

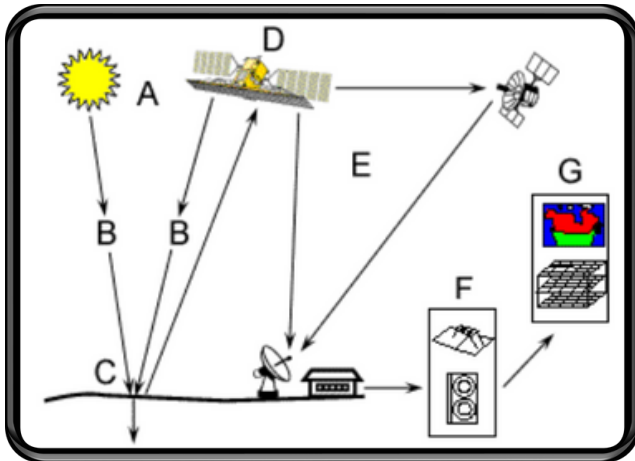
# REMOTE SENSING : INTRODUCTION

## DEFINITION

The science and technology by which characteristics of objects of interest can be identified **without direct contact**



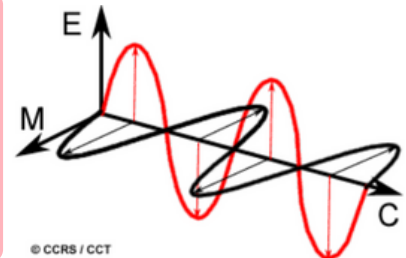
## PROCESS



- A - Energy Source or Illumination
- B - Radiation and the Atmosphere
- C - Interaction with the Target
- D - Recording of Energy by the Sensor
- E - Transmission, Reception, and Processing
- F - Interpretation and Analysis
- G - Application

## ELECTROMAGNETIC RADIATION

- **Energy source** to illuminate the target
- Consists of an **electrical field (E)** which varies in magnitude in a direction perpendicular to the direction in which the radiation is traveling, and a **magnetic field (M)** oriented at right angles to the electrical field
- Wavelength is **inversely proportional** to frequency



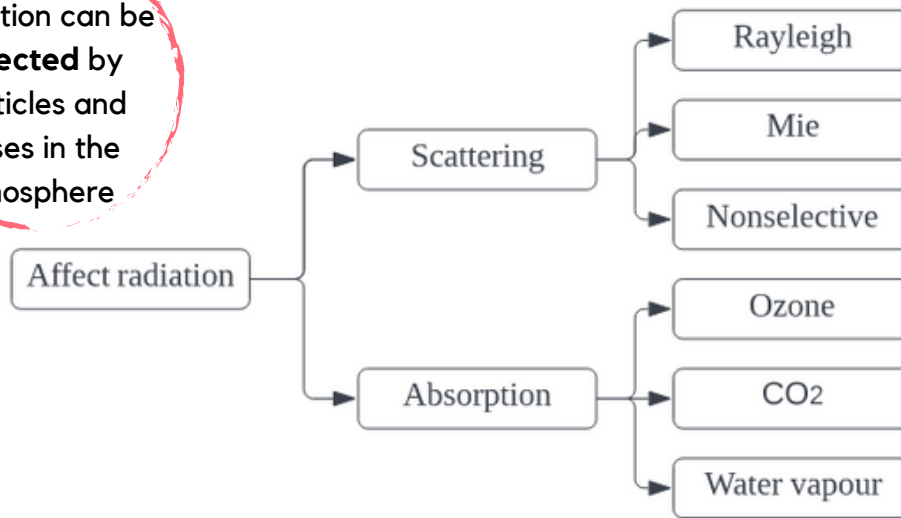
## ELECTROMAGNETIC SPECTRUM

<p>Wavelength (m) Frequency (Hz)</p> <p>Longer Lower</p> <p>1 km → <math>10^4</math> ← 1 kHz</p> <p>1 m → <math>10^2</math> ← 1 MHz</p> <p>1 cm → <math>10^{-2}</math> ← 1 GHz</p> <p>1 μm → <math>10^{-6}</math> ← 1 THz</p> <p>1 nm → <math>10^{-9}</math> ← 1 PHz</p> <p>Shorter Higher</p> <p>Radio Waves</p> <p>Microwaves</p> <p>Infrared</p> <p>Visible</p> <p>Ultraviolet</p> <p>X-Rays</p> <p>Gamma Rays</p> <p>RADARSAT SAR 5.3 GHz 5.66 cm</p> <p>SPOT HRV 0.5-0.89 μm</p> <p>© CCRS / CCT</p>	<b>Microwave</b>	1 mm to 1 m	<ul style="list-style-type: none"><li>• <b>Longer:</b> radio broadcast</li><li>• <b>Shorter:</b> similar to thermal IR</li></ul>
	<b>Infrared (IR)</b>	<ul style="list-style-type: none"><li>• <b>Thermal:</b> 3.0 μm to 100 μm</li><li>• <b>Reflected:</b> 0.7 μm to 3.0 μm</li></ul>	<ul style="list-style-type: none"><li>• <b>Thermal:</b> energy emitted from Earth surface in form of heat</li><li>• <b>Reflected:</b> similar to visible spectrum</li></ul>
	<b>Visible spectrum</b>	0.4 to 0.7 μm	Concept of colours
	<b>Ultraviolet (UV)</b>	10 nm to 400 nm	Earth surface materials like rocks or minerals

# REMOTE SENSING : INTRODUCTION

## INTERACTIONS WITH ATMOSPHERE

Radiation can be **affected** by particles and gases in the atmosphere



Electromagnetic radiation to be redirected from its original path

molecules in the atmosphere absorb energy at various wavelengths

## RADIATION - TARGET INTERACTIONS

### INTERACTIONS

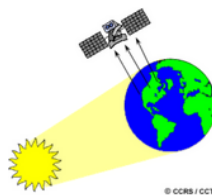
- **Absorption (A)** : radiation is absorbed into the target
- **Transmission (T)** : radiation passes through a target
- **Reflection (R)** : radiation "bounces" off the target and is redirected



### TYPE OF REFLECTIONS

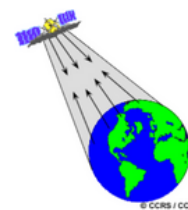
- **Specular**: Smooth surface & reflected in single direction
- **Diffuse**: Rough surface & reflected in all directions

## PASSIVE VS ACTIVE SENSING



**Passive sensors:** measure energy that is naturally available

e.g. Optical sensors



**Active sensors:** provide their own energy source for illumination

e.g. Synthetic Aperture Radar (SAR), Laser Scanner (LIDAR)

## CHARACTERISTICS OF IMAGES

- **Image:** any **pictorial representation**, regardless of what wavelengths or remote sensing device has been used to detect and record the electromagnetic energy.
- **Photograph:** images that have been detected as well as recorded on **photographic film**.
- **Photograph** can be **represented** and displayed in a **digital** format by subdividing the image into small equal-sized and shaped areas, called picture elements or **pixels**, and representing the brightness of each area with a numeric value or **digital number**.

