

REMOTE SENSING

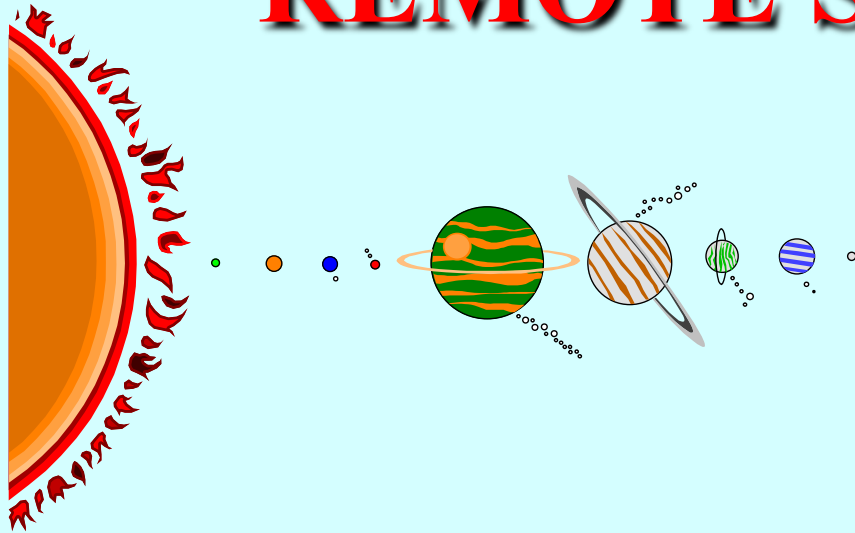
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Slides Change By: Dr. Abdullah Barat

Remote Sensing

The Science and Art of acquiring information about objects from measurements made at a distance without any physical contact with the objects.

REMOTE SENSING



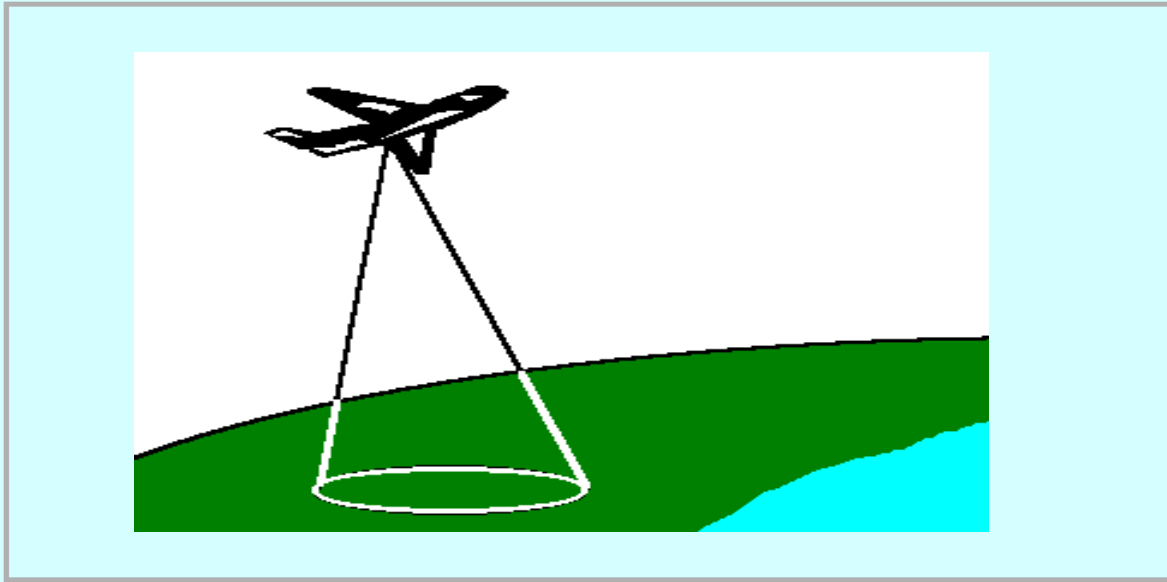
Remote Sensing refers to gathering and processing of information about earth's environment and its Natural & Cultural Resources through Aerial photography and Satellite scanning.

DEFINITION OF REMOTE SENSING

- Generally, Remote Sensing refers to the activities of recording / observing/ perceiving (**sensing**) objects or events at far away (**remote**) places.

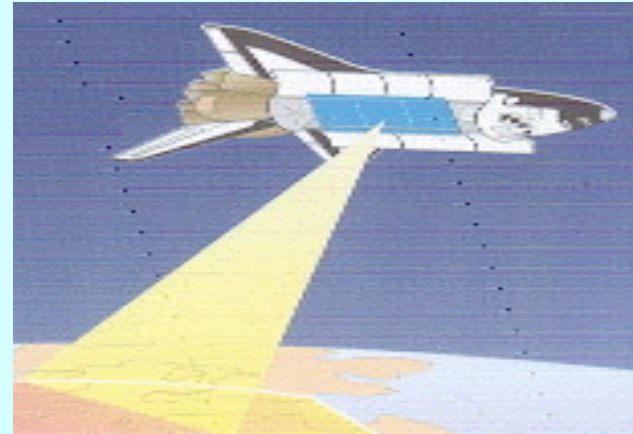
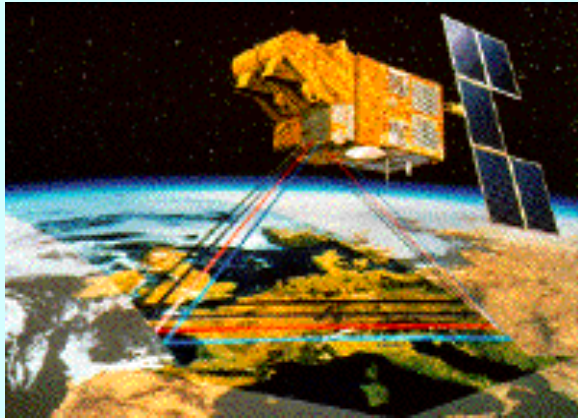
In remote sensing, the **sensors** are not in direct contact with the objects or events being observed.

AIRBORNE REMOTE SENSING



- In airborne remote sensing, sensors are mounted on an aircraft.
- An advantage is the capability of offering very high **Spatial Resolution** images (10 cm or less).
- The disadvantages are low coverage area and high cost per unit area of ground coverage.

SPACE BORNE REMOTE SENSING



In space borne remote sensing, sensors are mounted on-board a spacecraft (Satellite) orbiting the earth.

SPACE TECHNOLOGY AND ITS APPLICATIONS

NATIONAL SPACE SYSTEMS



COMMUNICATION



INSAT SERIES OF SATELLITES



**METEOROLOGY, RADIO/TV BROADCAST,
DISASTER WARNING**



REMOTE SENSING



IRS SERIES OF SATELLITES



**NATURAL RESOURCES MONITORING AND
MANAGEMENT**

Space borne remote sensing provides the following advantages:

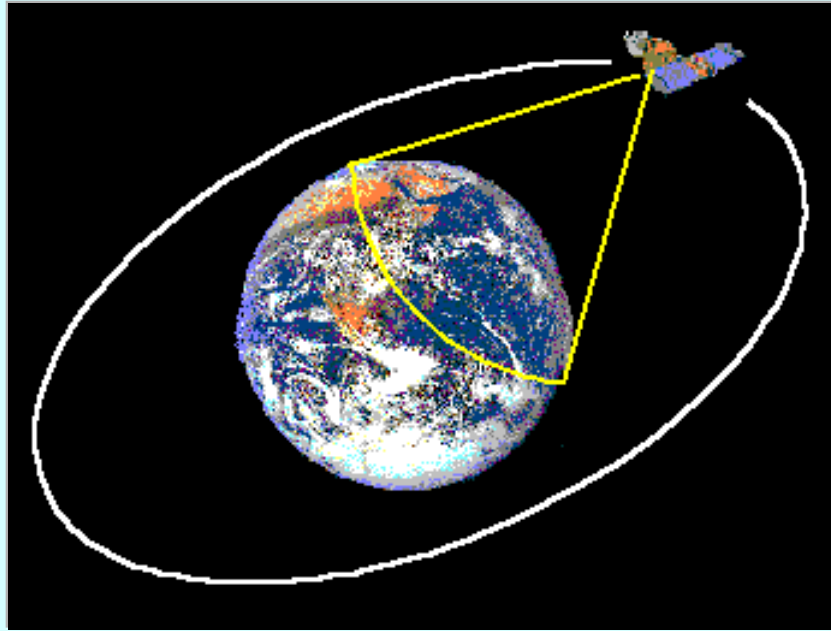
- **Large area coverage;**
- **Frequent and repetitive coverage of an area of interest;**
- **Relatively lower cost per unit area of coverage.**

SATELLITE ORBITS

- A satellite follows a generally elliptical orbit around the earth. The time taken to complete one revolution of the orbit is called the **orbital period**.
- Satellite traces out a path on the earth surface, called its **ground track**, as it moves across the sky.
- As the earth below is rotating, the satellite traces out a different path on the ground in each subsequent cycle.

- **Remote Sensing satellites are often launched into special orbits such that the satellite repeats its path after a fixed time interval.**
- **This time interval is called the repeat cycle of the satellite.**

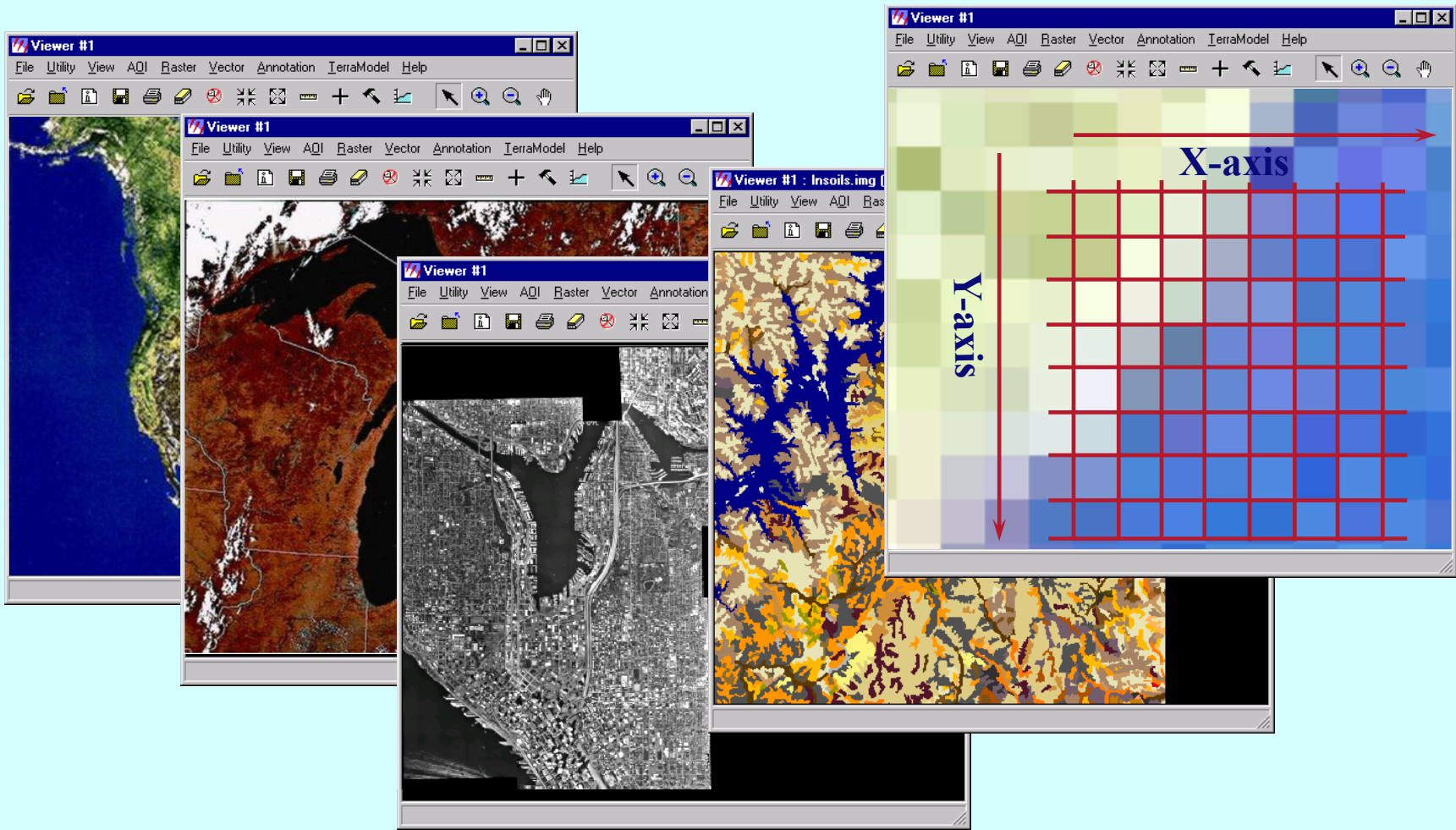
GEOSTATIONARY ORBITS



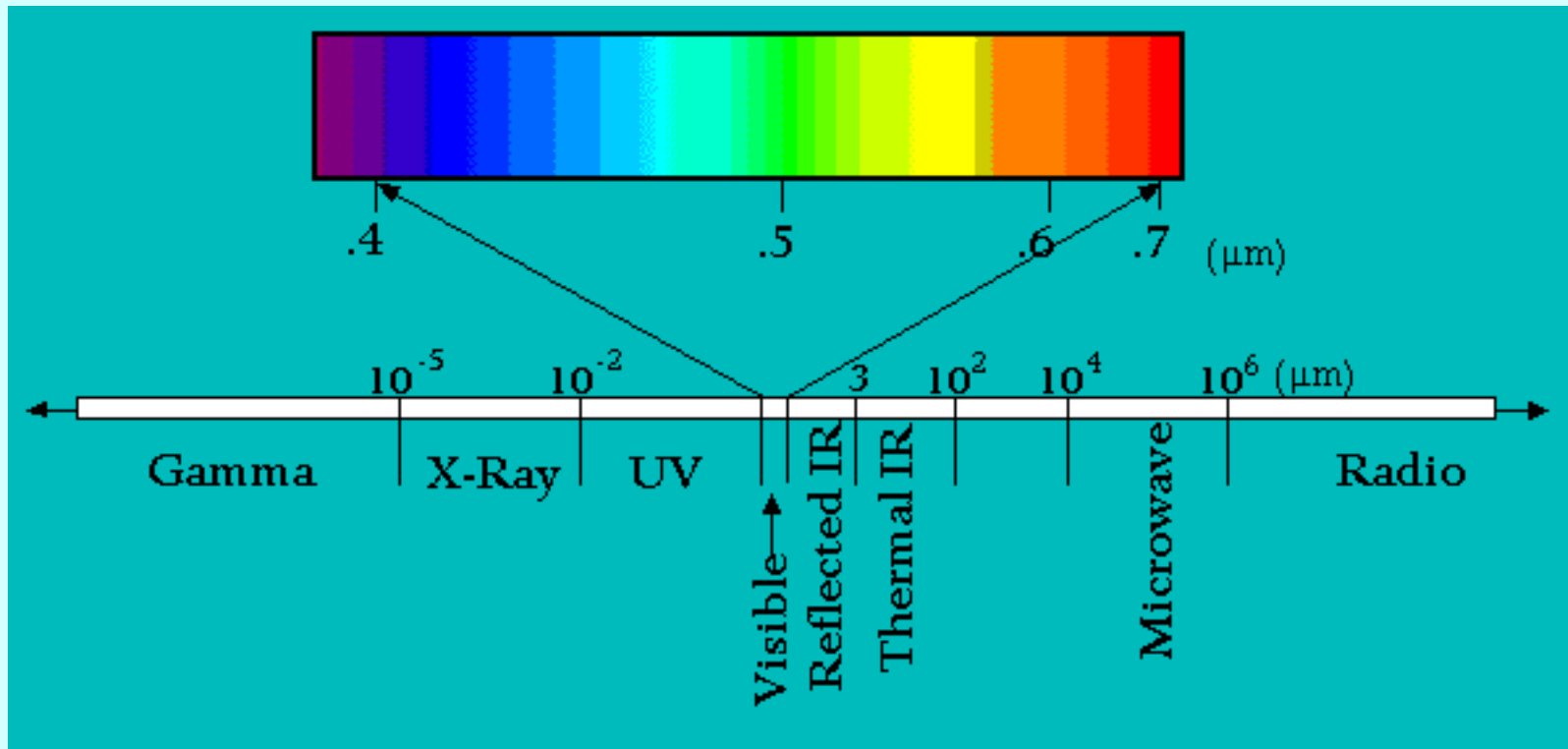
These satellite appears stationary with respect to the Earth's surface. Generally placed above 36,000 km from the earth.

What is an image?

- Data that are organized in a grid of Columns and rows
- Usually represents a geographical area



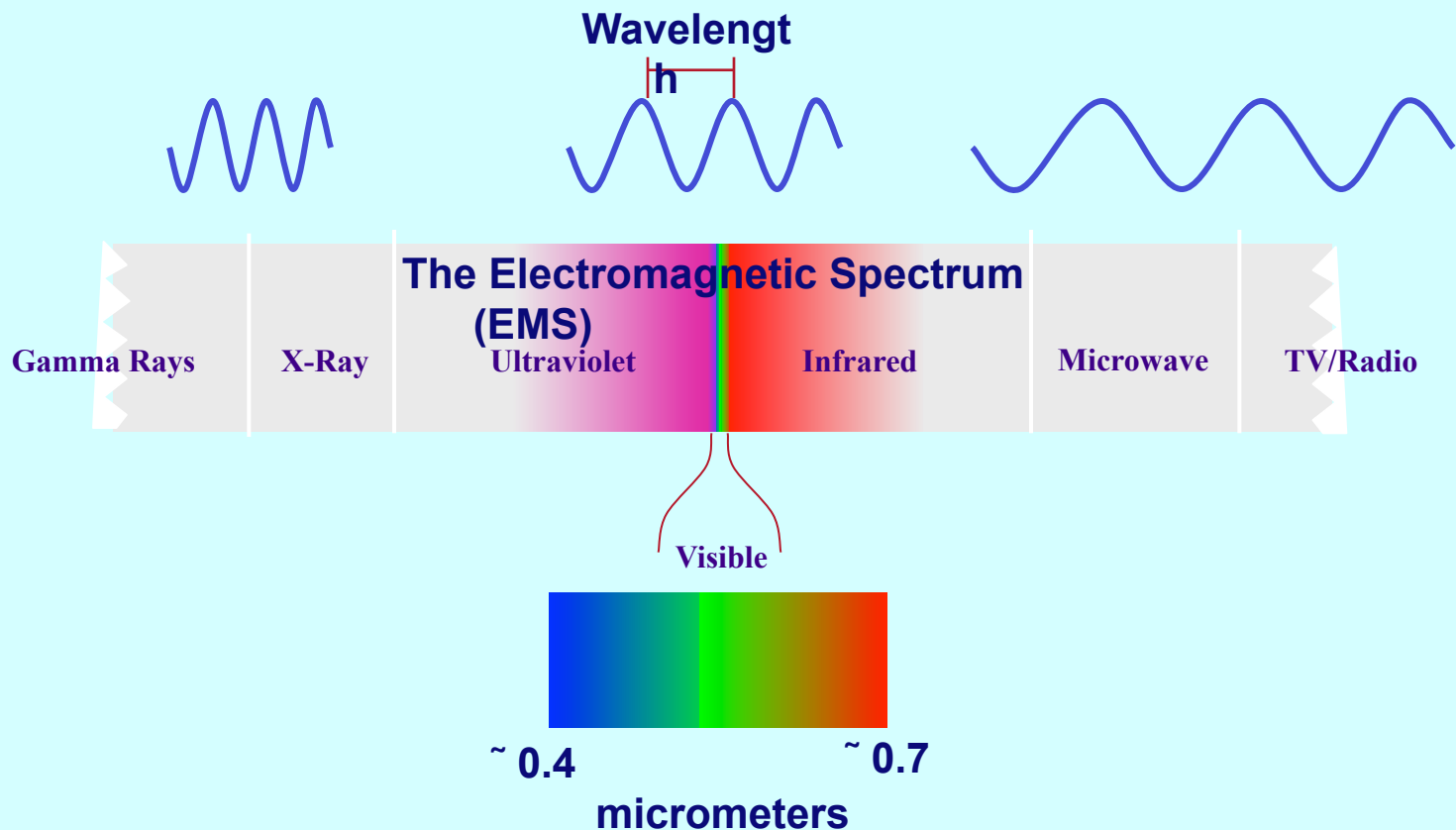
What can satellites see?



Satellite electromagnetic sensors let us “see” beyond the visible...

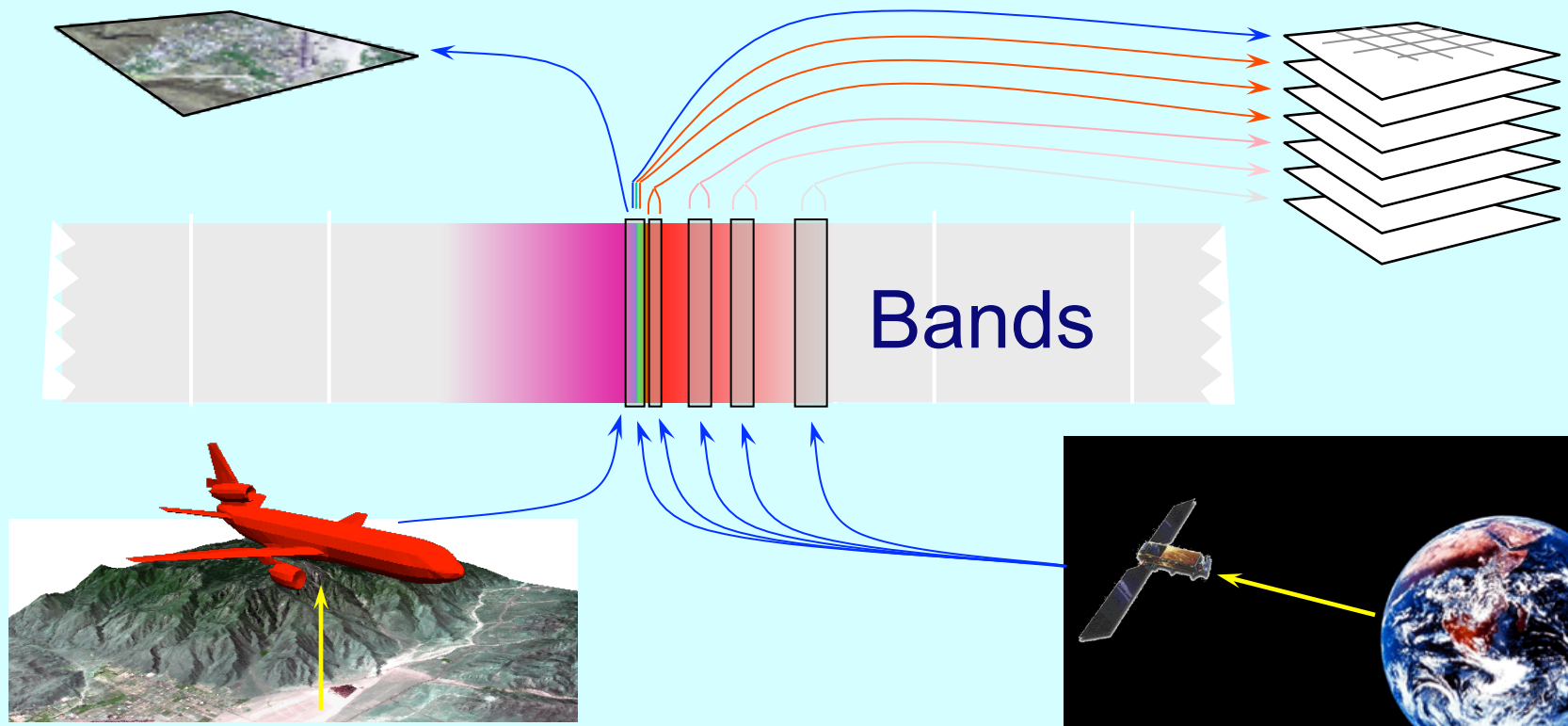
Measuring Light

- Light can be classified according to the length of the wave



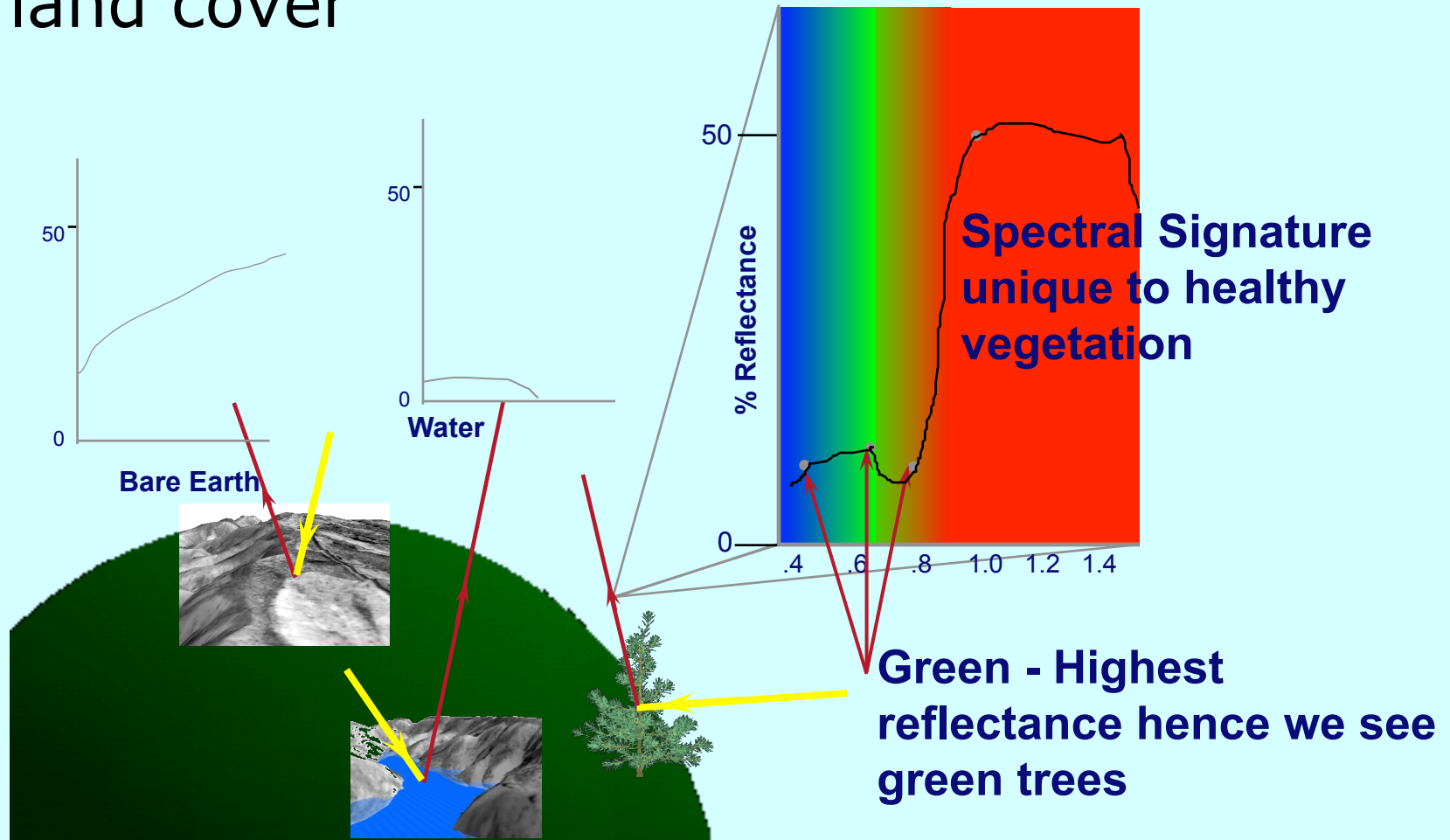
Measuring Light: Bands

- Human eyes only 'measure' visible light
- Sensors can measure other portions of EMS

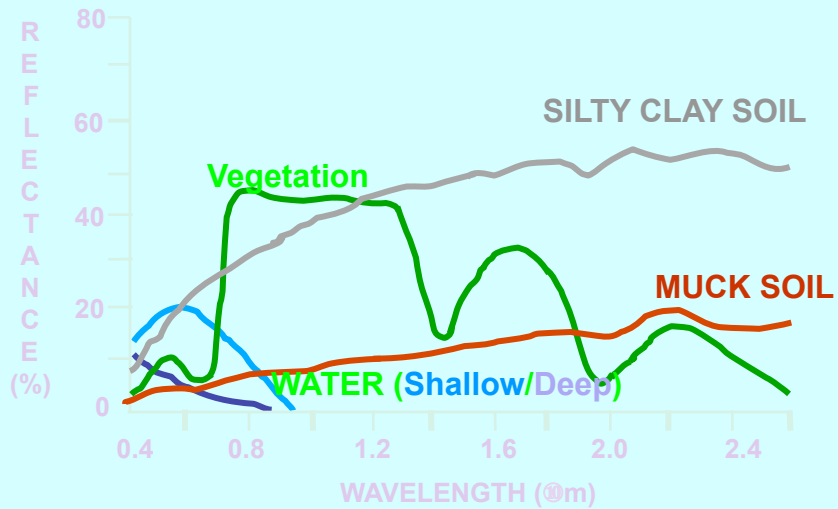


Spectral Signatures

- Signal received by sensor depends on land cover



Spectral Response of Earth Surface Features



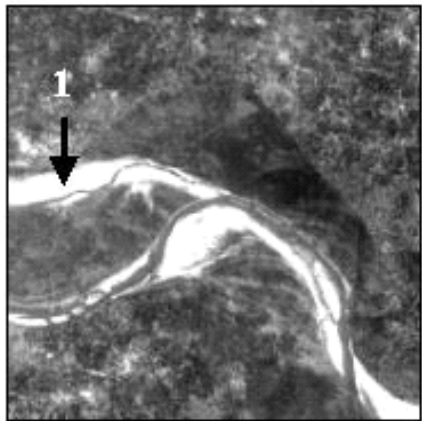
True Color Composite



False Color Composite



BLUE BAND
(0.4-0.5 μm)

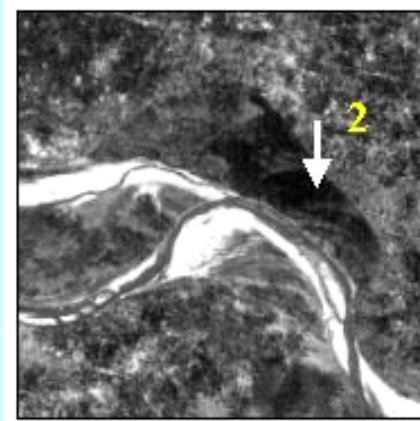


1- SAND

GREEN BAND
(0.5-0.6 μm)

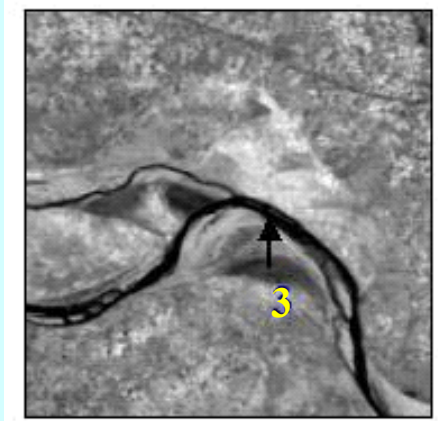


RED BAND
(0.6-0.7 μm)



2-VEGETATION

NEAR IR
(0.7-0.9 μm)



3-WATER

GENERATION OF FALSE COLOUR COMPOSITE

GREEN BAND WITH BLUE FILTER



RED BAND WITH GREEN FILTER



IR BAND WITH RED FILTER



STANDARD FALSE COLOUR COMPOSITE

ELECTROMAGNETIC SPECTRUM

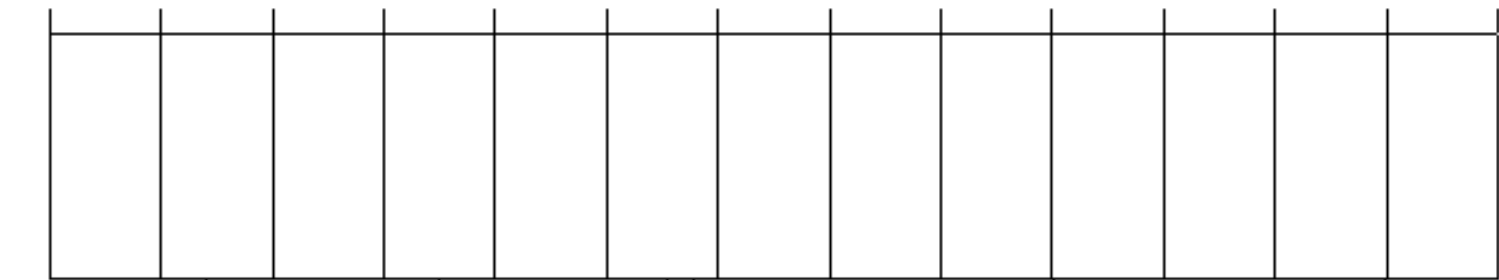
- The electromagnetic spectrum can be divided into several wavelength (frequency) regions, among which only a narrow band from about 400 to 700 nm is visible to the human eyes

Wavelength units: $1 \text{ mm} = 1000 \text{ }\mu\text{m}$; $1 \text{ }\mu\text{m} = 1000 \text{ nm}$

ELECTROMAGNETIC SPECTRUM

Wavelength (μm)

10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^0 10^1 10^2 10^3 10^4 10^5 10^6 10^7



Gamma Ray X-Ray Ultraviolet Infrared Microwaves Radio Waves

The Visible Spectrum

ultraviolet violet blue green yellow red infrared



400 480 540 580 700

Wavelength (nm)

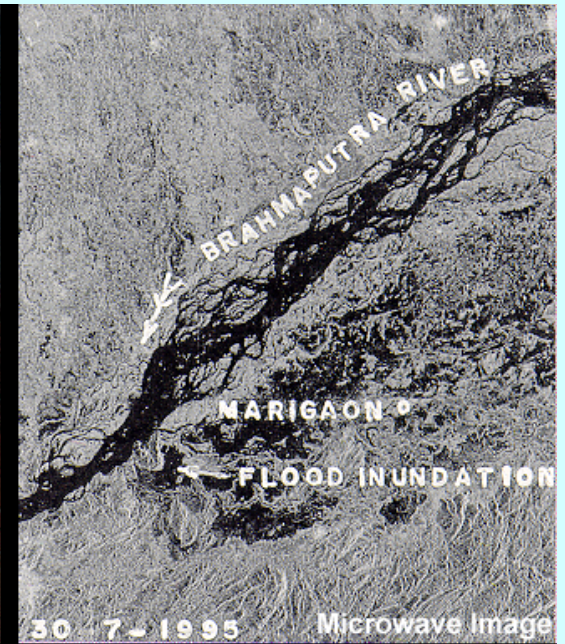
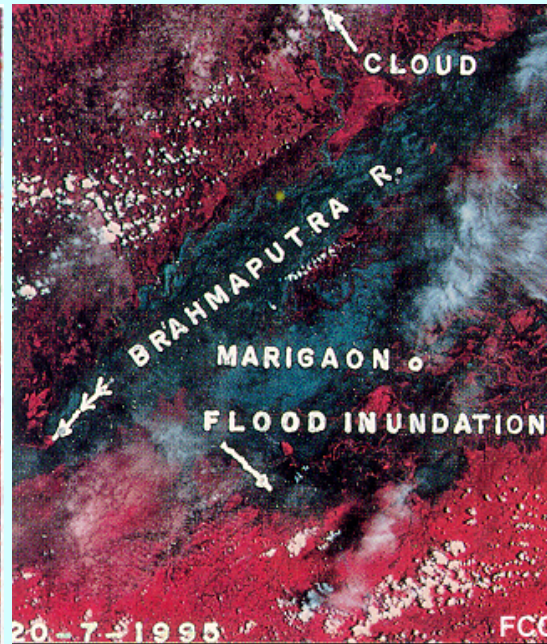
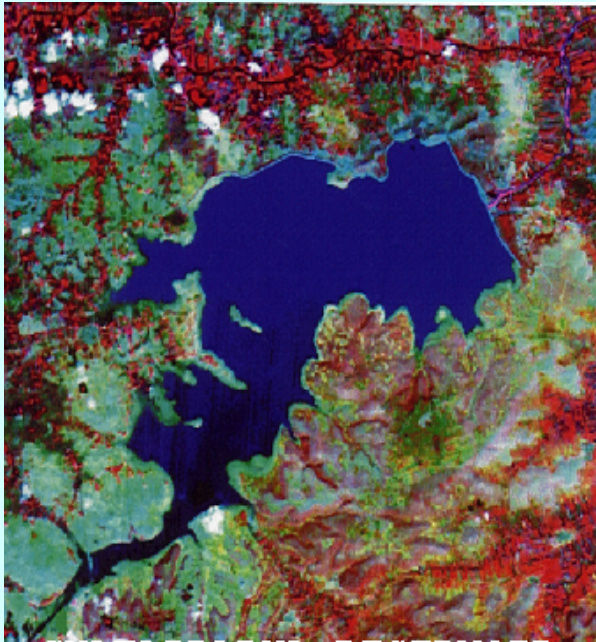
ADVANTAGES OF REMOTE SENSING

- **REAL TIME**
- **SPATIAL LOCATIONS AND EXTENTS OF FEATURES CAN BE COLLECTED ACURATELY**
- **CHEAPER**
- **FASTER**
- **EASY UPDATION**

LIMITATIONS

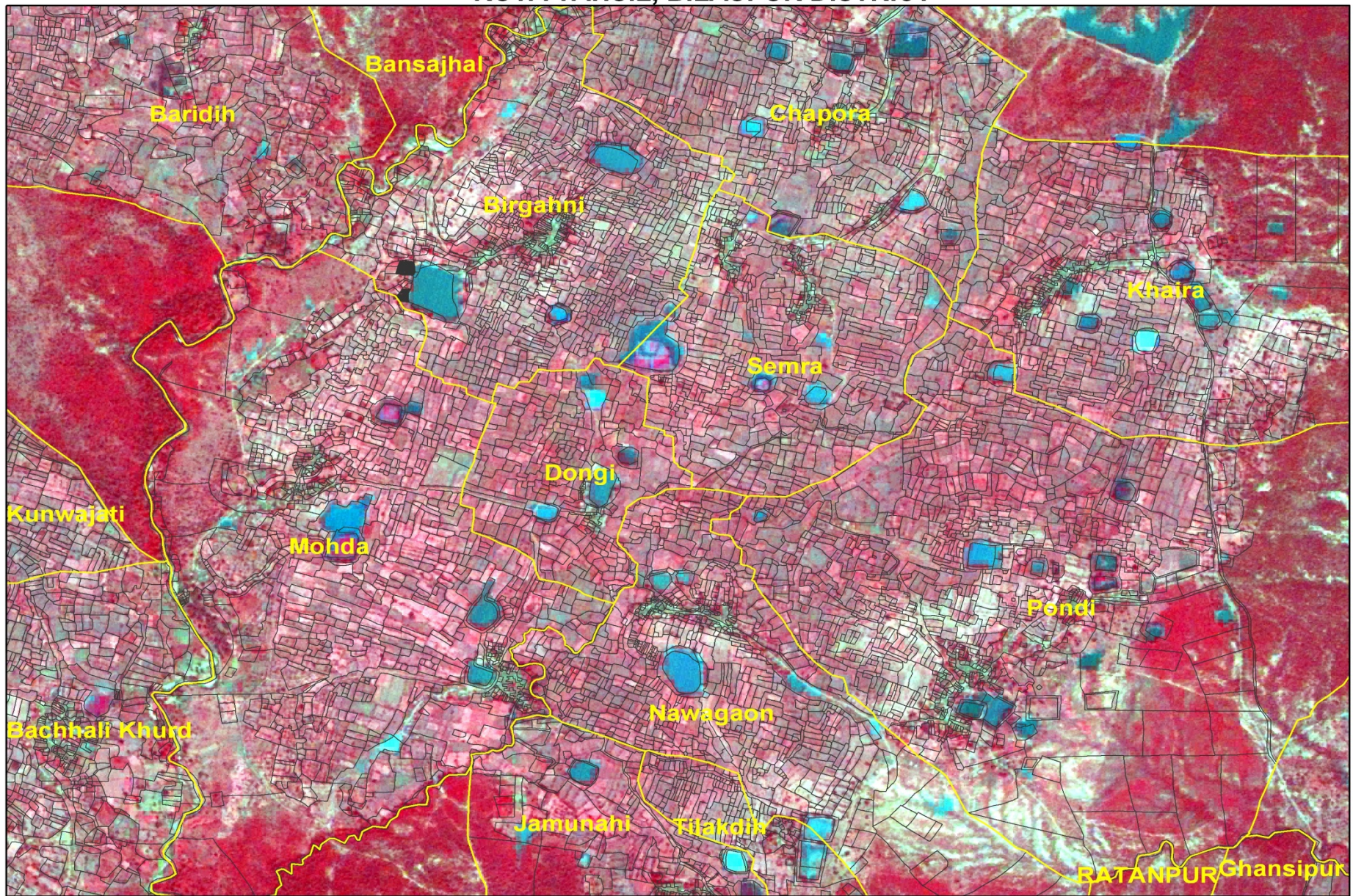
- **AVAILABILITY OF CLOUD FREE DATA**
- **LIMITATIONS IN MAPPING SMALLER AREAS**
- **CONSISTANCY IN DATA**

WATER RESOURCES APPLICATIONS



- **COMMAND AREA MANAGEMENT**
- **RESERVOIR CAPACITY EVALUATION**
- **TANK INVENTORY**
- **CANAL ALIGNMENT**
- **SNOW MELT RUN-OFF**
- **FLOOD MAPPING**
- **FLOOD MONITORING**

KOTA TAHSIL, BILASPUR DISTRICT



GEOREFERENCED CADASTRAL MAPS OVERLAID ON HIGH RESOLUTION SATELLITE DATA

DISASTERS

Floods

40 M ha
flooding
4.2 crore
people in 2002



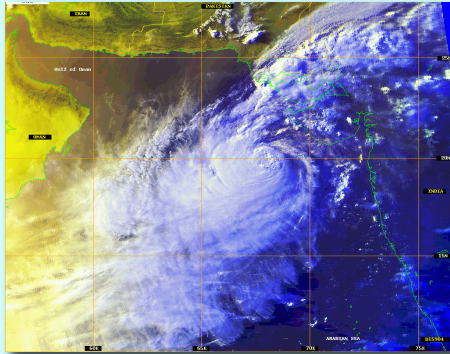
Landslides

Sub-Himalayan/
Western Ghats
8% of TGA
5000 people in 2002



Cyclones

5700 km long
coastline
15,000 people
in 2002



Earthquakes

55% of area in
Seismic Zone III-IV
40,000 people in
2001



Drought

68% net sown
area in 116
dist.
30 crore people
in 2002



Forest Fires

≈65% of total
forests under
potential threat
of ground fire



COASTAL & MARINE RESOURCES



- Coastal Zone Management Plan
- Shoreline Changes
- Coastal Wetlands
- Aquaculture sites

Mangrove and plantations



Casuarina plantation



Mangrove: *Sonnerartia apetala*
and *Acanthus ilicifolius* In Jagatsinghpur



Long: 86 24 31 and Lat. 20 00 10