Modern Surveying method

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Introduction to
Remote Sensing

Introduction

- Remote sensing is broadly defined as science and art of collecting information about object , area or phenomena from distance without being in physical contact with them.

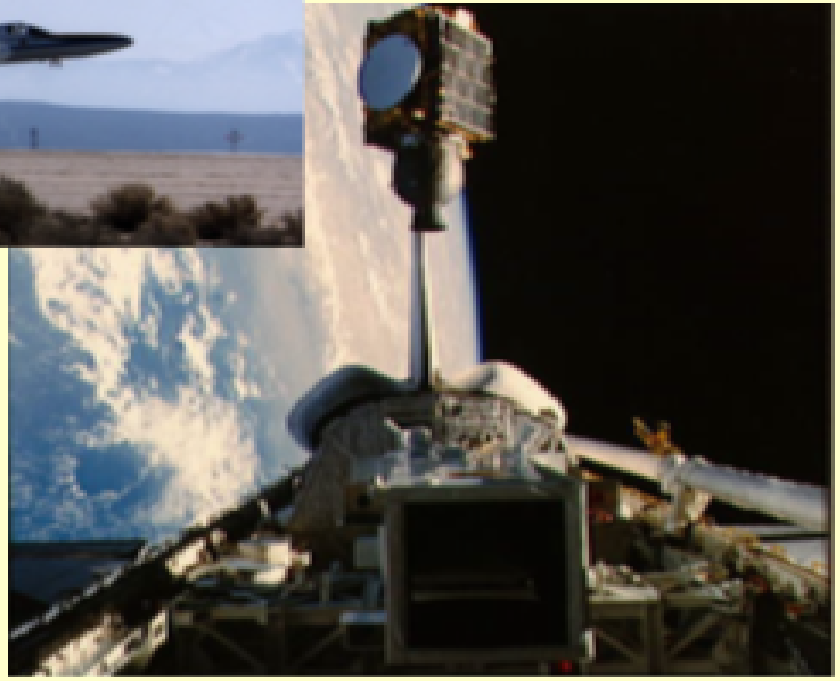
- Human eye is perhaps the most familiar example of remote sensing system

Remote Sensing Systems

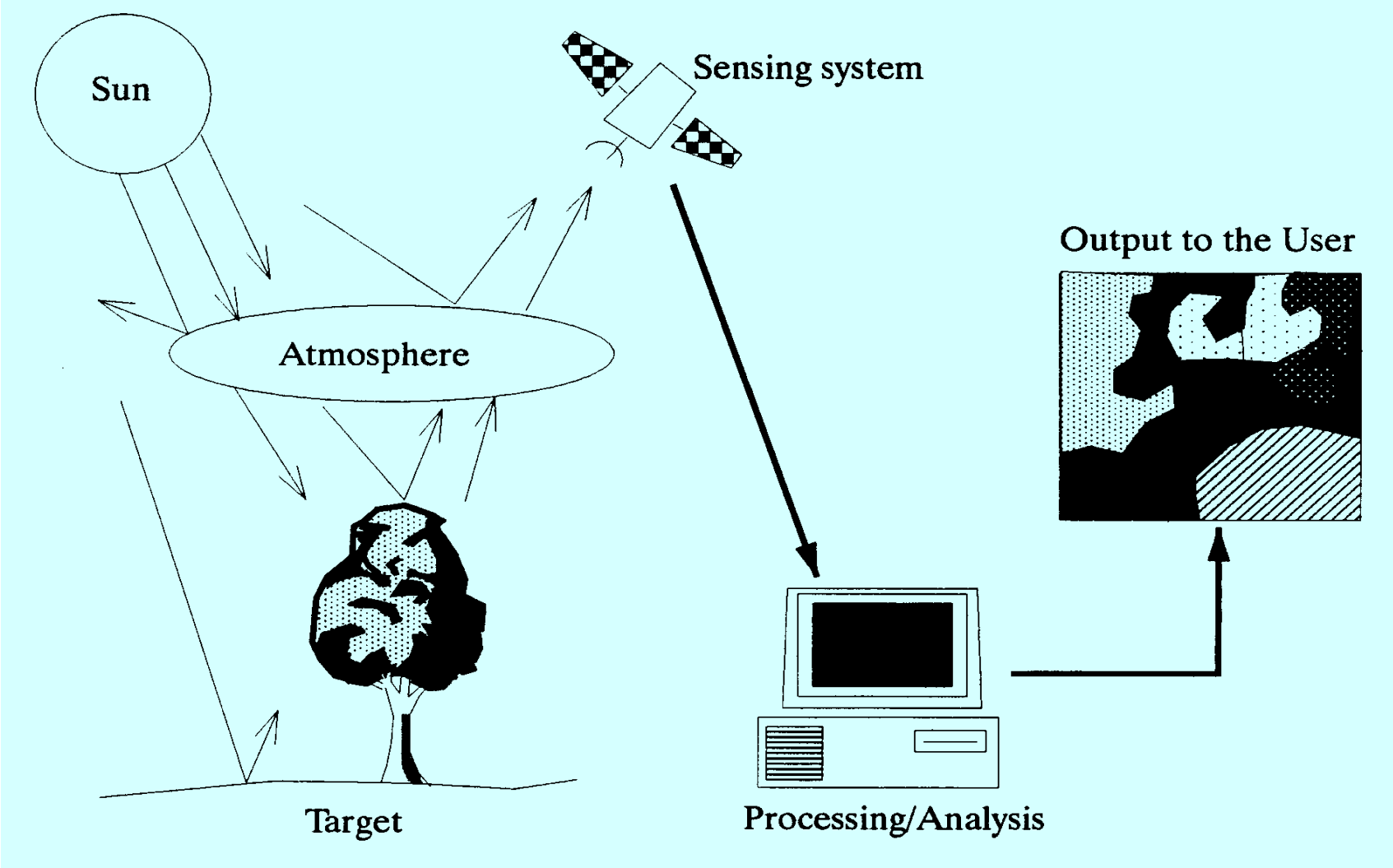
- Passive
  - Human eye
  - Camera
  - Radiometer
- Active
  - Radar
  - Sonar
  - Laser

Remote Sensing Platforms

- Ground based
- Aircraft
- Space shuttle
- Satellite



Components of a Remote Sensing System



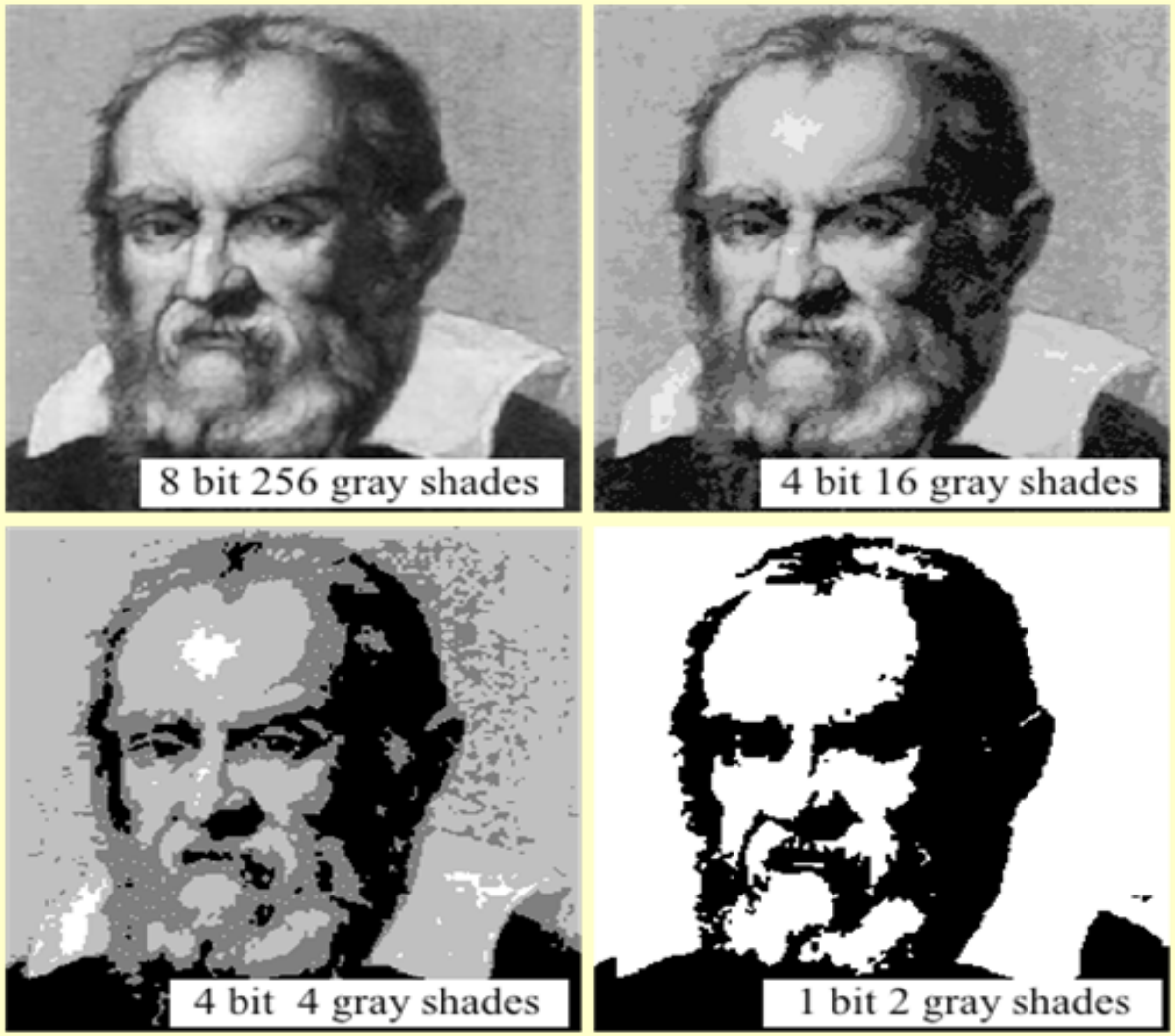
Four Fundamental Properties For Design

- Image depends on the wavelength response of the sensing instrument (radiometric and spectral resolution) and the emission or reflection spectra of the target (the signal).

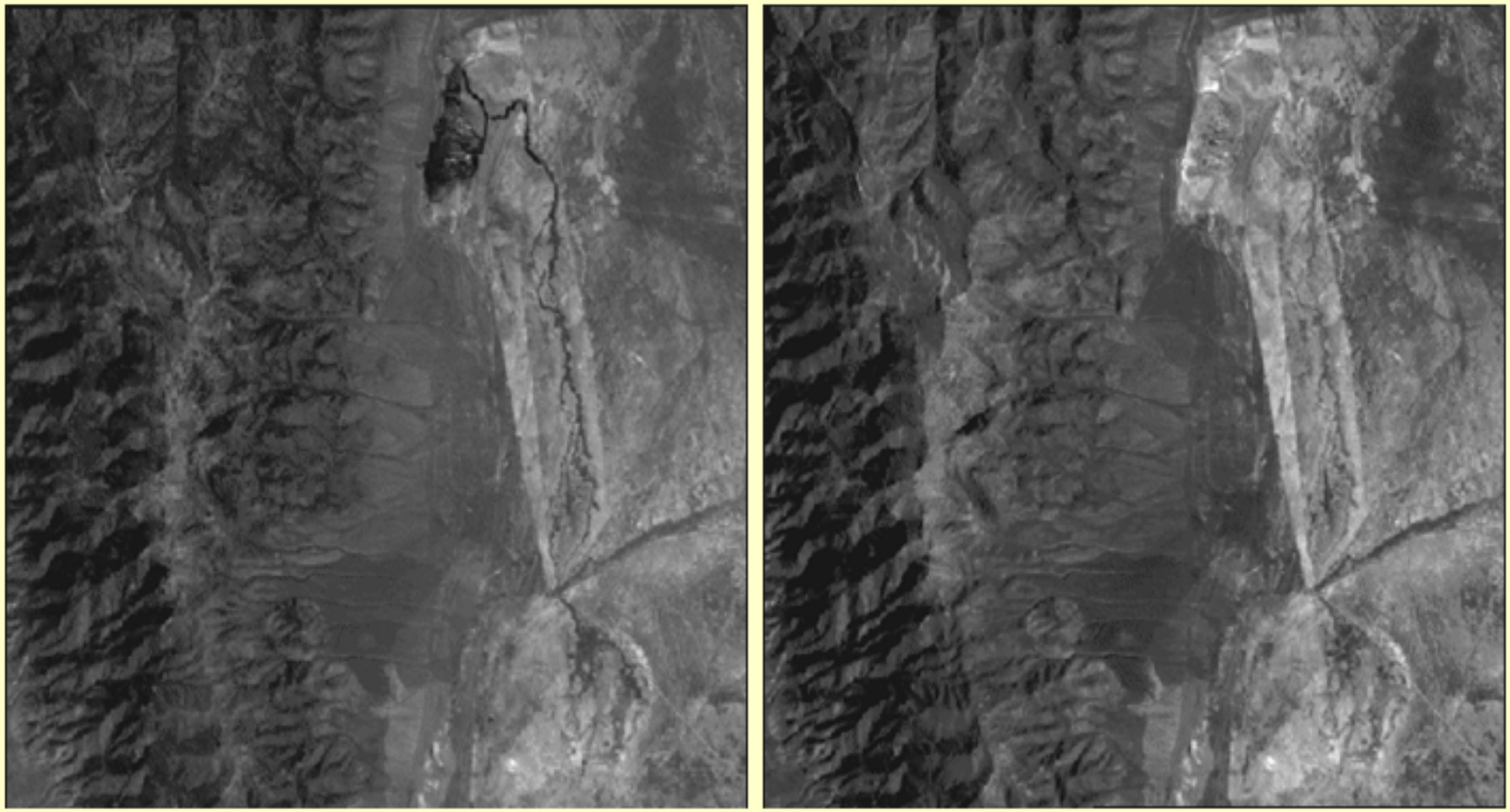
- Radiometric resolution
- Spectral resolution
- Spatial resolution
- Temporal resolution

Radiometric Resolution

- Number of Shades or brightness levels at a given wavelength
- Smallest change in intensity level that can be detected by the sensing system



Spectral Response Differences



Spatial Resolution

80 x 80

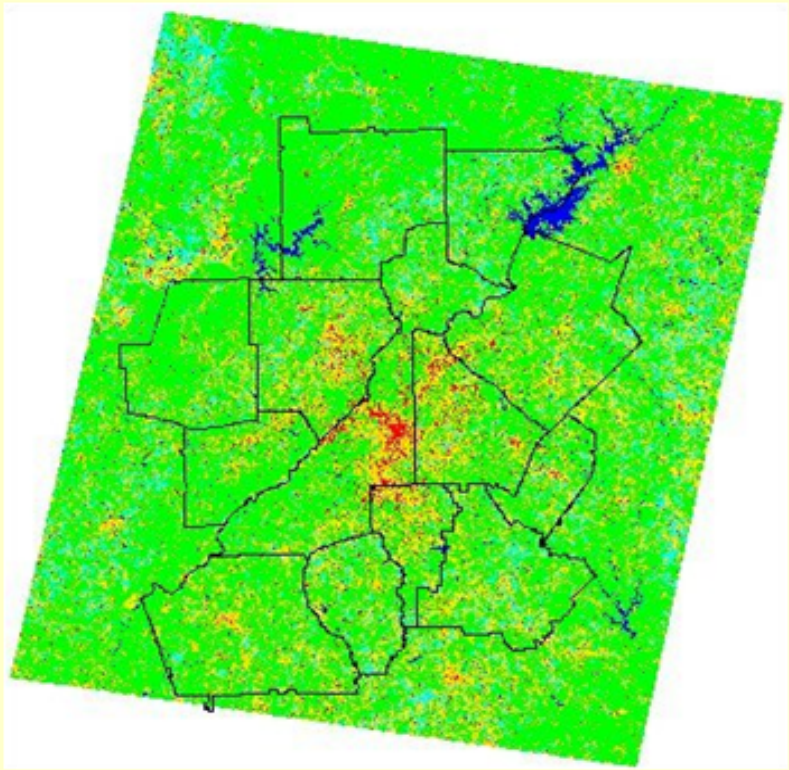
40 x 40

320 x 320

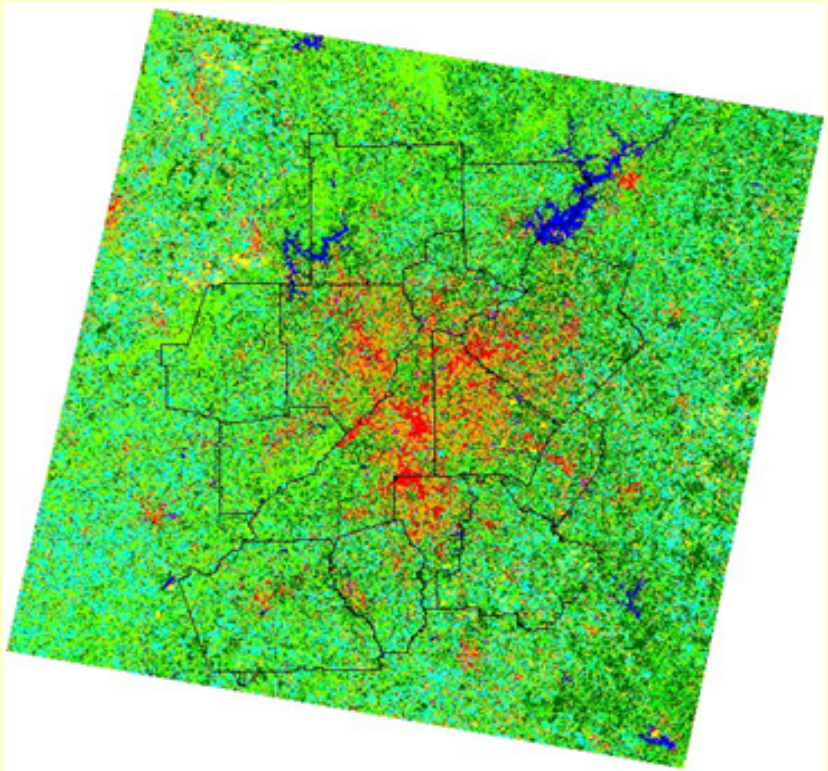
Application of Temporal Data: Urban Sprawl

Atlanta, GA

1973



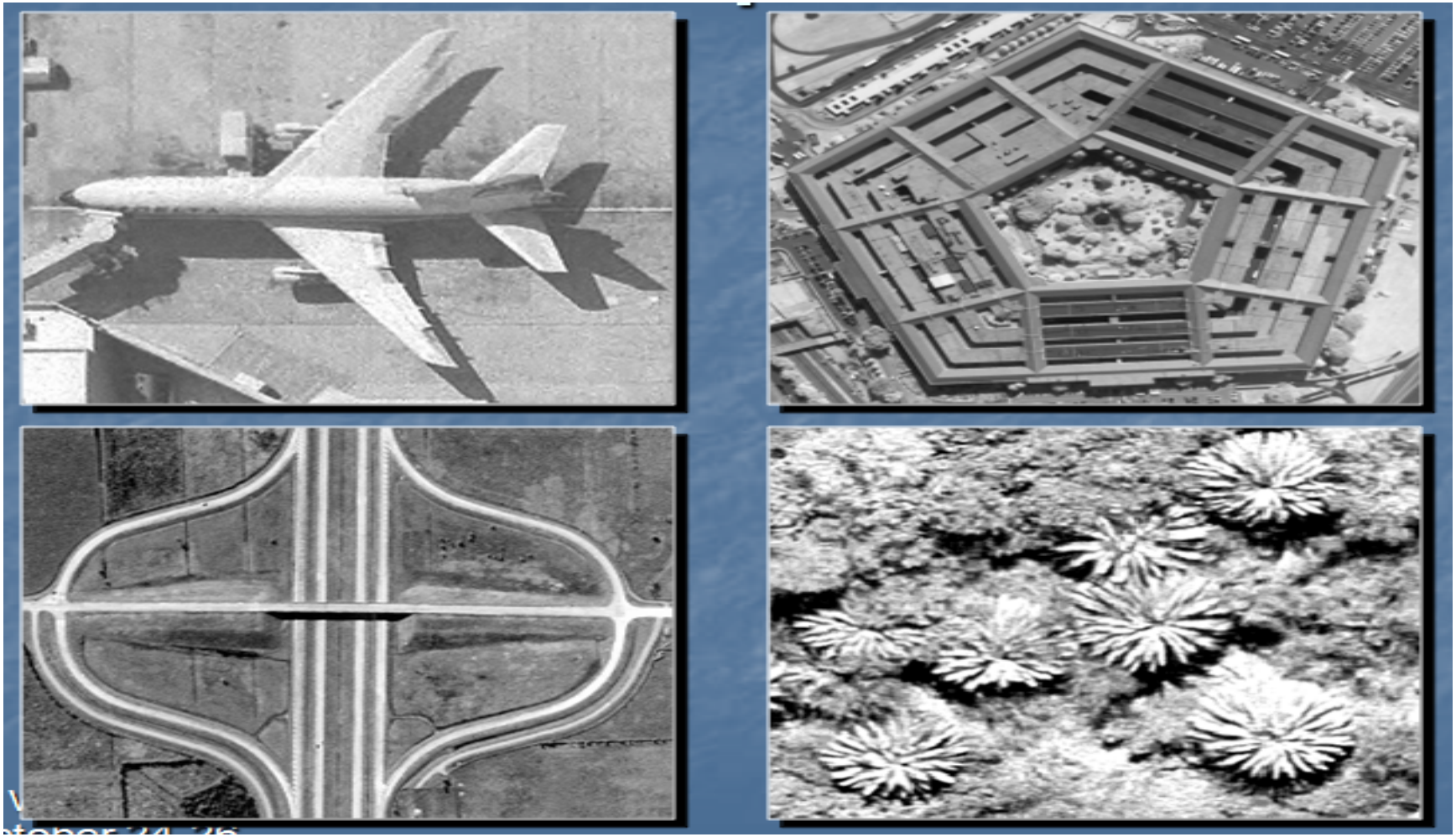
1987



Elements of Image Interpretation

- Shape:
  - Many natural and human-made features have unique shapes.
  - Often used are adjectives like linear, curvilinear, circular, elliptical, radial, square, rectangular, triangular, hexagonal, star, elongated, and amorphous.

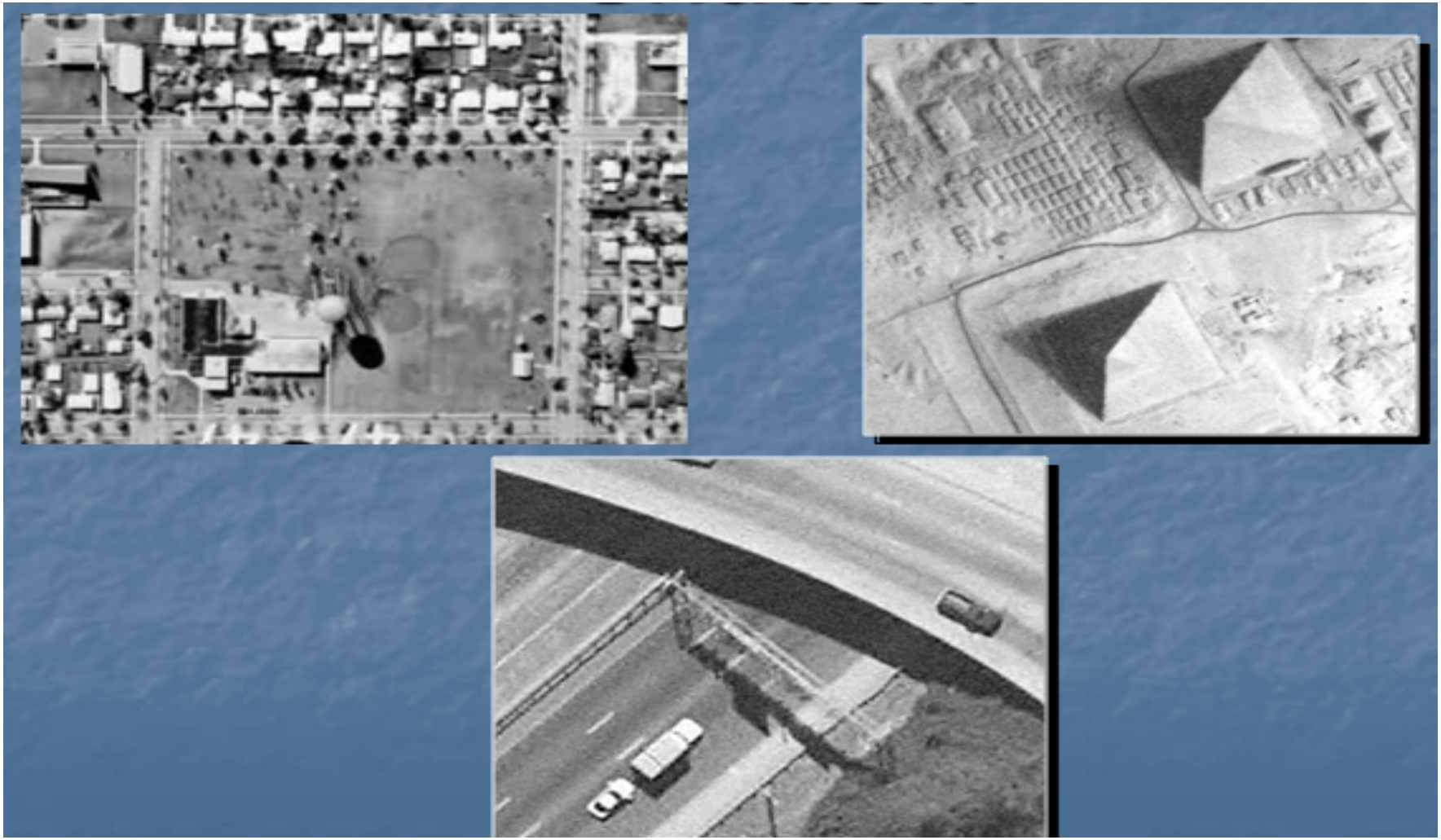
Shape



Elements of Image Interpretation

- Shadow:
  - Shadow reduction is of concern in remote sensing because shadows tend to obscure objects that might otherwise be detected.
  - However, the shadow cast by an object may be the only real clue to its identity.
  - Shadows can also provide information on the height of an object either qualitatively or quantitatively.

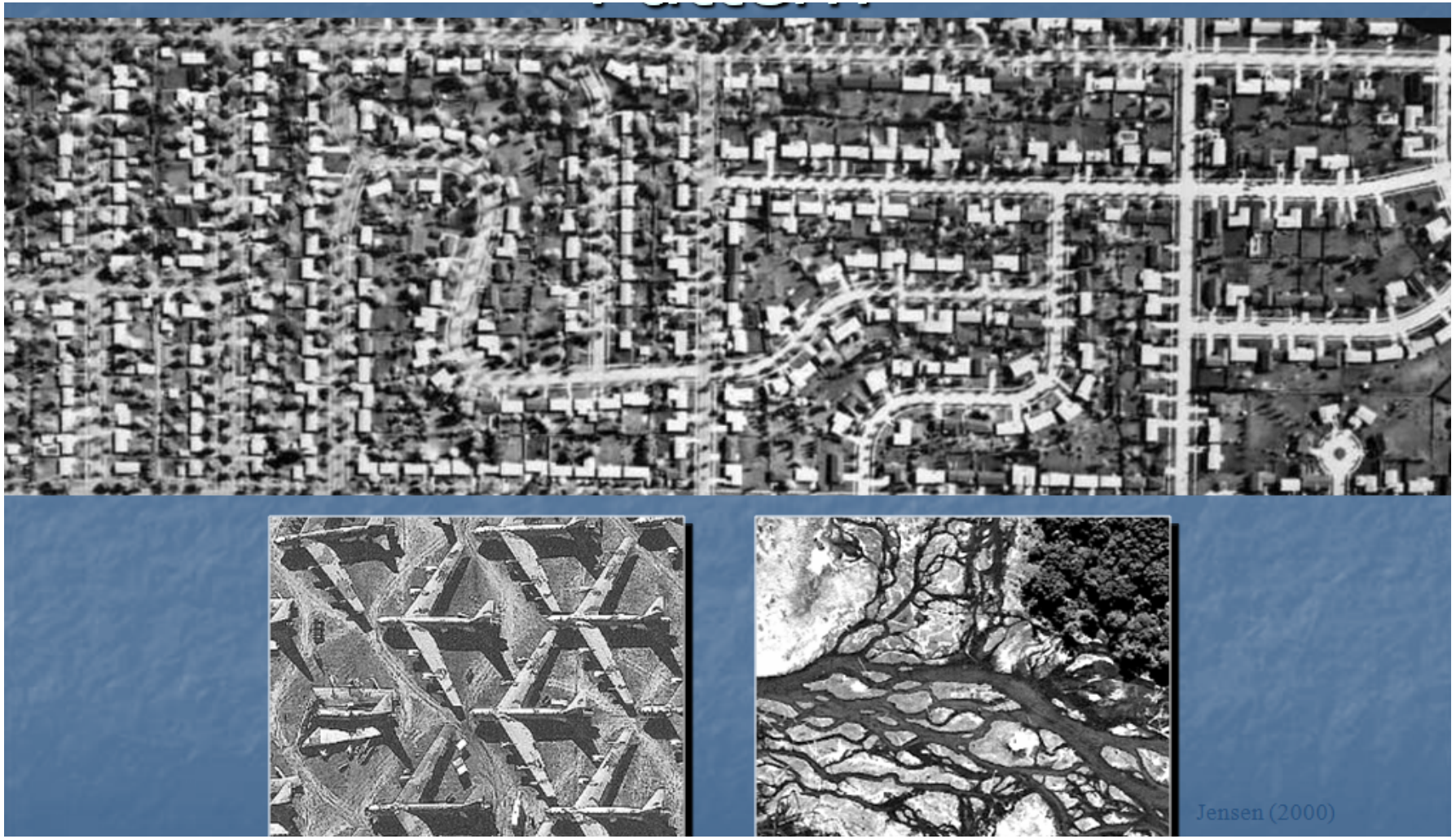
Shadow



Elements of Image Interpretation

- Pattern:
  - Pattern is the spatial arrangement of objects on the landscape.
  - General descriptions include random and systematic; natural and human-made.
  - More specific descriptions include circular, oval, curvilinear, linear, radiating, rectangular, etc.

Pattern



Elements of Image Interpretation

- Height and Depth:
  - As discussed, shadows can often offer clues to the height of objects.
  - In turn, relative heights can be used to interpret objects.
  - In a similar fashion, relative depths can often be interpreted.
  - Descriptions include tall, intermediate, and short; deep, intermediate, and shallow.

Height and Depth

Application of remote sensing

- ❖ Agriculture
- ✓ Early season estimation of total cropped area.
- ✓ Command area management
- ✓ Identification of crop and their coverage estimation
- ✓ Detection of crop violations.
- ❖ Forestry
- ✓ Improved forest type mapping
- ✓ Monitoring large scale deforestation , forest fire.
- ✓ Wild life habitant assessment.
- ❖ Land use and soils
- ✓ Mapping land
- ✓ Change direction
- ✓ Soil categorization

❖ Ocean Resources

- Wealth of oceans
- Potential fishing zone
- Low tide / high tide marking

❖ Watershed

- Major river valley project
- Monitoring watershed development
- Watershed characterization at larger scale.

❖ Environment

- Impact assessment on vegetation
- Sitting application
- Loss of biological diversity

❖ Water resources

✓ Monitoring surface water bodies

✓ Glacier inventory

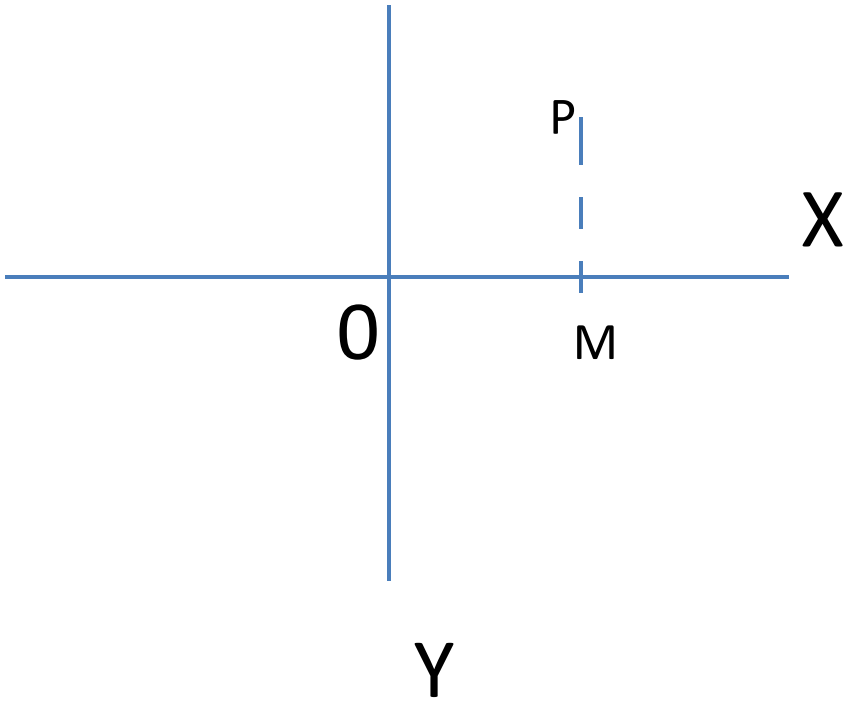
✓ Snow- cloud discrimination.

- ❖ Natural resources base application
- ✓ Management of wild , reviver, recreation area , flood plain, wet land agricultural land , aquifer, forest, wild life.
- ✓ Environmental impact analysis
- ✓ Hazardous and toxic facility siting
- ✓ Wild life analysis , migration routes planning
- ❖ Disaster
- ✓ Mapping flood , damage assessment.
- ✓ Disaster warning mitigation.


Global Positioning System

GPS

- Location of points on plane surface is determined by using the cartesian system of coordinates. In this system OX and OY are two orthogonal fixed straight lines in the plane of the paper. The line OX is called the X-axis the line OY is called the Y axis. The point of intersection of the axes is called the origin.
- Consider a point P on the plane of the paper XY. The distance OM along the axis is called the abscissa the distance MP measured parallel to Y axis is called the ordinates of P. both the abscissa and ordinates of the point P are called its coordinates.


P
X
0
M
Y

Three Parts

- Space segment
- Control segment
- User segment

Fundamental concept of GPS

- Space – this segment of GPS consist of the orbiting satellites making up the constellation composed of 24 satellite and the design of the orbit, and spacing of the satellite orbital plan.
- Control- this segment consists of ground station of observation from where users observe the building , launching , orbital positioning and monitoring of the system.
- The Users – the space segment consists of 24 satellite which revolve about the earth at an altitude of about 20,200km having a period of about 12hrs with 55 degree inclination and place in six differential orbital plane, having four satellite in each plane

Four Basic Functions of GPS

- Position and coordinates.
- The distance and direction between any two waypoints, or a position and a waypoint.
- Travel progress reports.
- Accurate time measurement.

Advantages of GPS

- **Identification of spherical coordination.-** GPS help to identify geographical coordinates on satellite image and also to reduce distortion and positional accuracy of the images. By identifying three or four well defined points, the location of the satellite image on the ground can be obtained by the method of resection. The GPS receivers collect accurate geographical coordinates of these locations. The remaining images are located both on the satellite image and on the ground. The remaining image points are filled in between the locations of the control points by normal method of air surveying to obtain real-world coordinates.
- **Truthing of satellite images.-** in case on a Seattleite image there appears region of unusual or unrecognized reflectivity. The coordinate of such region may be reloaded in a GPS receiver.
- **Cost effective tool-** GPS is cost effective tool for updating GIS or computer aided design (CAD) systems. The users of GPS equipment simply move from one location to the other along the surface of the earth and the geographical coordinates. GPS provide to be an excellent tool for data collection by the users in clear sky environment

Geographical information system (GIS)

- What is GIS?
- “Geographic Information Systems (GIS) are fundamental tools for learning geography. They provide a means of enquiring into geography through mapping. By extending and deepening the way that maps are used to explore geographical issues

Use of GIS

- **Construction of power transmission projects:-**

  Government of India has adapted the GIS in route surveying to improve efficiency of major project. GIS has provide very useful for transmission projects trough geographical tough regions such has forests , deserts, hilly terrain etc. the importance of caring out surveying for designing an optimal transmission line route covering multiple location through in topographical variation .
- **Rural road network planning and management** :- in India ruler roads comprise of other district roads and village roads. Under pradhan mantri gram sadak yojana all village s with population exceeding more than 500 will be provided connectivity by all weather roads. GIS technology in ruler roads is primarily used for geographic analysis as well as in planning and measurement of rural road accessibility.

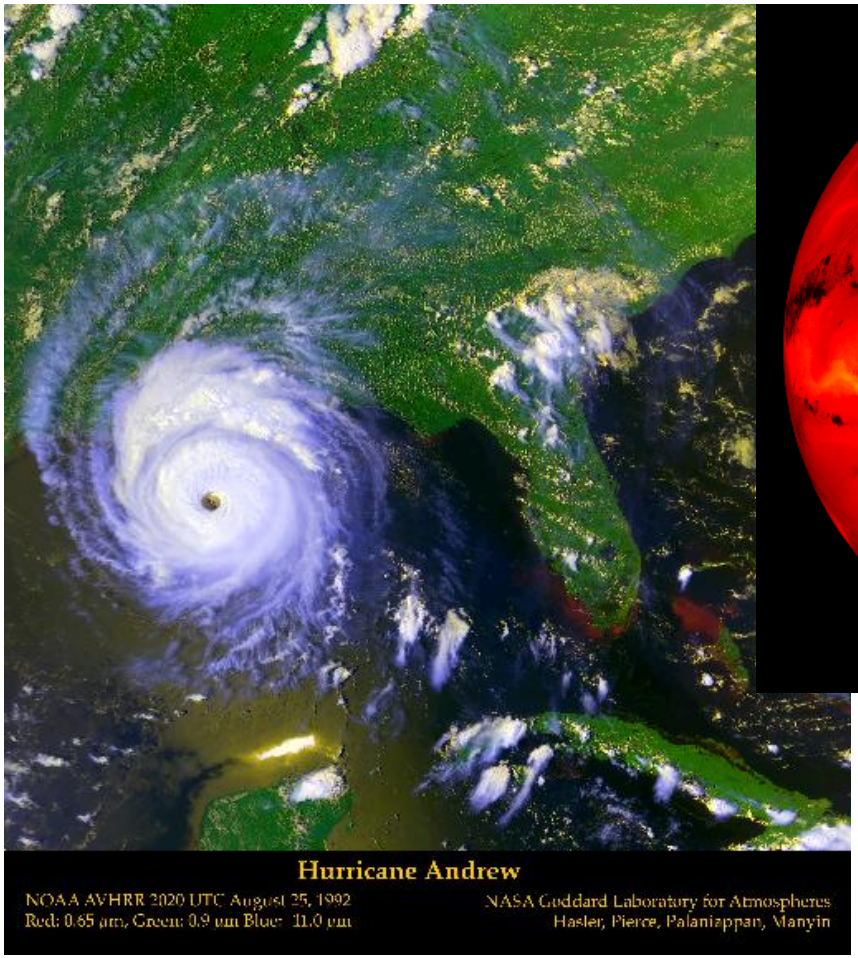
- **Traffic assessment and traffic information system.-** the knowledge of GIS is also used to study the traffic composition on a road or a flyover or a grade separator. The procedure involves identifying suitable location for conducting traffic surveys. Preparation of traffic flow diagram. The study of such traffic composition helps in effective monitoring of the traffic.

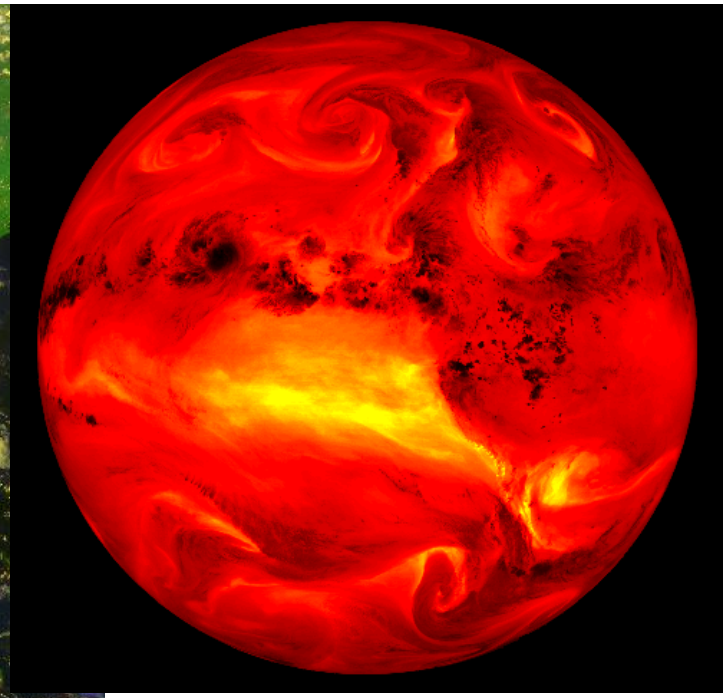
- **Pollution profile mapping and transportation planning.-** GIS technology also help in study the pollution profile of a city and also enable transport planning, as metros city have become highly polluted due to high degree of private vehicle usage . Study of pollution profile of metros has become the necessity of the day. The pollution study is carried out at a road network in term of link volume categorized by vehicle types.

- **Identification of ropeways, water ways and tunneling.-** because of difficult terrain and due to ecological reasons , it is not feasible to connect each habitation with all weather roads. GIS provides alternative transports system such as rope way, water ways and tunnels in hilly regions , GIS helps to select area for providing ropes way and also examine the existing road networks system including footpath also topography of the region.
- **Urban infrastructure and utility planning-**

1. laying pipeline for gas distributions.
2. Setting up new power /gas transmission plant
3. Developing water supply network. Providing drainage / sanitary projects.
4. Laying roads and directing traffic.
5. Managing telecom networks.
6. Urban planning.

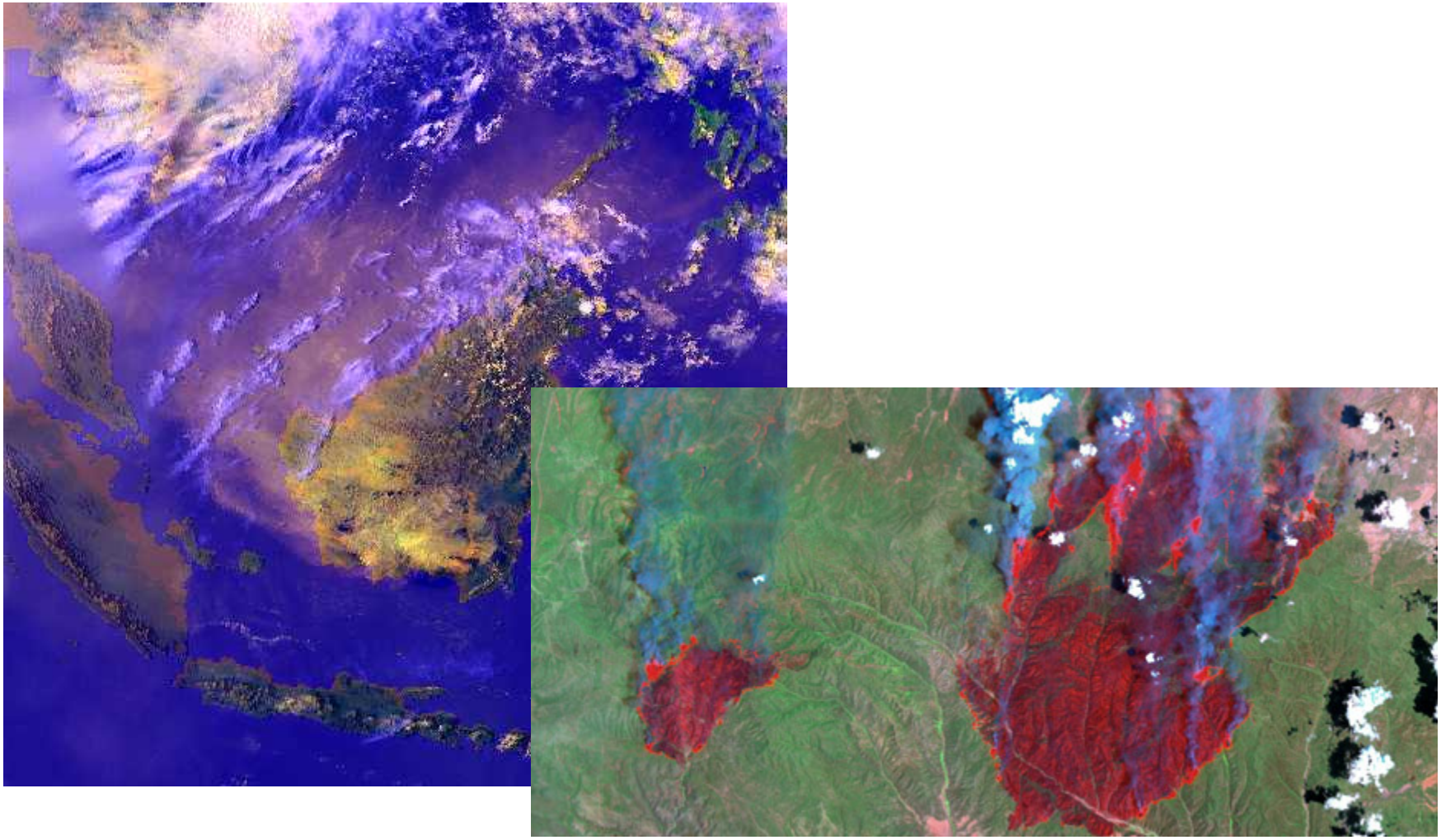
Monitoring Weather





Change Detection - Flooding

Detecting and Monitoring Wild land Fires



Monitoring Sea Surface Temperature