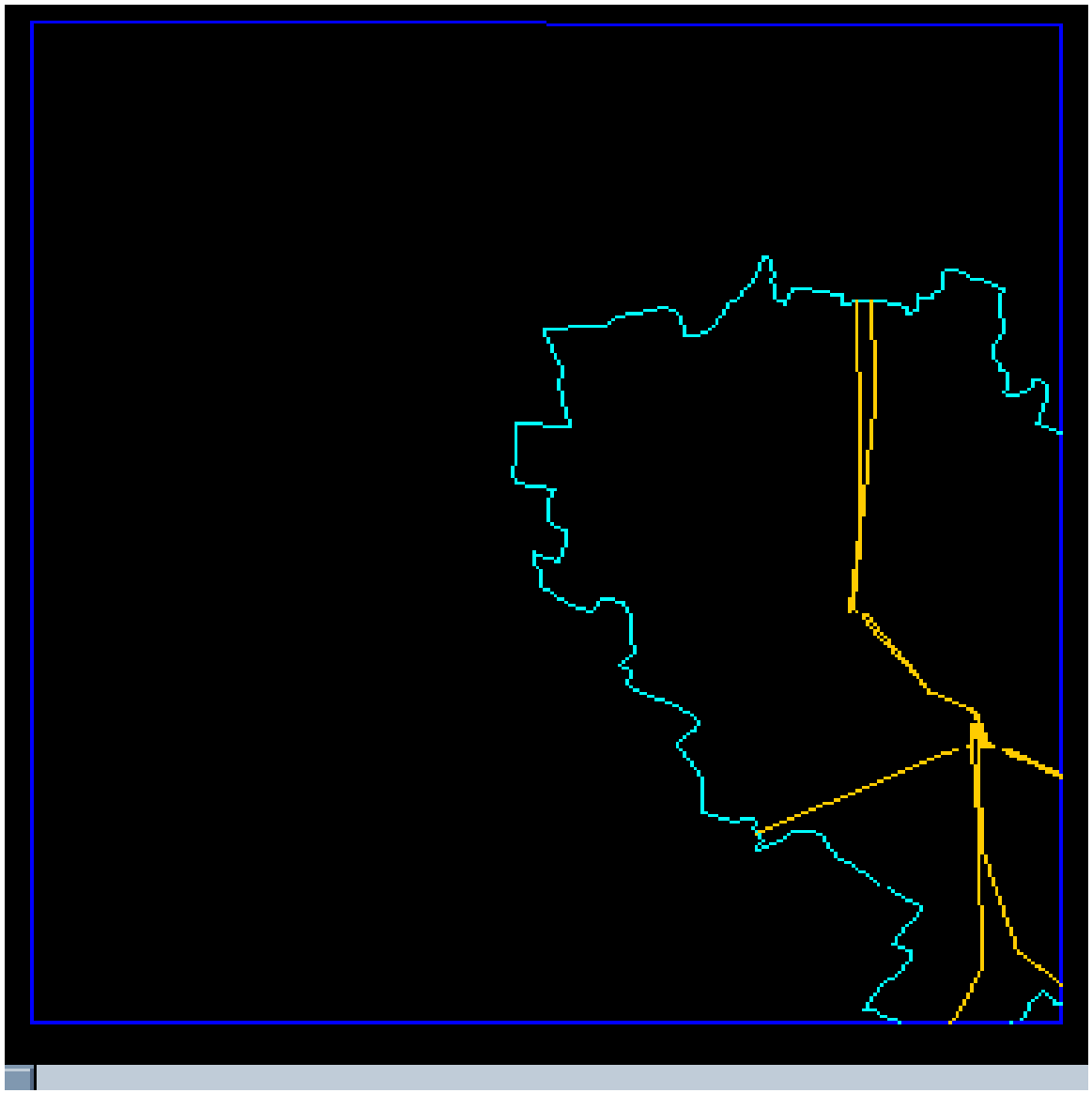
اولا:- Urban



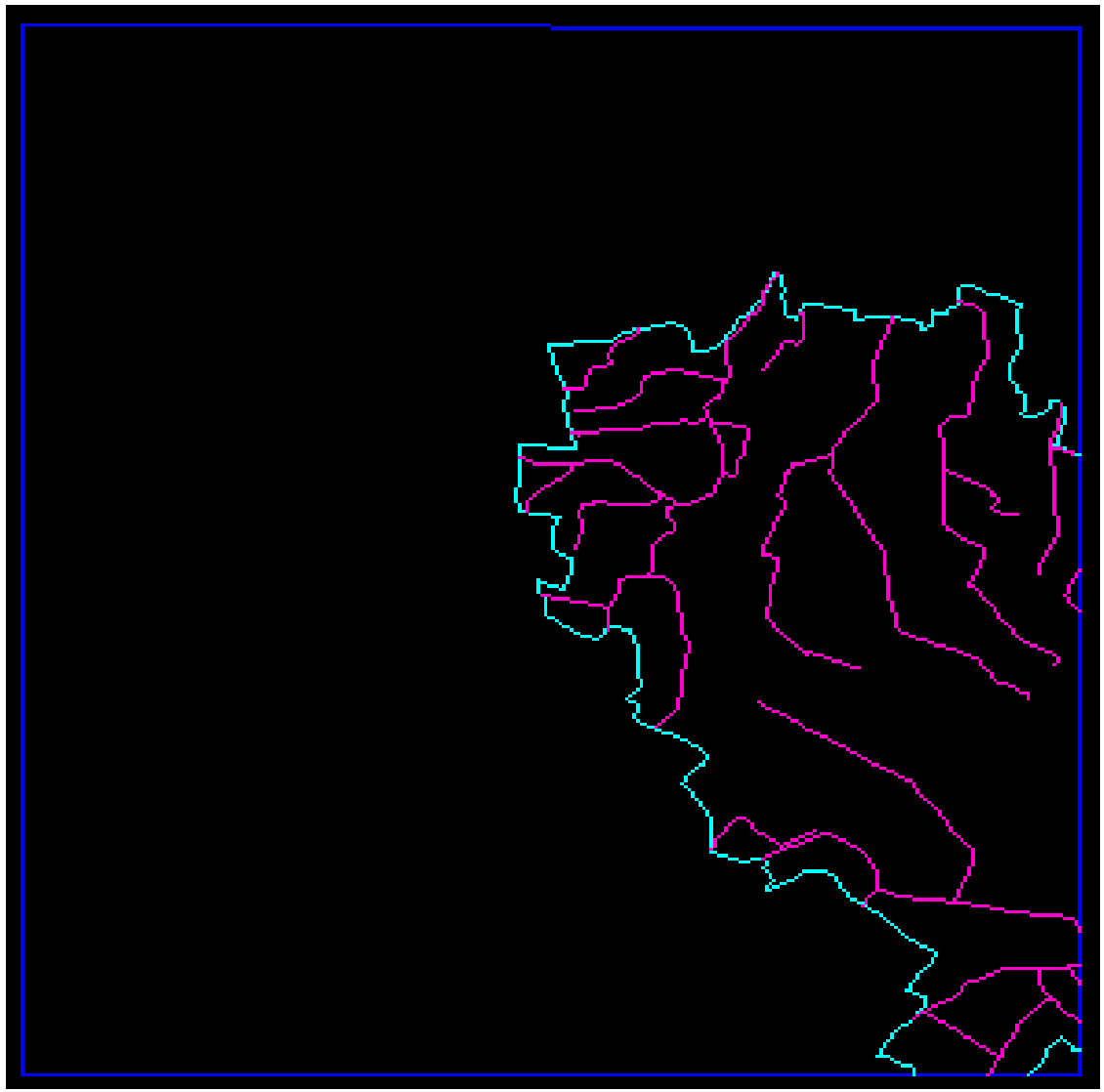
ثانيا:- Roads



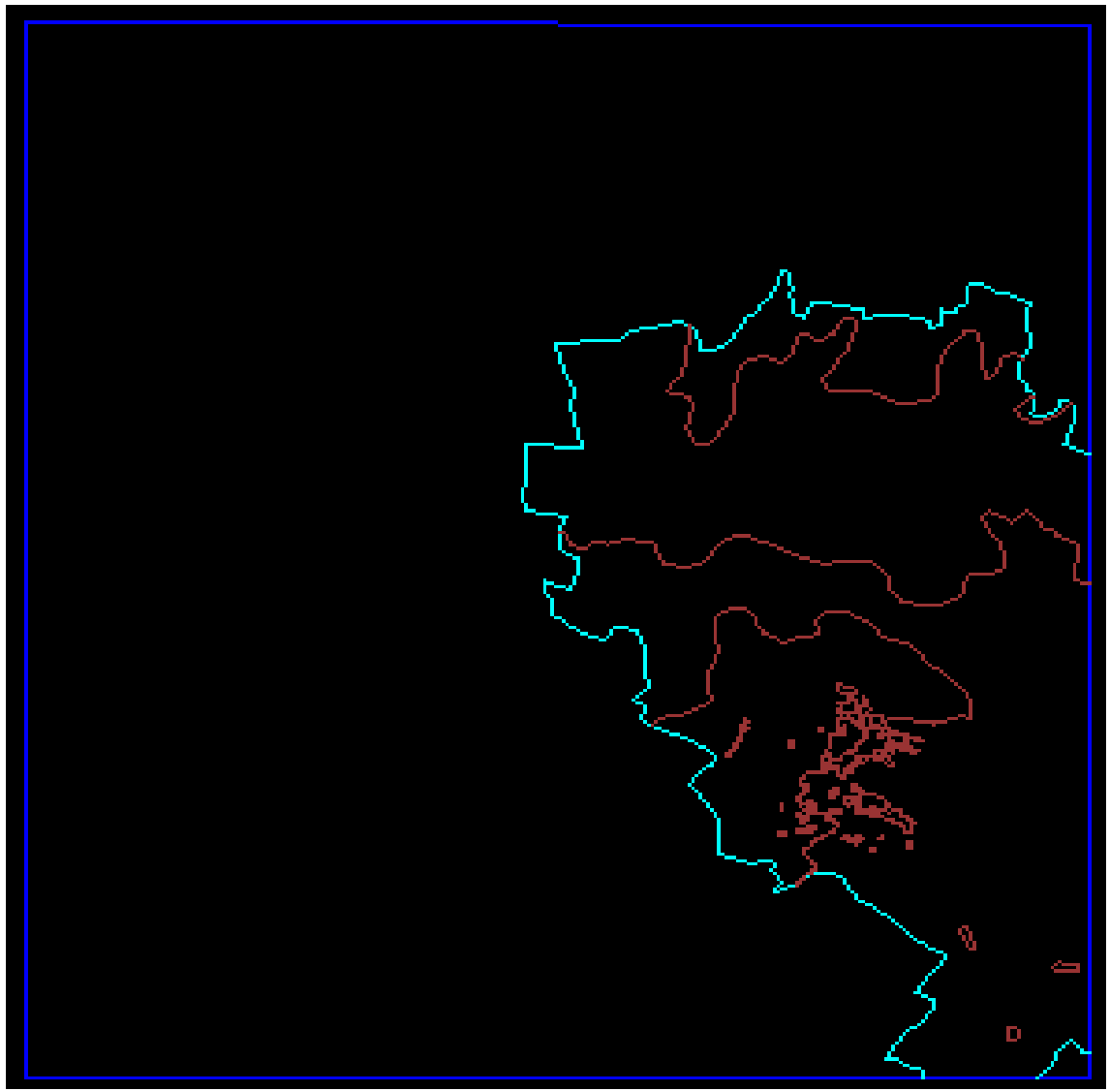
Utilities ثالثا



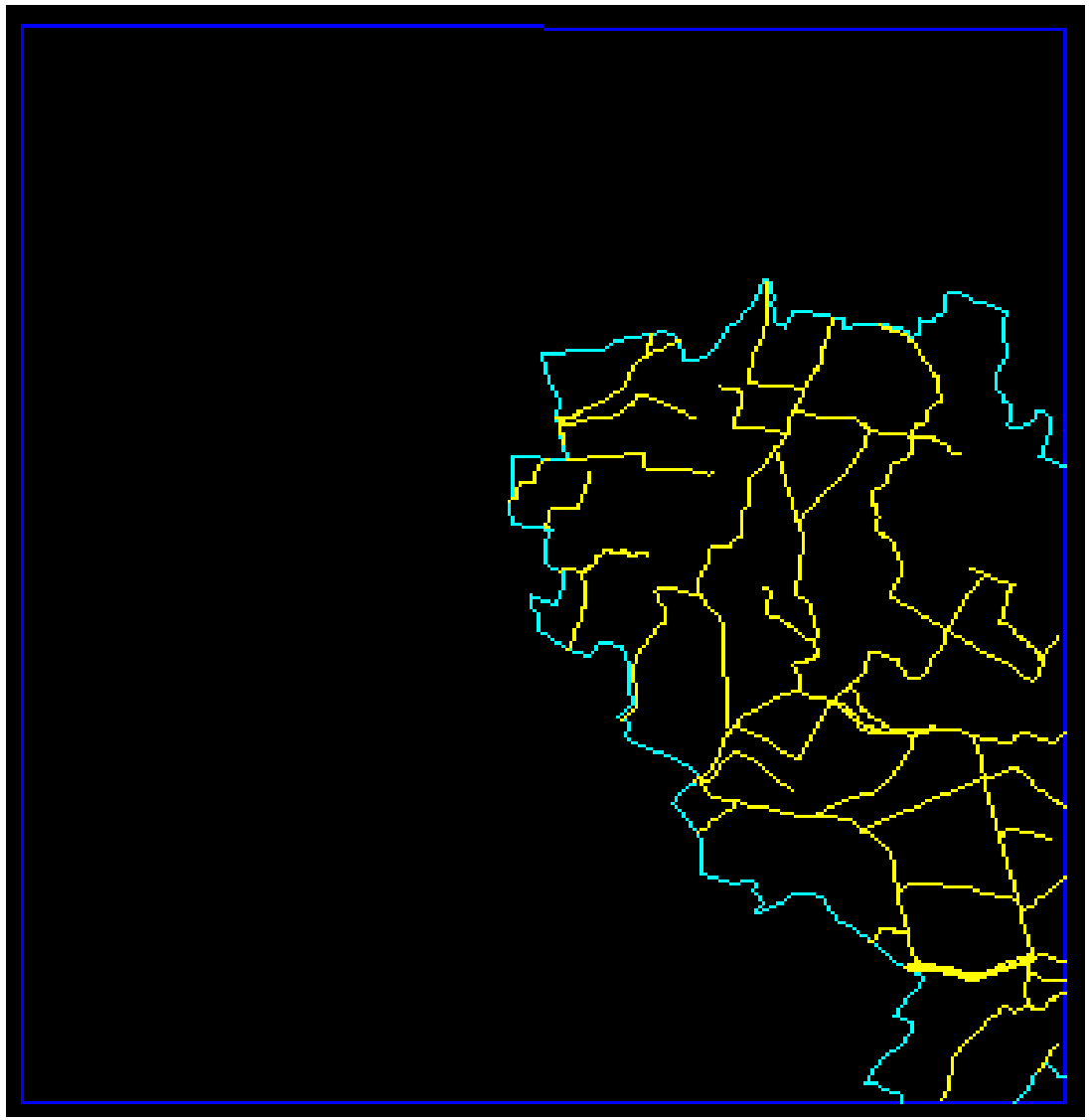
رابعا: Drainage



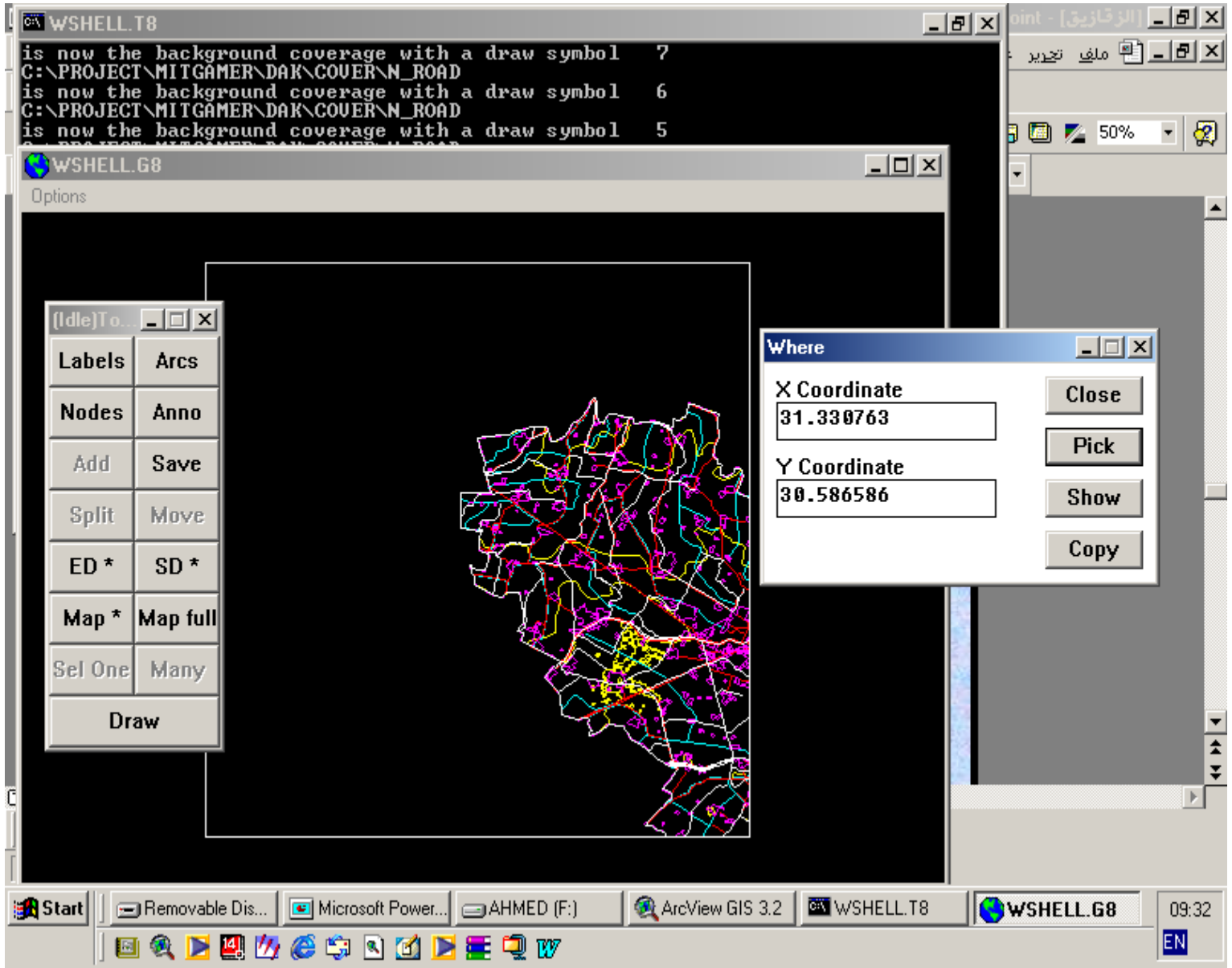
خامسا: Contours



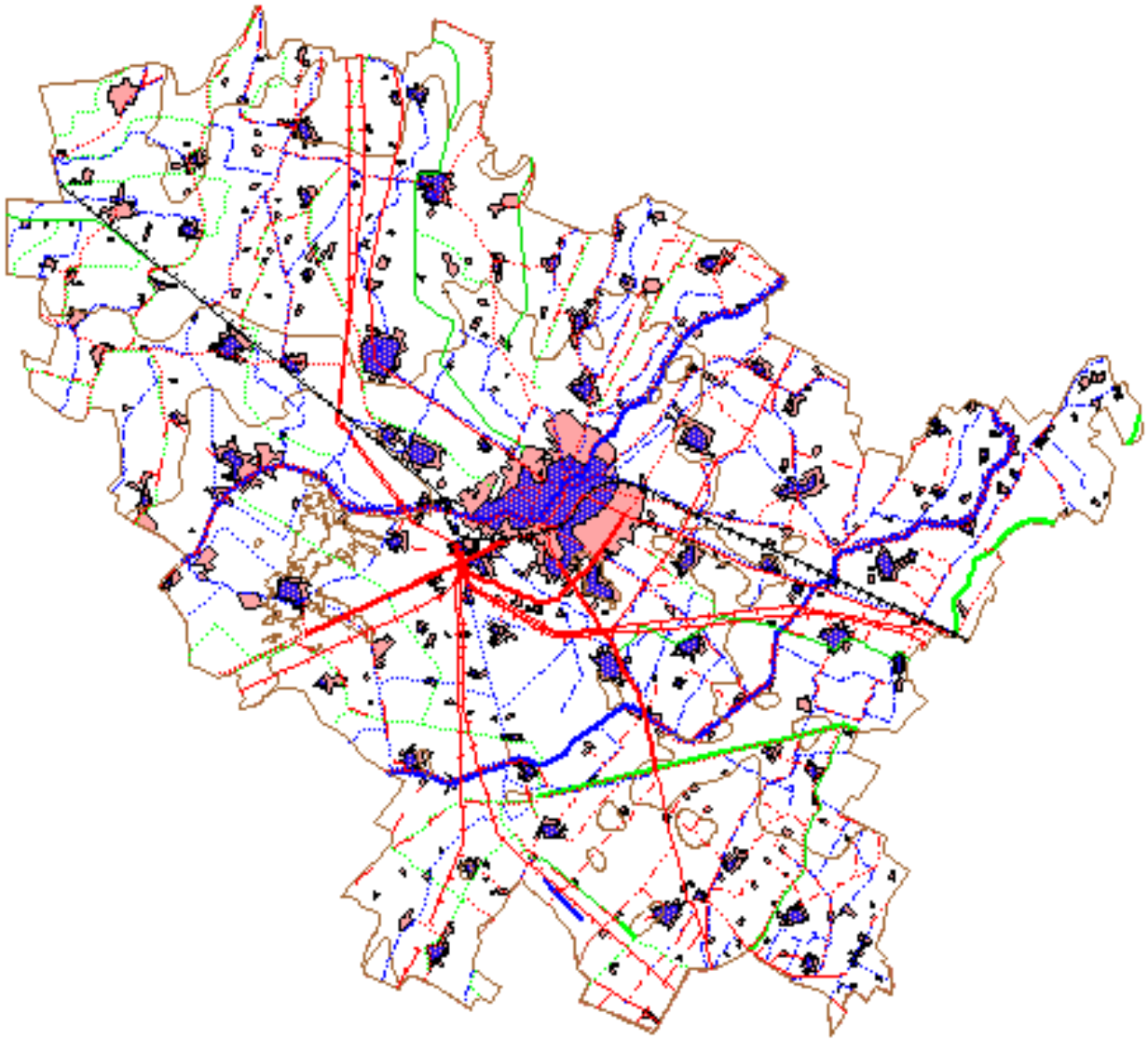
Canals :سادسا



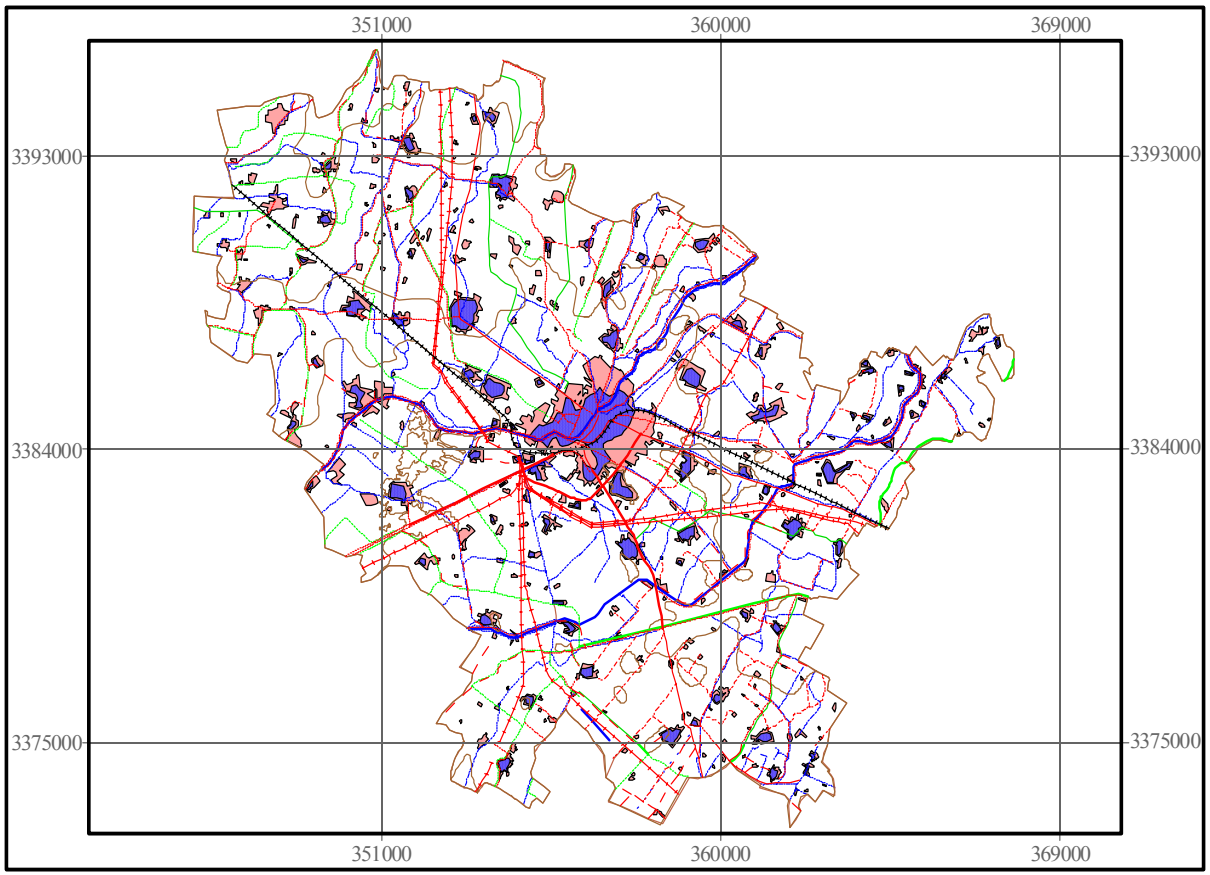
عملية التصحيح فى DAK



تجميع الخرائط



Development of Built up area using Remot Sensing and GIS (Zagazig Center)



4 0 4 8 Kilometers

Legend

N W E S

Roads :
- dual road
- main paved road
- secondary unpaved road
- unpaved road
- track
- railway track

Utline :
- Electric

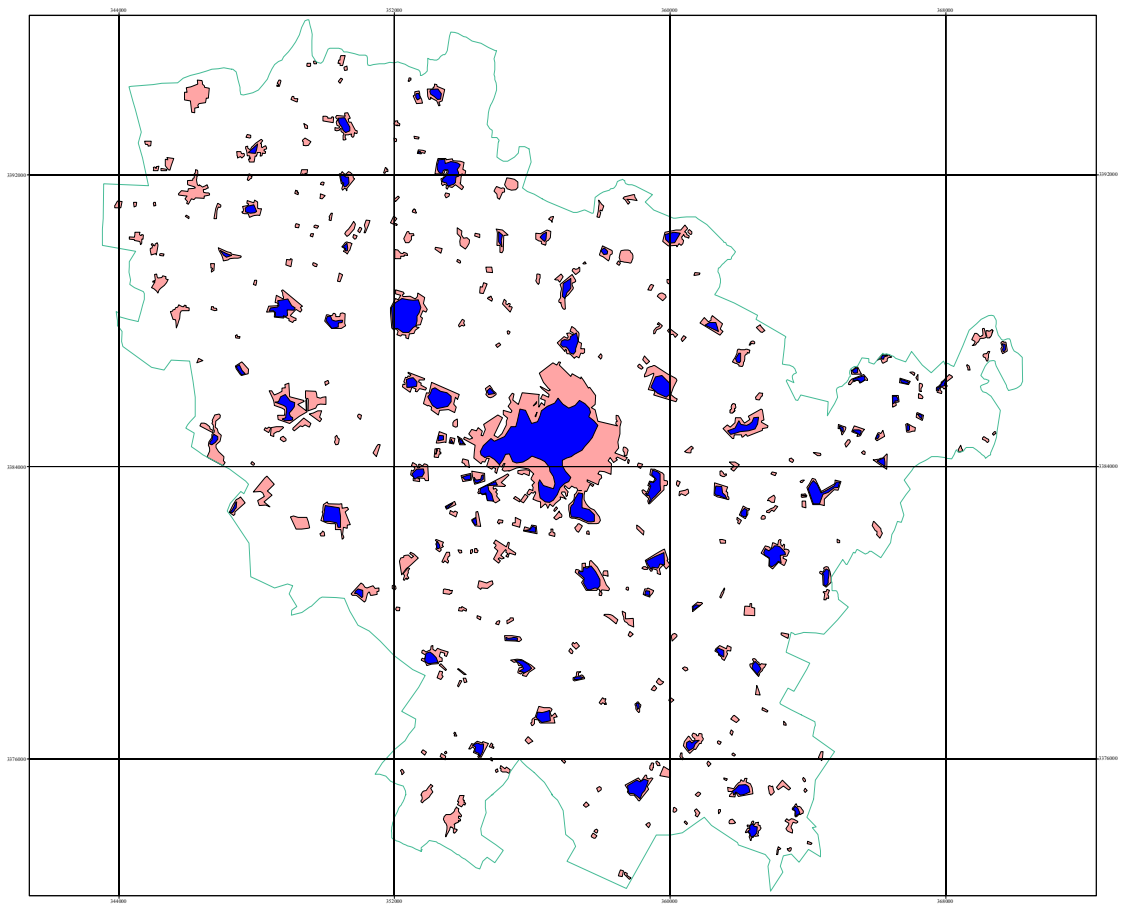
Drains :
- more than 25m
- from 10 to 25m
- from 5 to 10m

Contour :
- Contour

Canal :
- more than 25m
- from 10_25m
- from 5_10m

Urban :
- Urban 1976
- Urban 1990

Development of Built up area by Remot sencing and GIS in Zagazig city



300000 0 300000 Miles

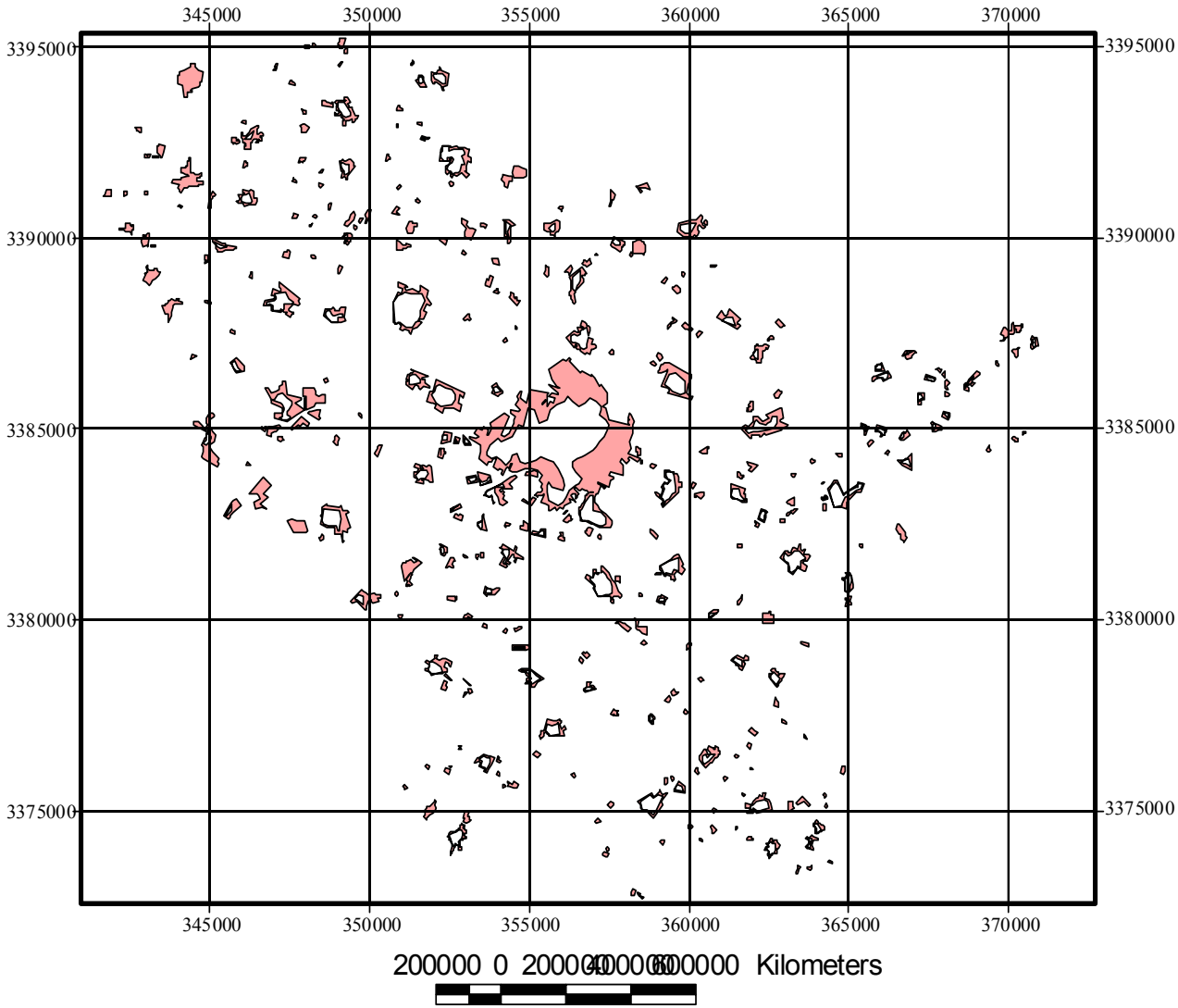
Legend

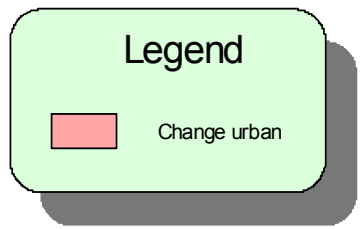
N

Urban 1976

Urban 1990

Change detection of urban (1976_1990)





Thank you…

Mamdouh Abdeen