Surveying

REMOTE SENSING (RS)

What is remote sensing (RS)?

Remote sensing refers to the **activities of**

- **perceiving(become aware/conscious)**
- **Observing,**
- **recording,**

objects or events at far away (remote) places.



- In **general sense**,

human visual system is an **example** of a RS system

- **In a more restricted sense**,

Definition: RS refers to the **technology of acquiring information:**

-about the earth's surface (land and ocean) and atmosphere

-using sensors onboard airborne (aircraft, balloons, UAV) or space-borne (satellites, space shuttles) platforms .

Characteristics of a RS System

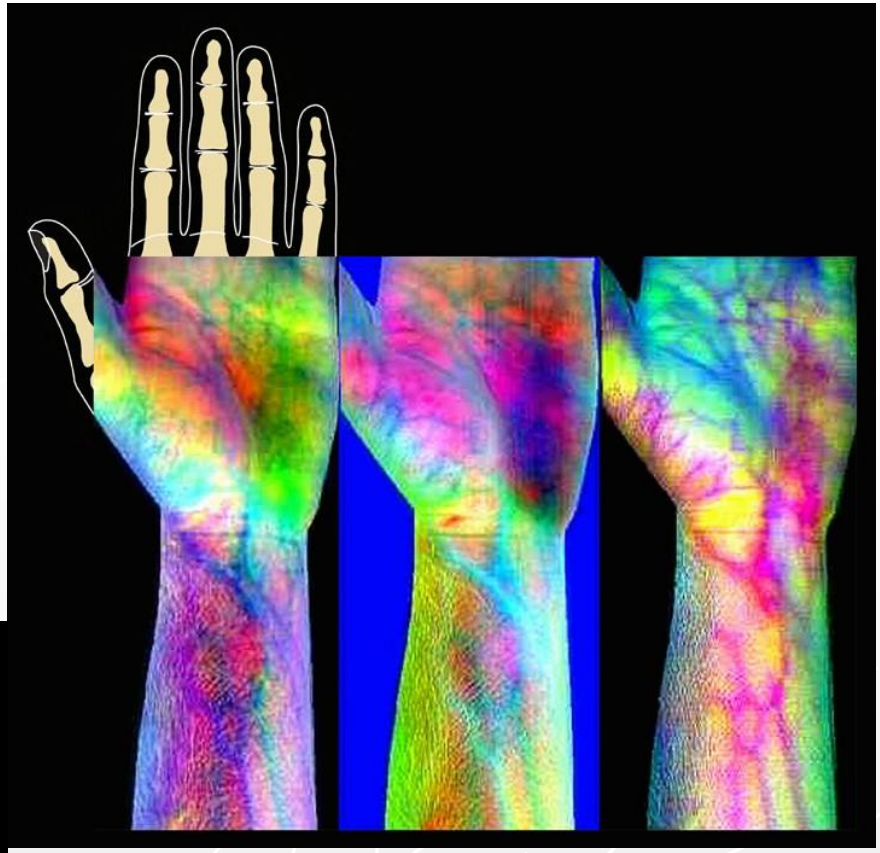
- **Sensors are not in direct contact** with the objects or events being observed
- **Information needs a physical carrier** to travel from the objects/events to the sensors
  - ***electromagnetic radiation*** is normally used as an information carrier
- **Output of a RS system is usually an *image*** representing the ***scene*** being observed.
- **Image analysis and interpretation is required** in order to ***extract*** useful ***information*** (***Data?***) from the image.

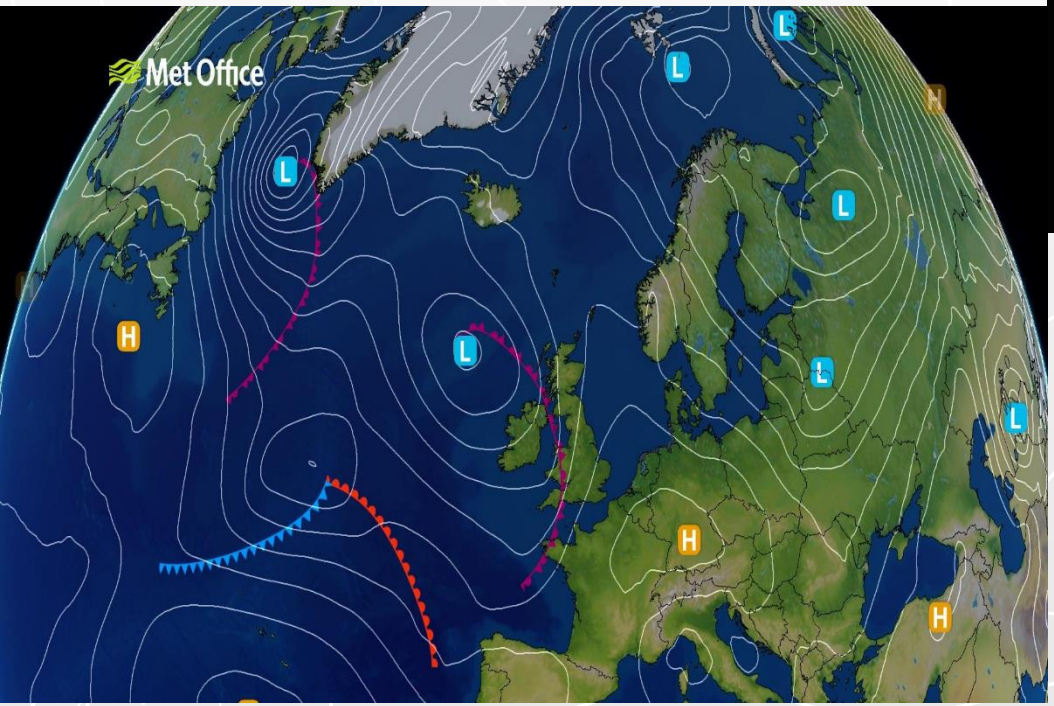
Fundamental characteristics of RS as a **source of information:**

- **Synoptic Vision of ground surface/event conditions** otherwise not obtainable with traditional techniques

- **Repeating Cycle: periodic observations** enabling **temporal comparisons** and **updating** of the collected data.

- **Multispectral Acquisitions** give a clear idea of object & event.

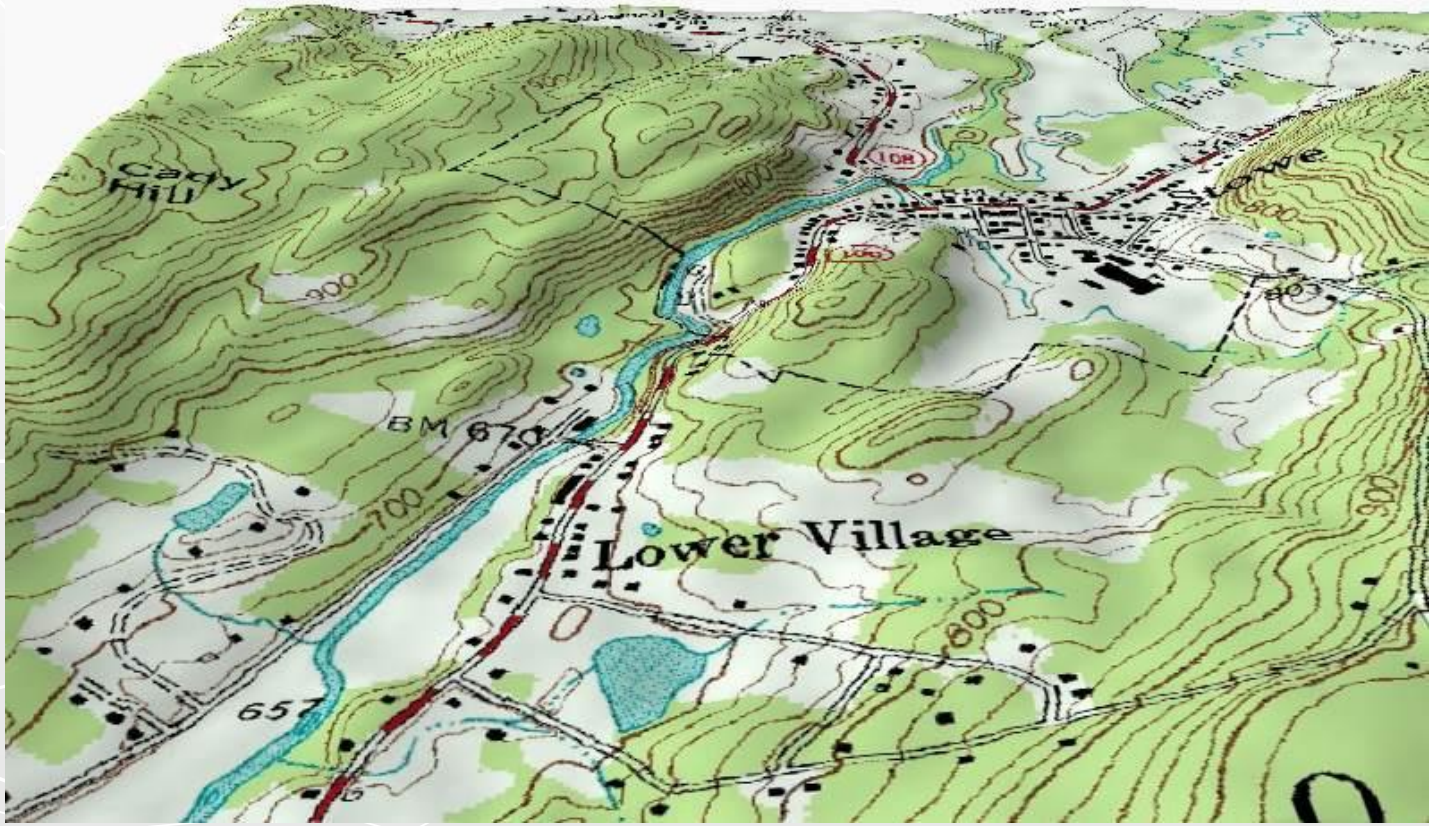



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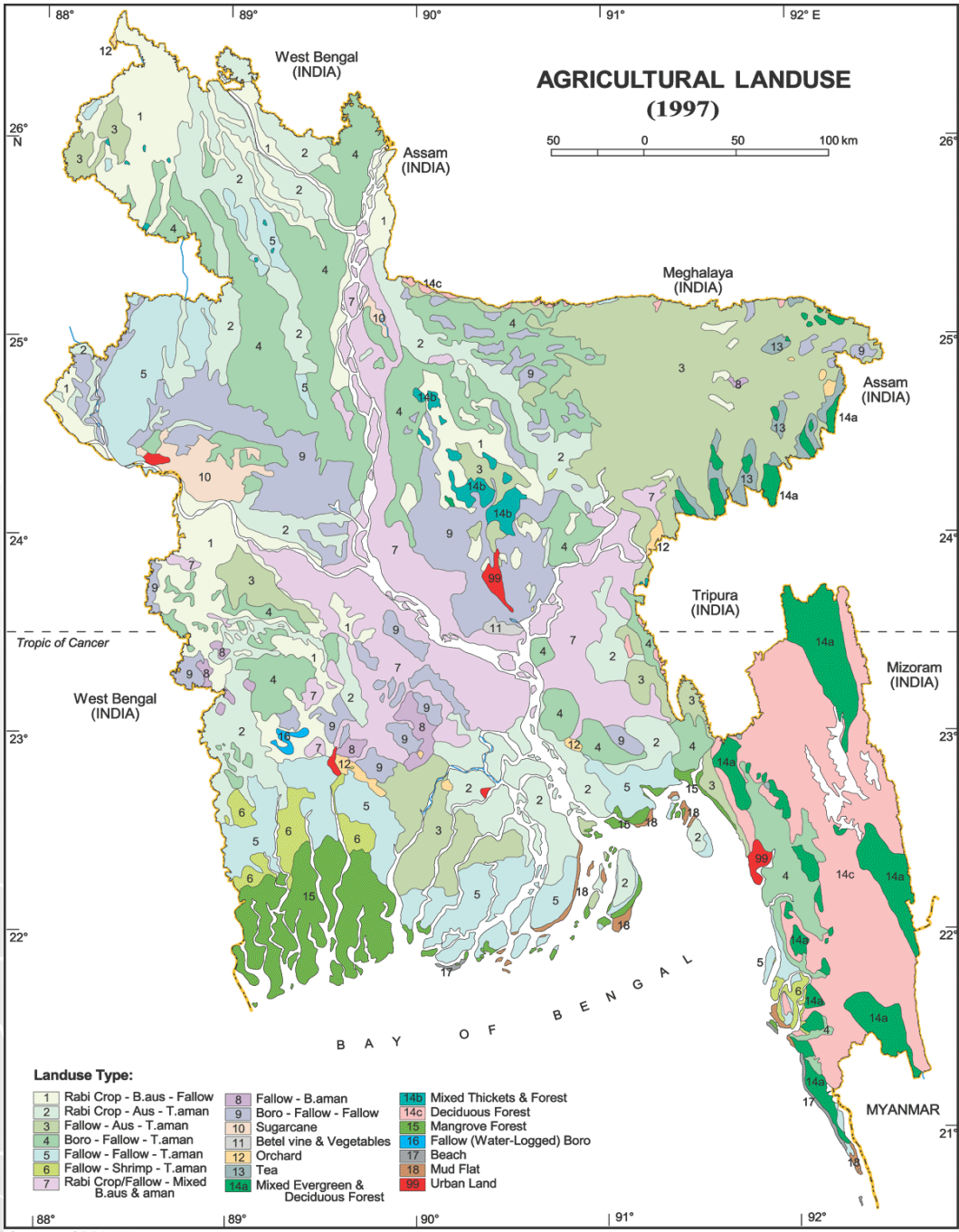
Main goal of RS is the **production** of **a) Topographic map, b) Thematic map**

Topographic map:

- Characterized by ***large-scale detail*** and **quantitative representation of *relief***, usually using ***contour line***.

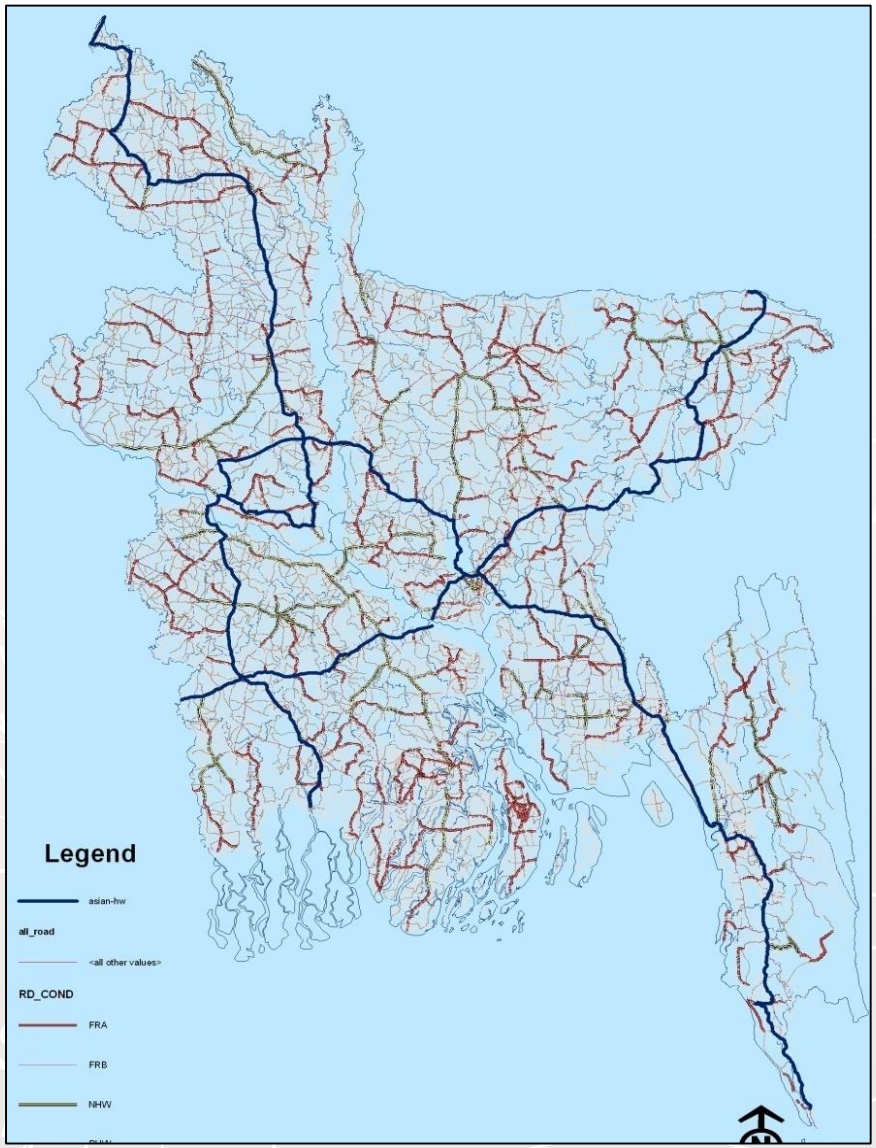


Thematic map: map especially designed to show a ***particular theme*** connected with a specific geographic area.

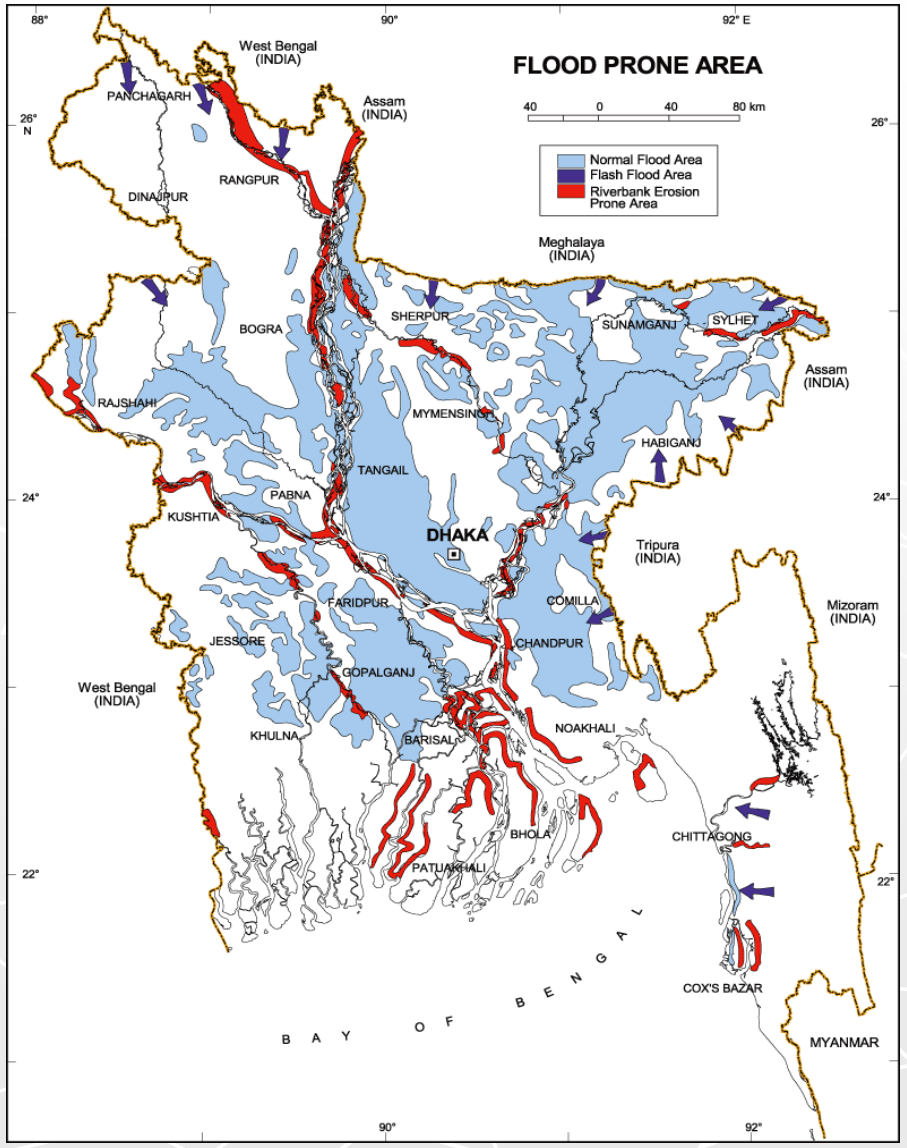


Source: *SRDI, 1997*

More example of Thematic Map

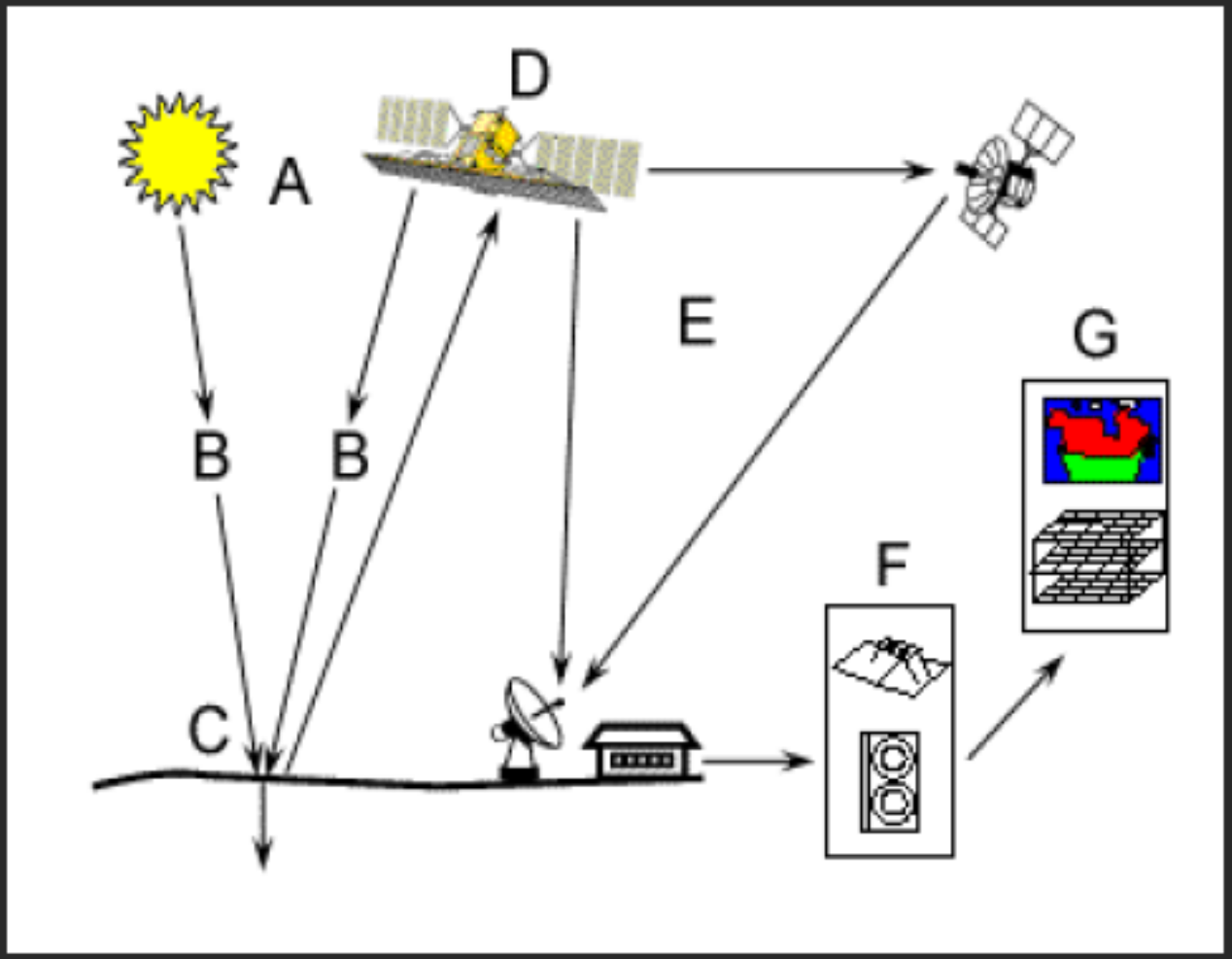


Road Network of Bangladesh



Flood Prone Areas of Bangladesh

Remote Sensing system/Process



A. Energy Source or Illumination

B. Atmosphere

C. Interaction with the Target

D. Recording of Energy by the Sensor

E. Transmission, Reception, and Processing

F. Interpretation and Analysis

G.Application

Basic components of RS System:

A. A uniform **energy source**:

- **provide energy over all wavelengths**, at a constant, known, high level of output, **irrespective of time and place**.

B. A non-interfering atmosphere:

- an atmosphere that **will not modify the energy** from the source in any manner, whether that energy is **on its way to** earth's surface or **coming from it**.

- **hold** irrespective of wavelength, time, place, and sensing altitude involved.

C. A series of unique energy/matter interaction at the earth's surface

D. A super sensor: Recording of Energy by the sensor. This will be a sensor, highly sensitive to all wavelengths

E. Transmission, Reception and processing: A real-time data handling system

F. Interpretation and analysis: Multiple data users

G. Applications

Types of Remote Sensing

Basing on location of the sensor:

- **Airborne** remote sensing (by aerial photography)
- **Space-borne** remote sensing (by satellites)

Basing on type of Energy Resources:

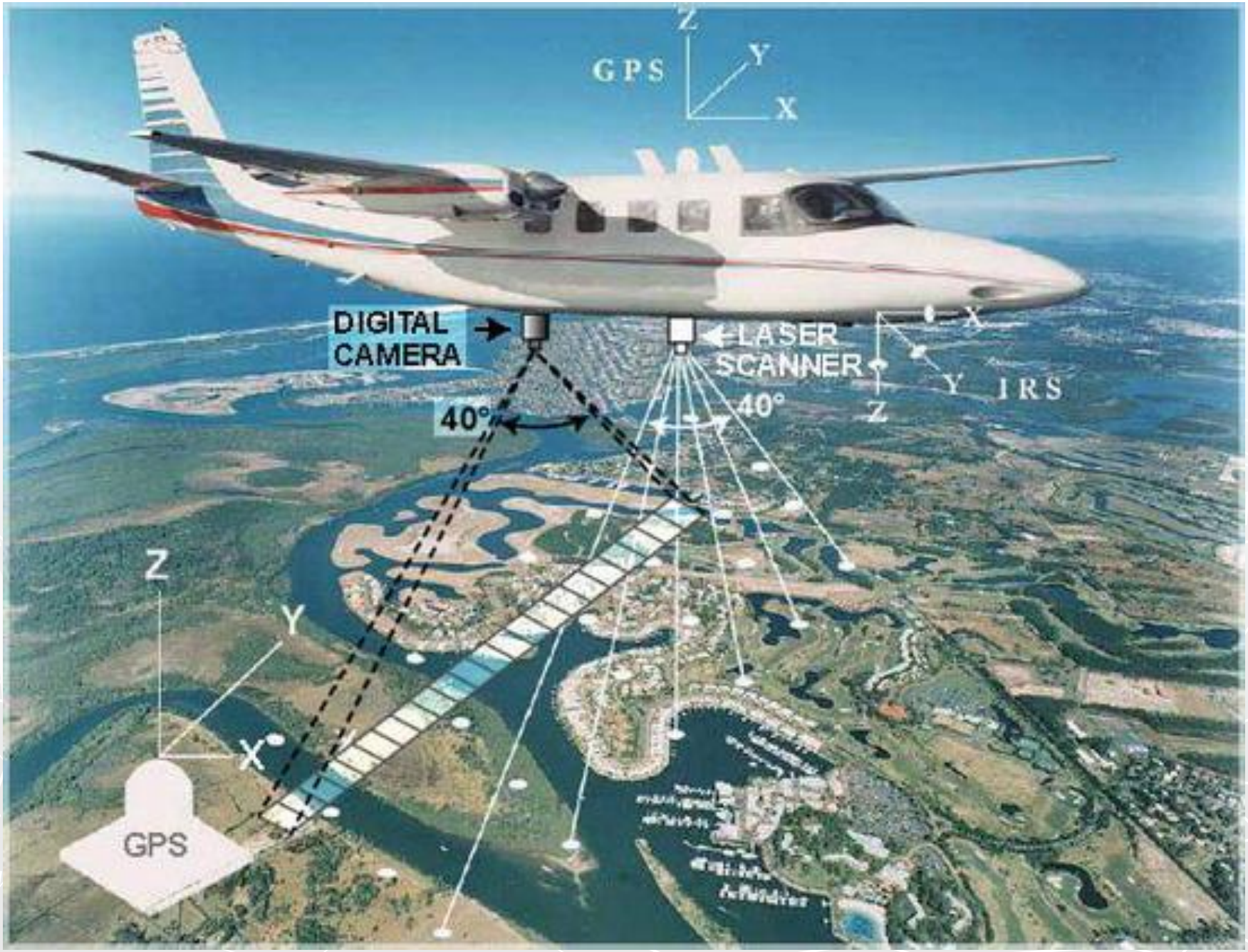
- **Passive Remote Sensing:** Makes use of sensors that **detect the reflected** or emitted electro-magnetic **radiation from natural sources.**

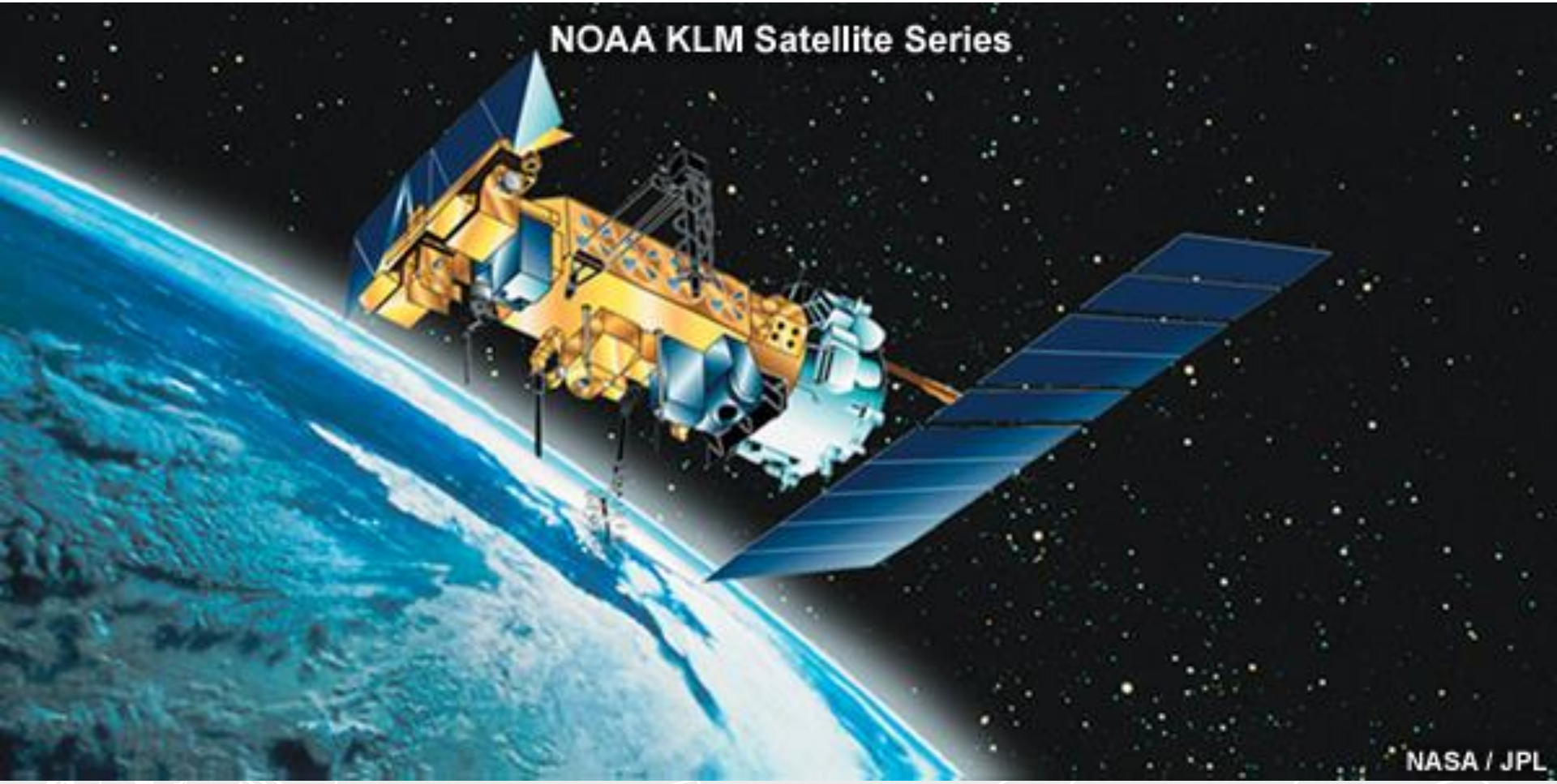
Types of Remote Sensing

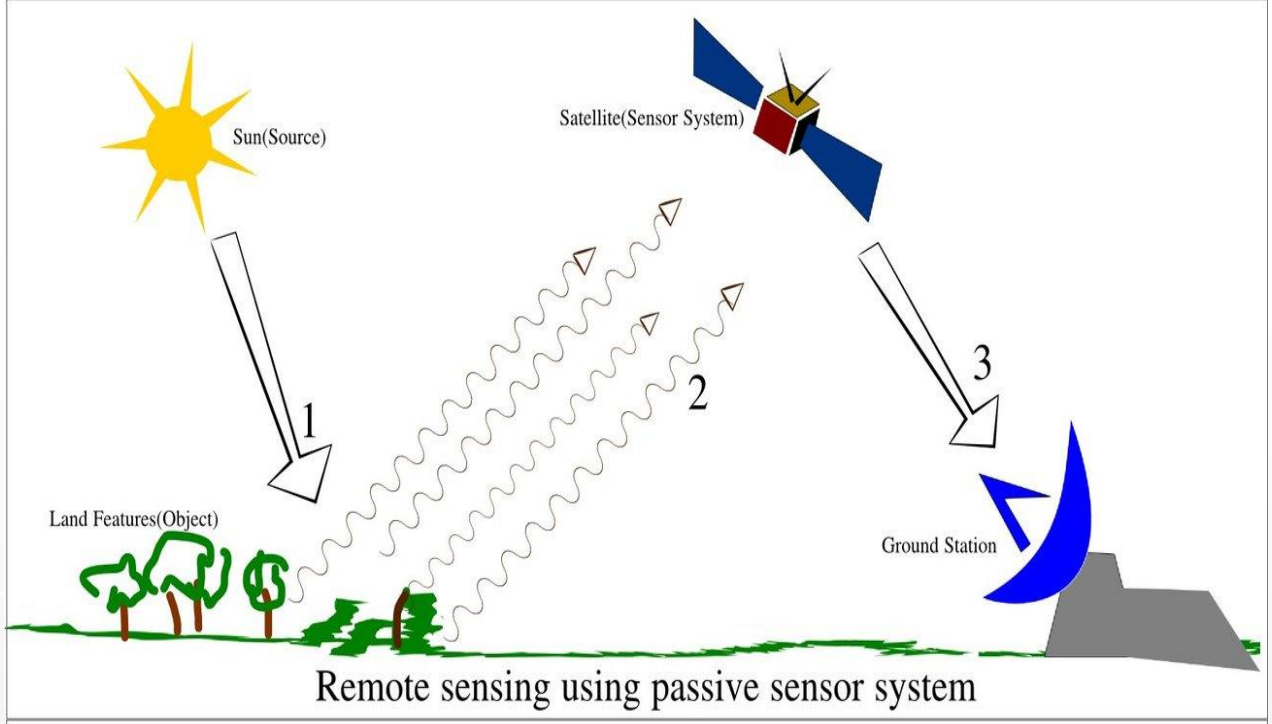
•**Active remote Sensing:** Makes use of sensors that detect reflected responses from objects that are irradiated from **artificially-generated energy sources**, **such as radar**.

Basing on Wavelength Regions:

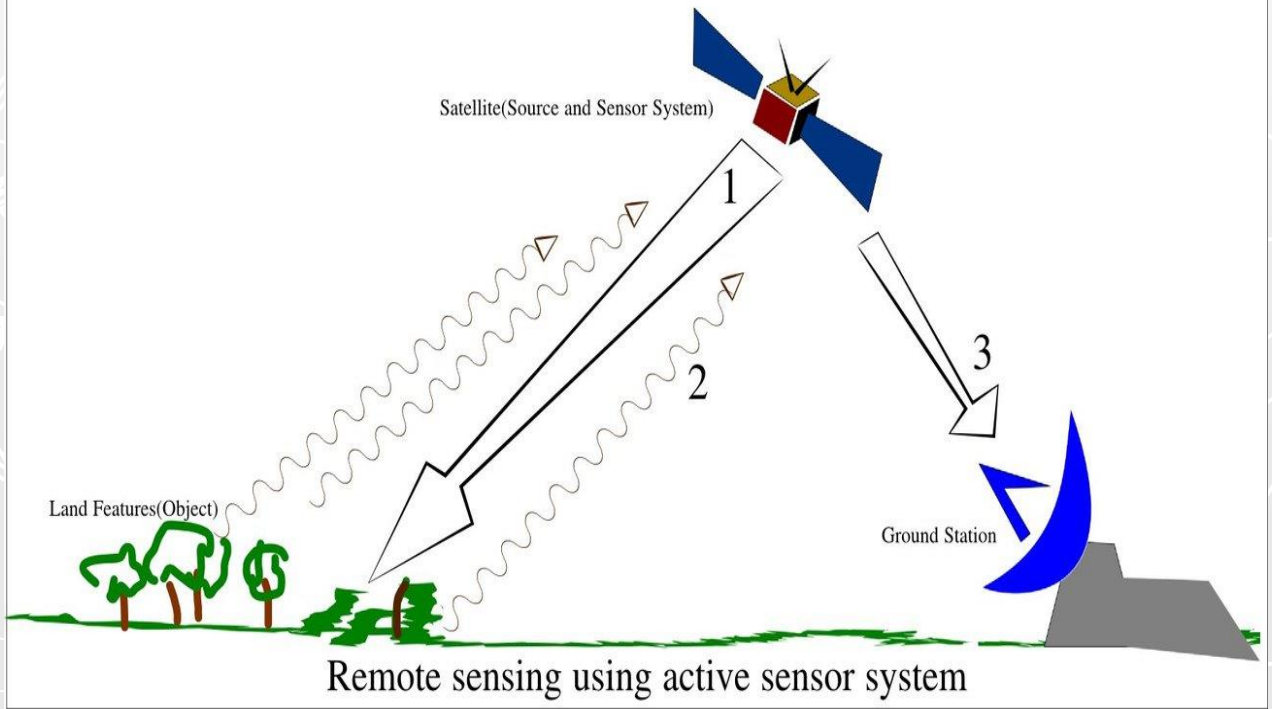
- **Visible and Reflective Infrared** Remote Sensing.
- **Thermal Infrared** Remote Sensing**.**
- **Microwave** Remote Sensing**.**


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LASER SCANNER
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40°
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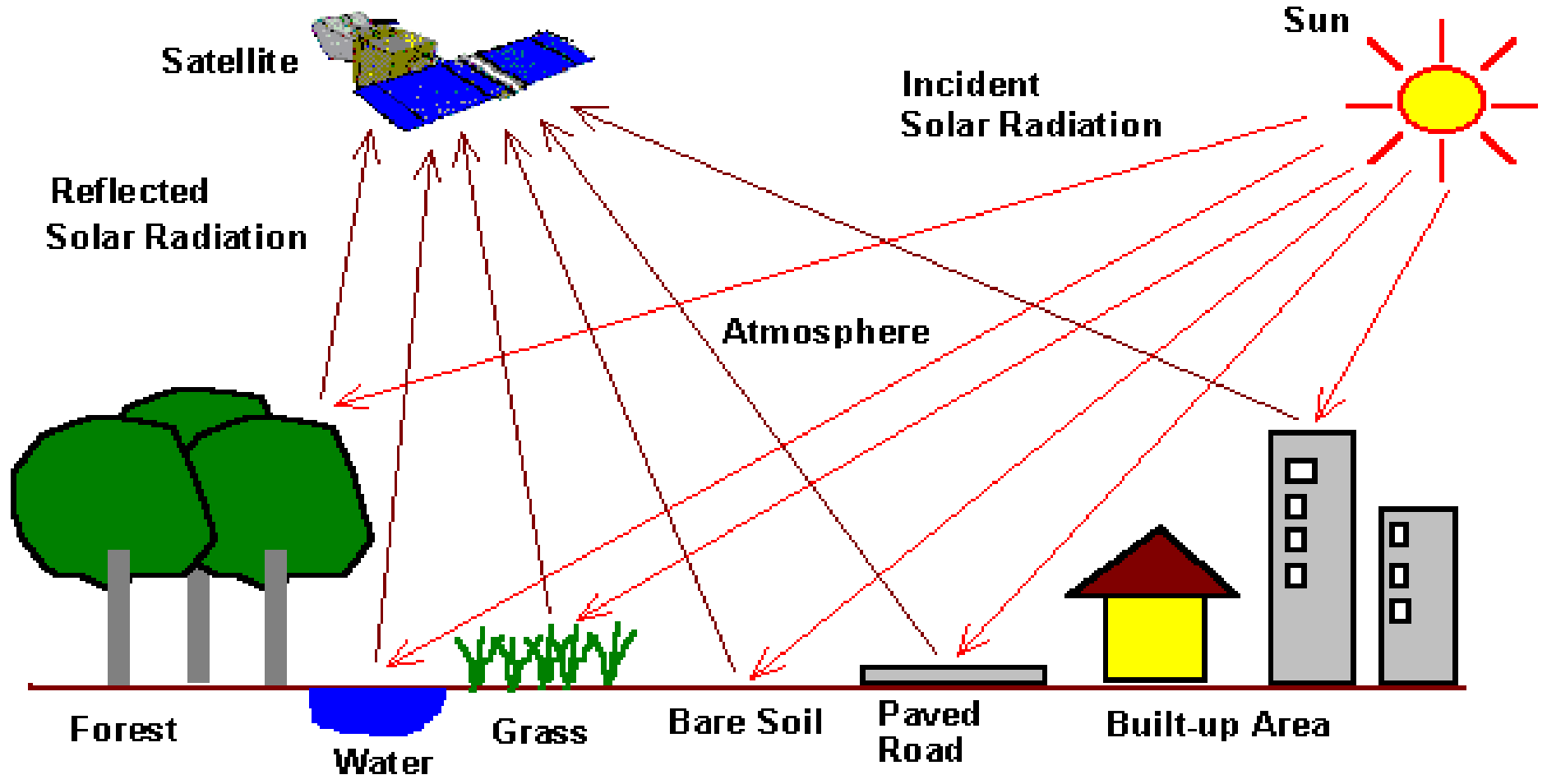

NOAA KLM Satellite Series
NASA / JPL

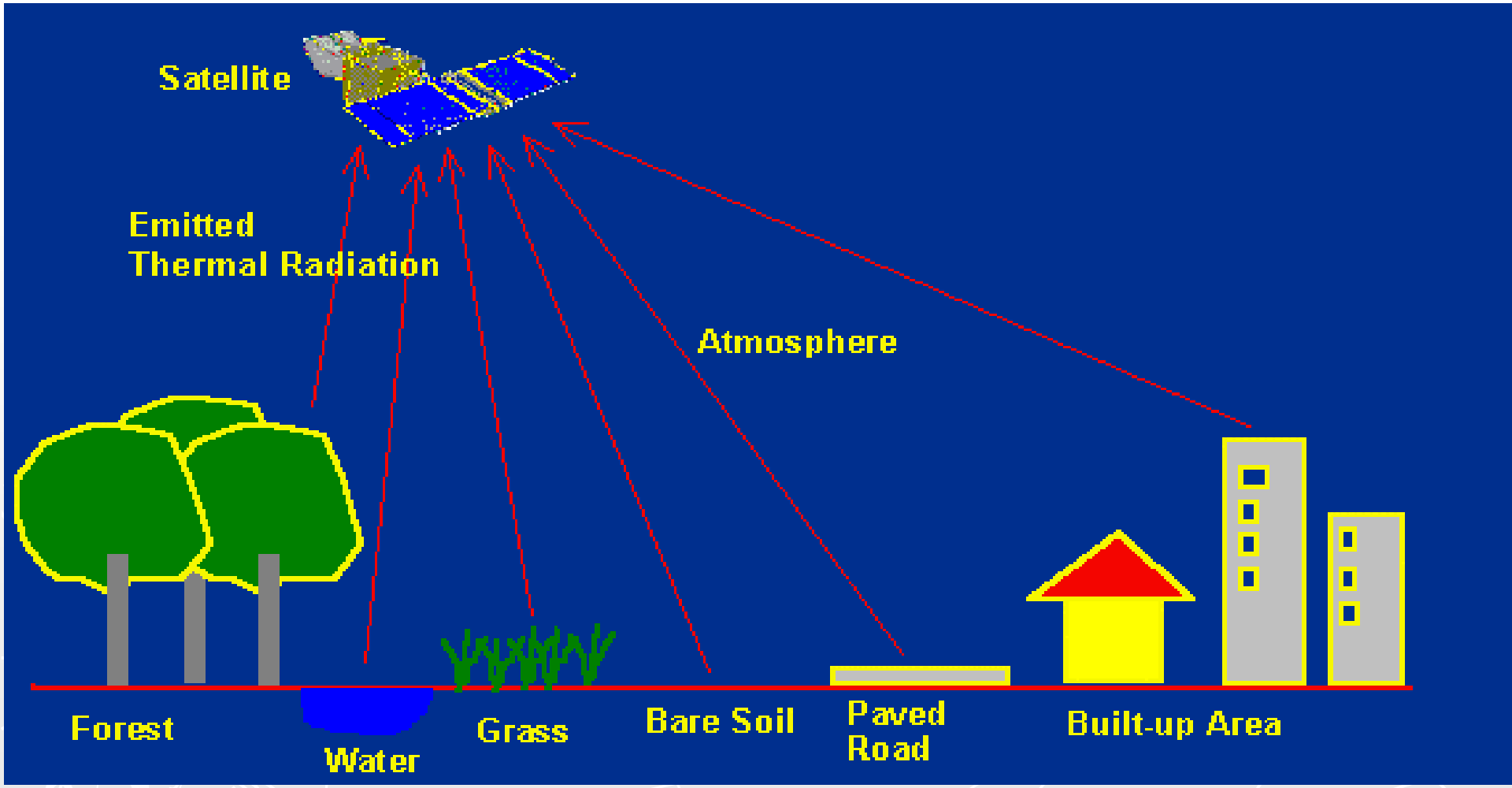


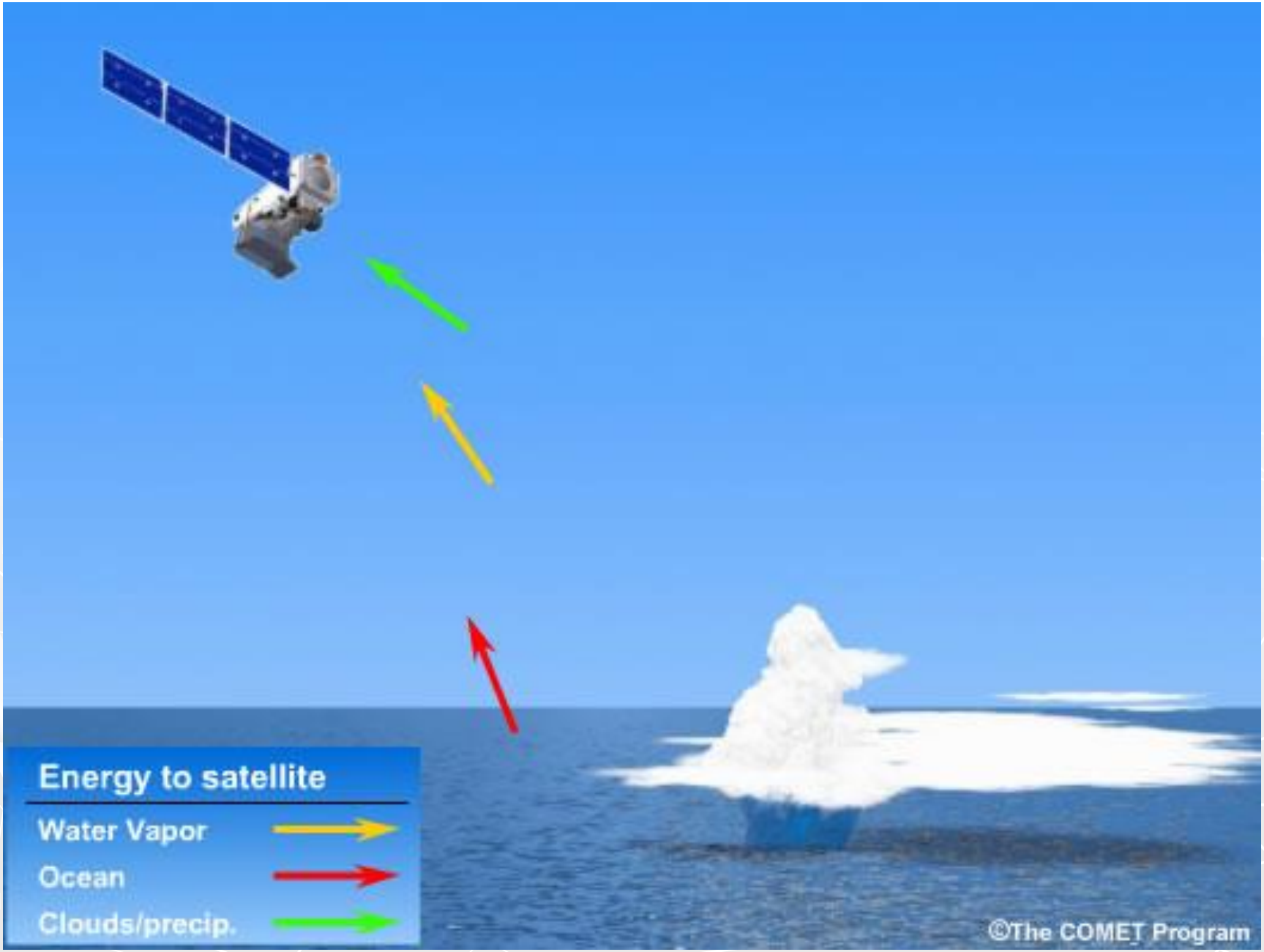
Remote sensing using passive sensor system



Remote sensing using active sensor system


Satellite
Sun
Incident
Solar Radiation
Reflected
Solar Radiation
Atmosphere
Forest
Water
Grass
Bare Soil
Paved
Road
Built-up Area

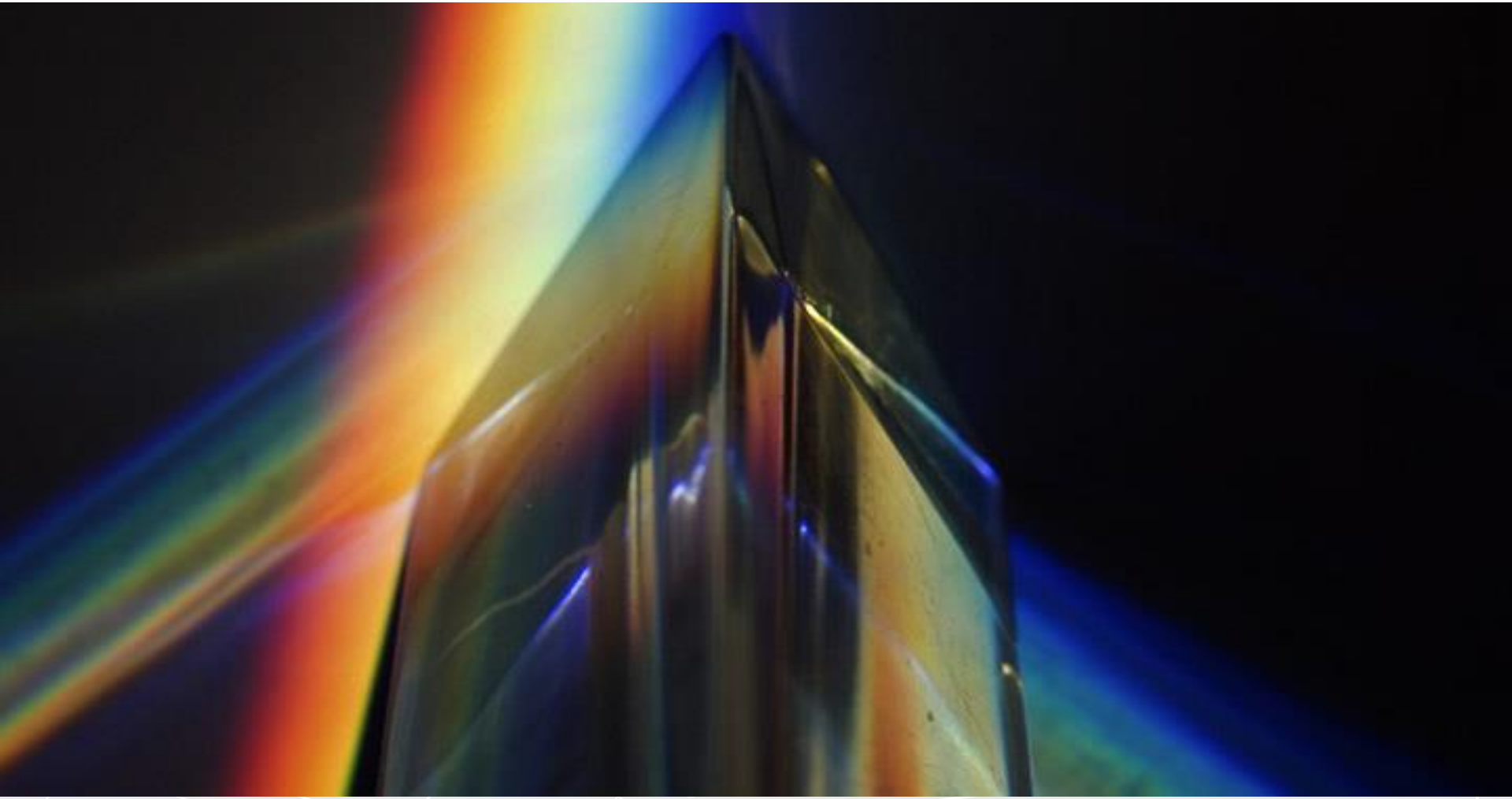

Satellite
Emitted
Thermal Radiation
Atmosphere
Forest
Water
Grass
Bare Soil
Paved
Road
Built-up Area


Energy to satellite
Water Vapor
Ocean
Clouds/precip.
©The COMET Program

Fundamentals of Remote Sensing

- In remote sensing, the **sensors are not in direct contact** with the objects or events being observed.
- **Information needs a physical carrier** to travel from the objects/events to the sensors through an intervening medium.
- Electromagnetic radiation (EMR) is normally used as an information carrier in remote sensing.
- **Output of a remote sensing system is usually an image** representing the scene being observed.

Electromagnetic energy



What is a Sensor?

A sensor is a **device** **that** **measures and records** **electromagnetic energy.**

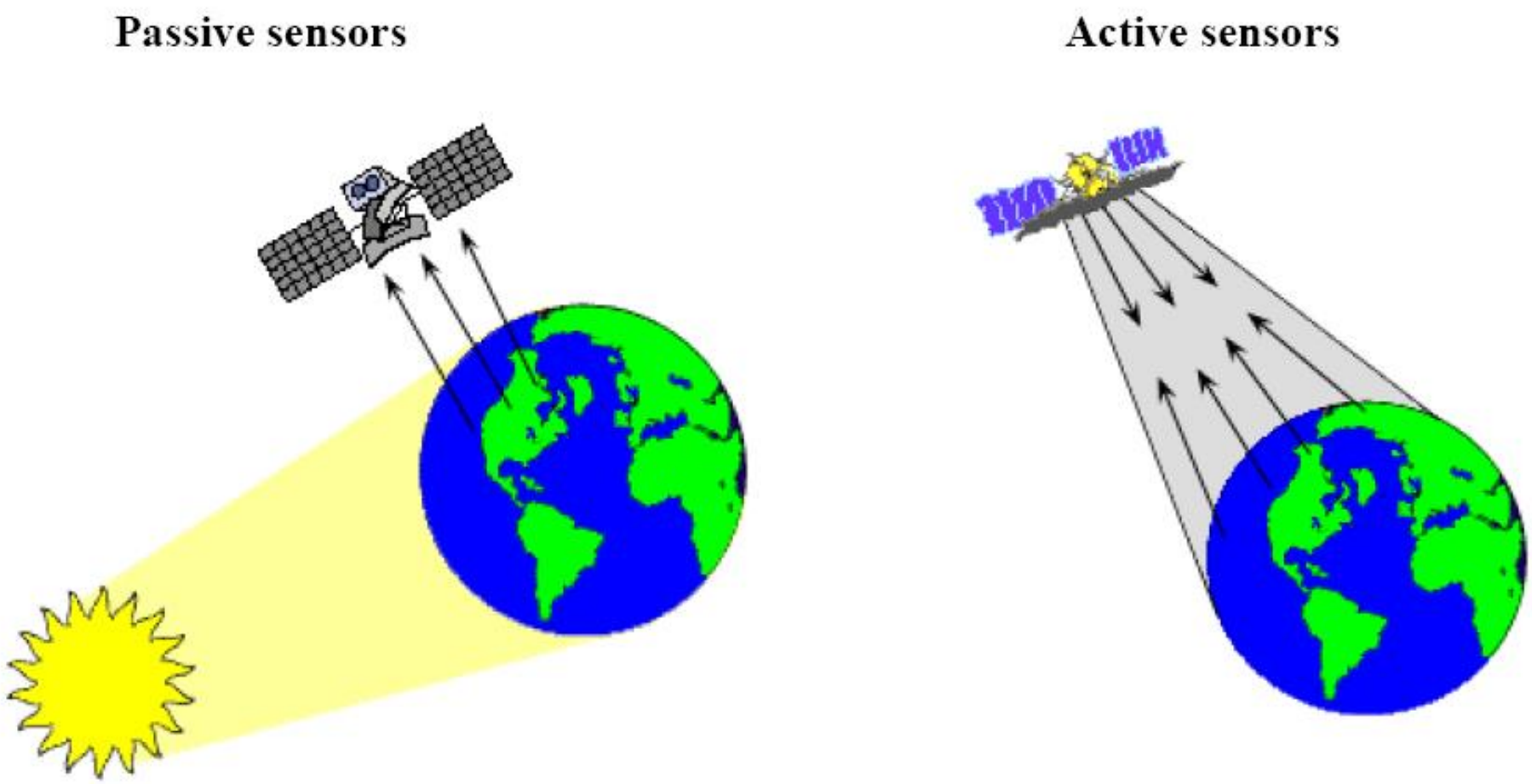
Sensors can be **divided into two groups-**

- **Passive sensors** depend on an **external source of energy**, usually the sun. The most common passive sensor is the photographic camera.

❑ **Active sensors** have their **own source of energy**, an example would be a radar gun.

What is a radar gun?

A **hand held sensor** used **to measure vehicle speed** by the traffic police.

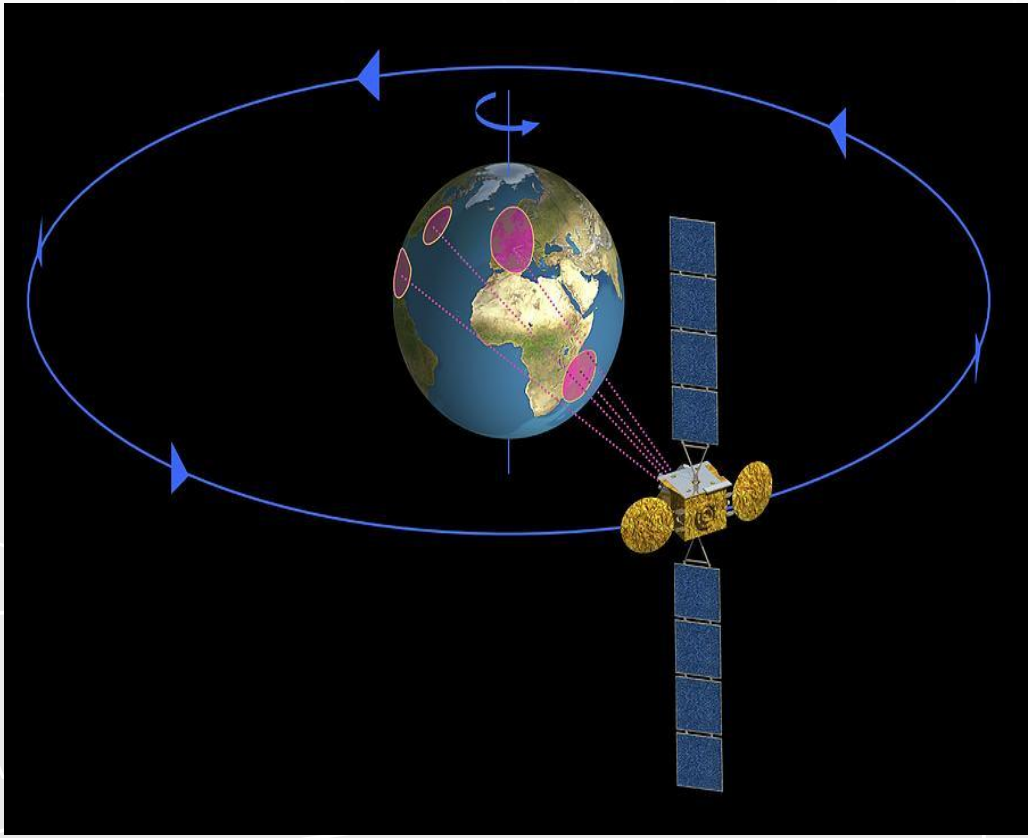


Orbits: Path followed by a satellite is referred to as its orbit.

Different **Types of orbit** are-

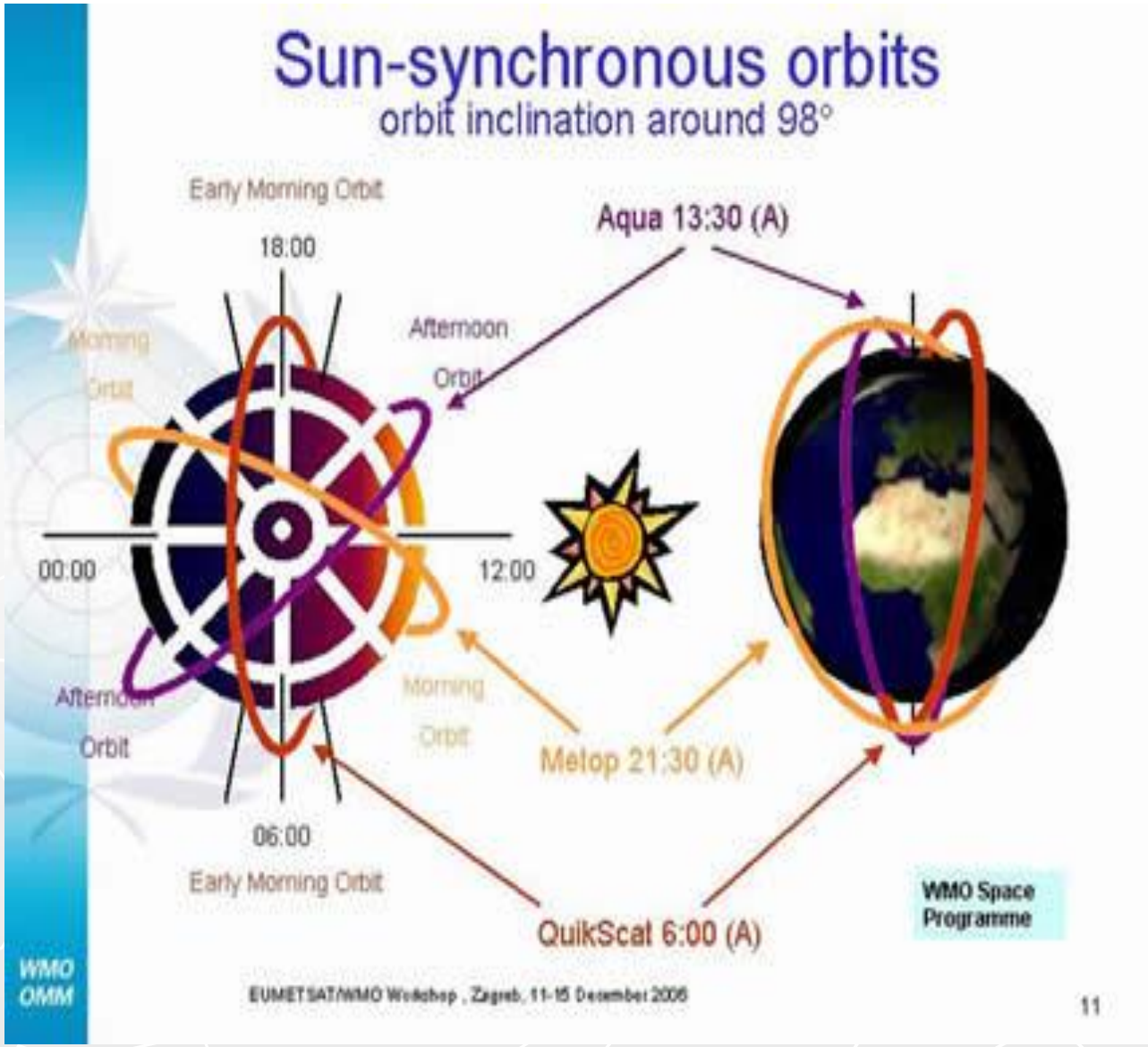
Geostationary Orbit

- **Satellite <u>appears stationary with respect to the Earth's surface</u>.**
- Geostationary orbits are commonly used by **<u>meteorological satellites</u>**.



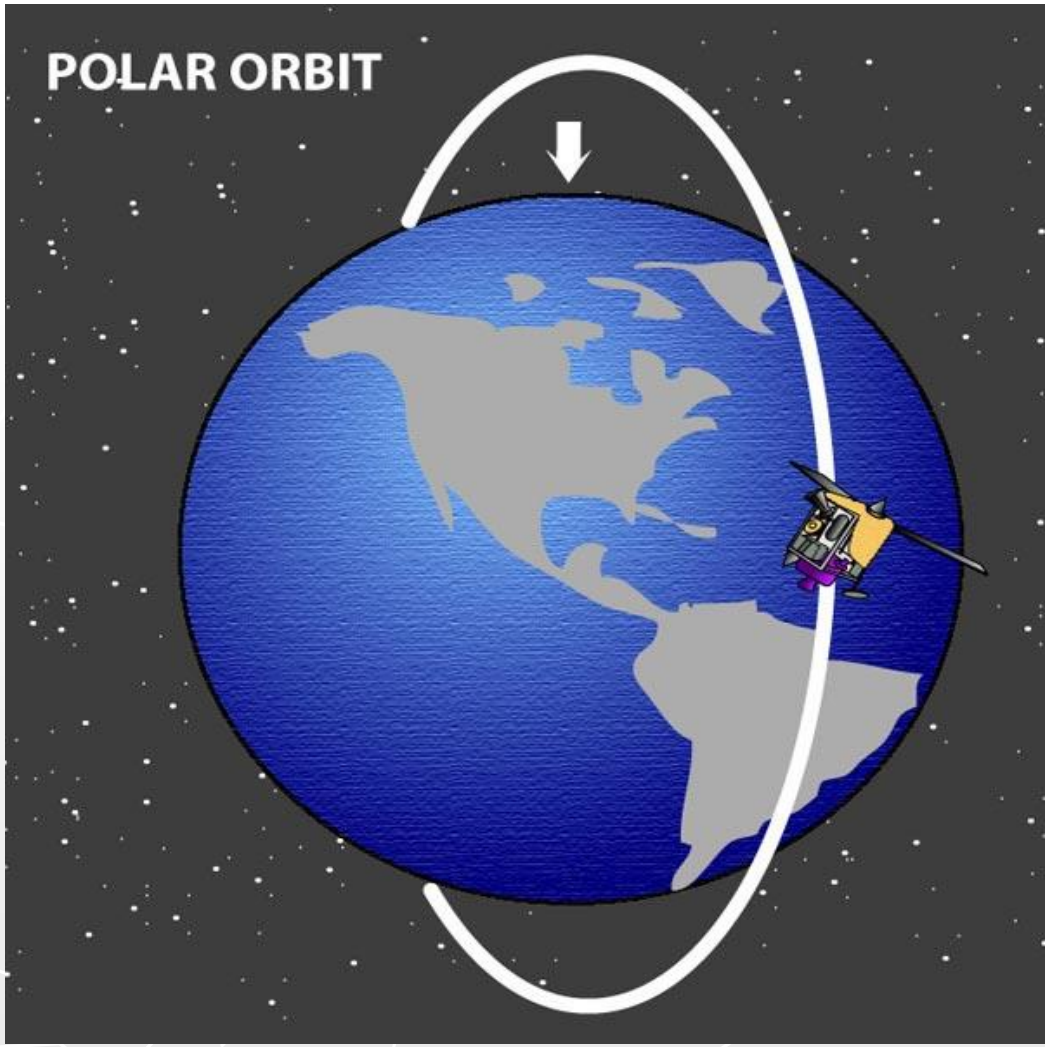
Sun Synchronous Orbits

A sun synchronous orbit is a near polar orbit whose altitude is such that the **satellite will always pass over a location at a given latitude at the same local solar time.**



Near Polar Orbits

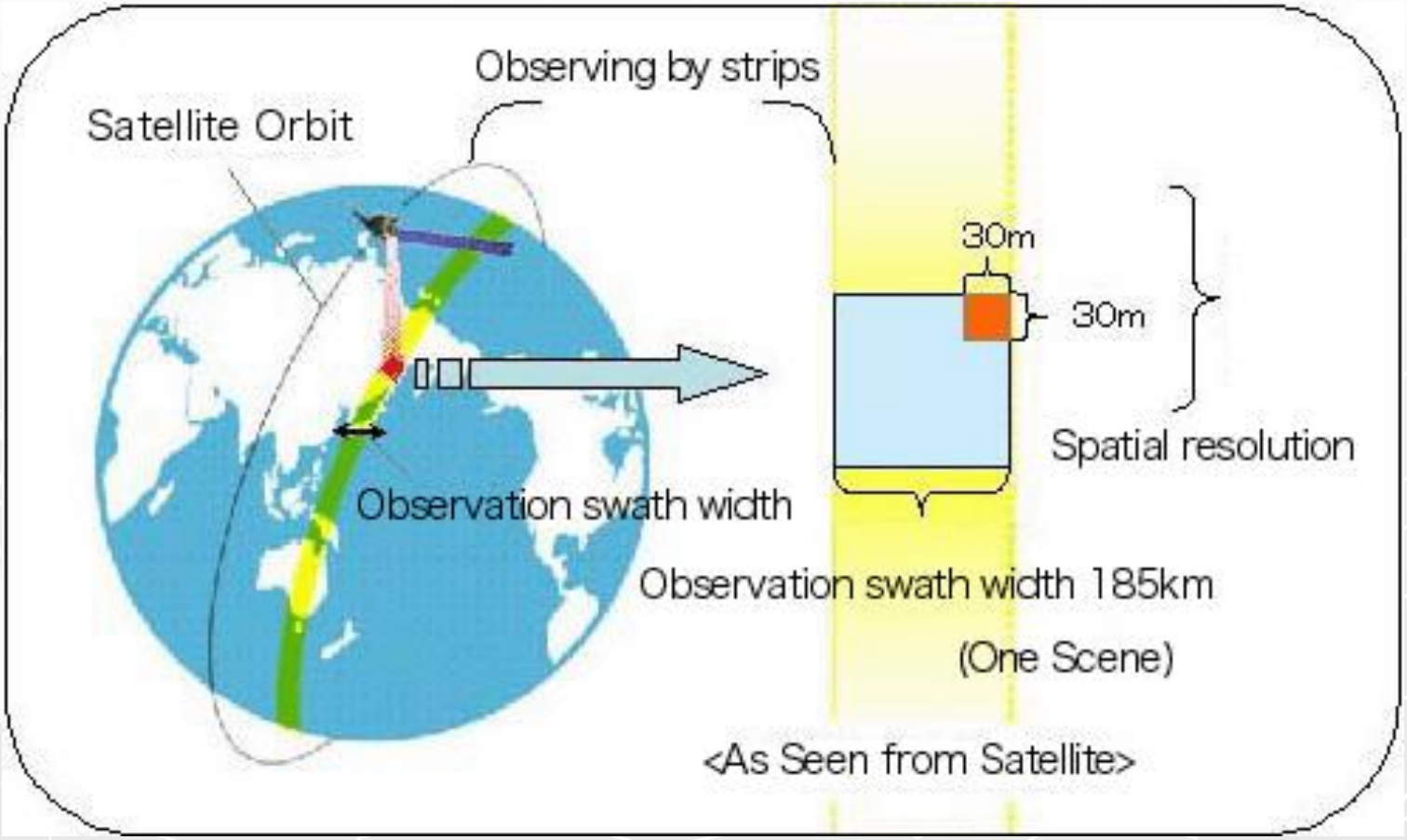
A near polar orbit is one with the **orbital plane inclined at a small angle** with respect to the earth's rotation axis.



What is Swath?

As a satellite revolves around the earth, the **sensor sees a certain portion of the earth's surface.**

Area imaged is referred to as the **Swath**.



Surveying

Thanks