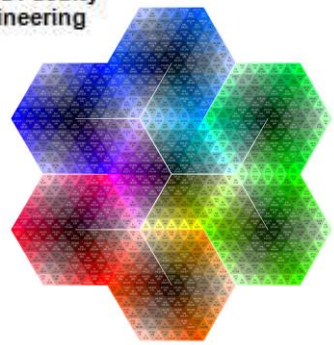
Benha University

Shoubra Faculty of Engineering

Remote Sensing
Lecture 1: Introduction



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Geomatics Department

What you learn from this course

1. Be familiar with various RS principles.
2. To know the theory of image interpretation and LULC mapping.
3. The Relationships of RS with GPS/GNSS, Cartography and GIS.
4. Learn the types of optical satellites and images resolutions in RS.
5. Multispectral, Thermal, Hyperspectral Sensing.
6. The fundamentals of image processing.
7. To know the Lidar and Radar sensing systems.
8. To demonstrate how to use various RS software.

Course Contents 1ST Part:

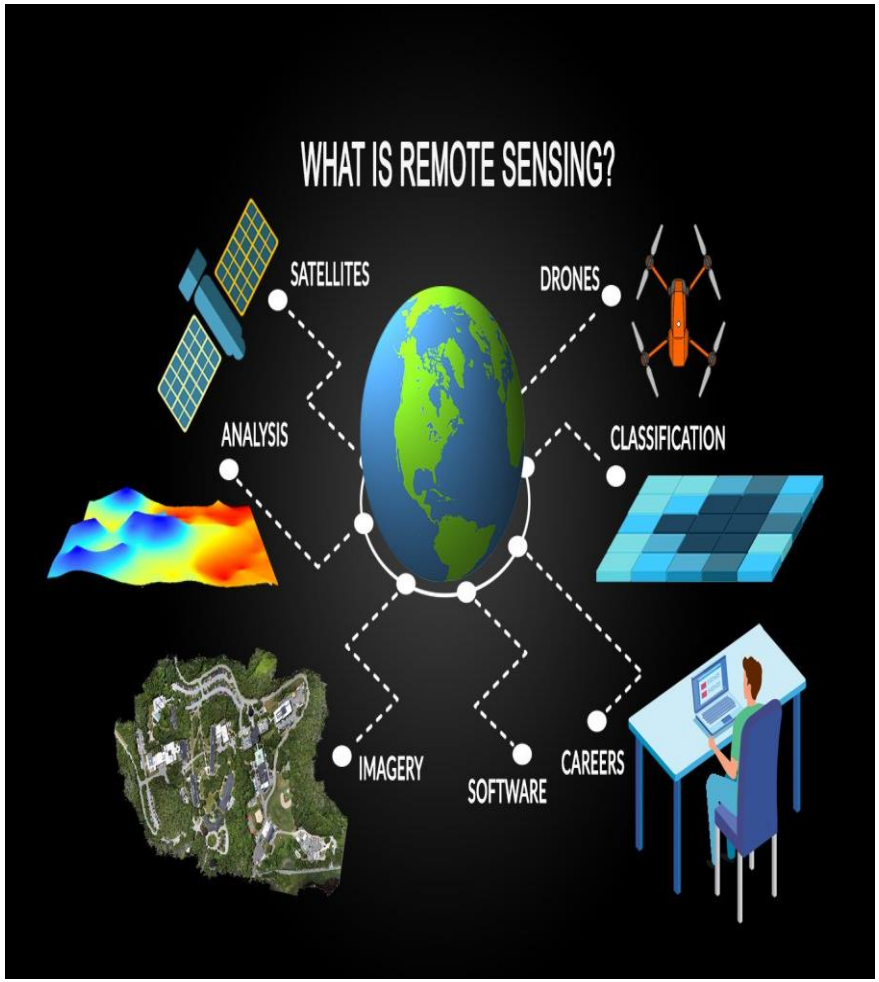
- (Lec. 1) Introduction
- (Lec. 2) Sensors
- (Lec. 3) Characteristics of Images
- (Lec. 4) Images interpretation and LULC Mapping
- (Lec. 5) Multispectral Sensing
- (Lec. 6) Thermal and Hyperspectral Sensing
- (Lec.7) Operating Satellites in the Optical Spectrum
- (Lec. 8) Mid-Term Exam

Weighting of Assessments:

Assessment	Weight
Mid-term Examination	20%
Semester work	20%
Final Examination	60%
Total	100%

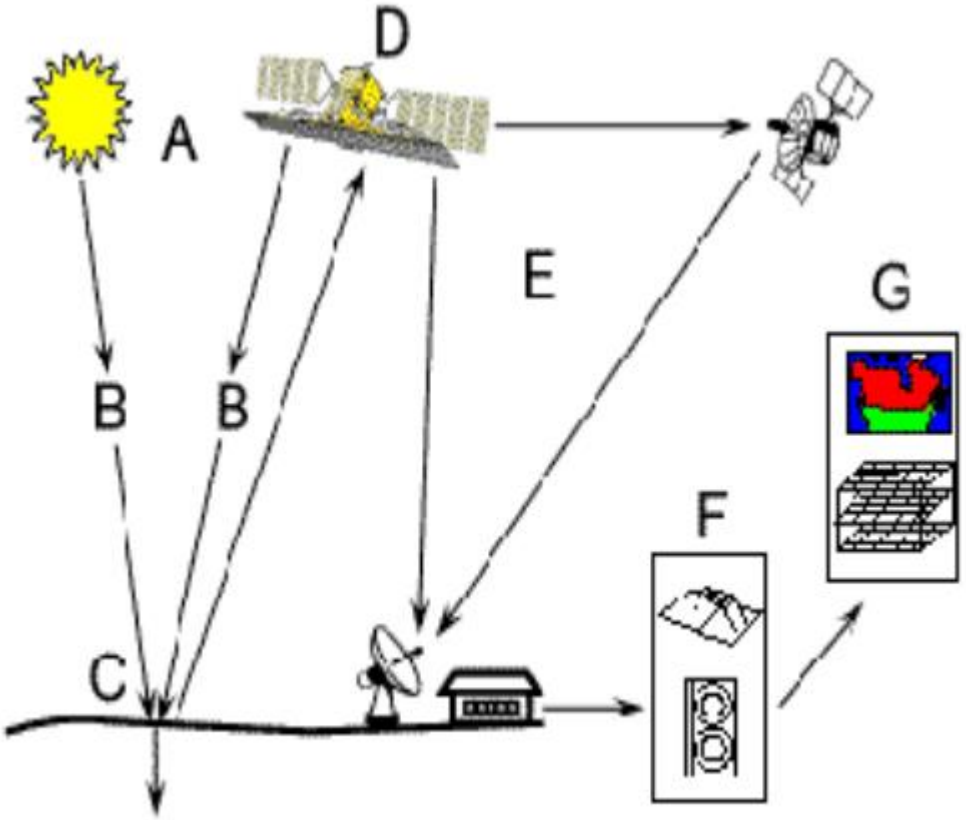
What is Remote Sensing?

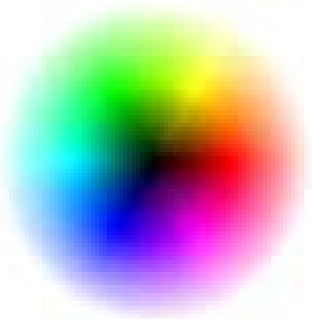
- Definition: ""Remote sensing is the science (and to some extent, art) of acquiring information about the Earth's surface without being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing, and applying that information.""



The Electromagnetic Radiation

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



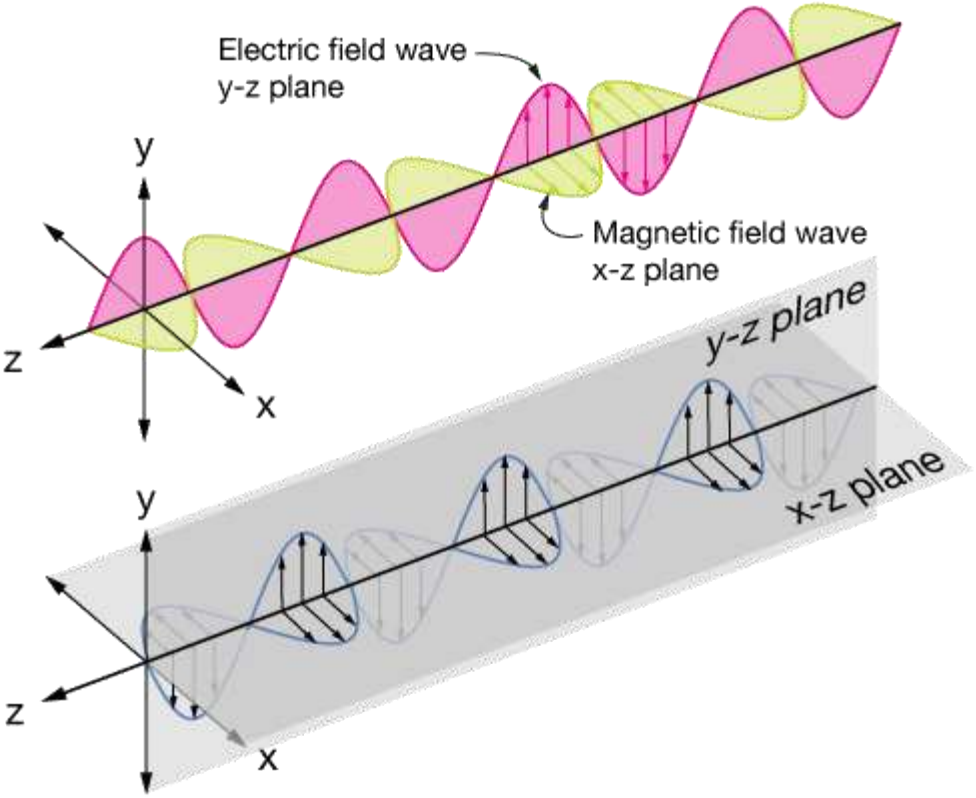


The RS system

1. An energy source which illuminates or provides electromagnetic energy to the target of interest.
2. The traveled energy will interact with the atmosphere it passes through.
3. The energy interacts with the target depending on the properties of both the target and the radiation.
4. A sensor will collect and record the reflected electromagnetic radiation.
5. A receiving and processing station where the data are processed into an image (hardcopy and/or digital).
6. To extract information about the target which was illuminated.
7. reveal some new information or assist in solving a particular problem.

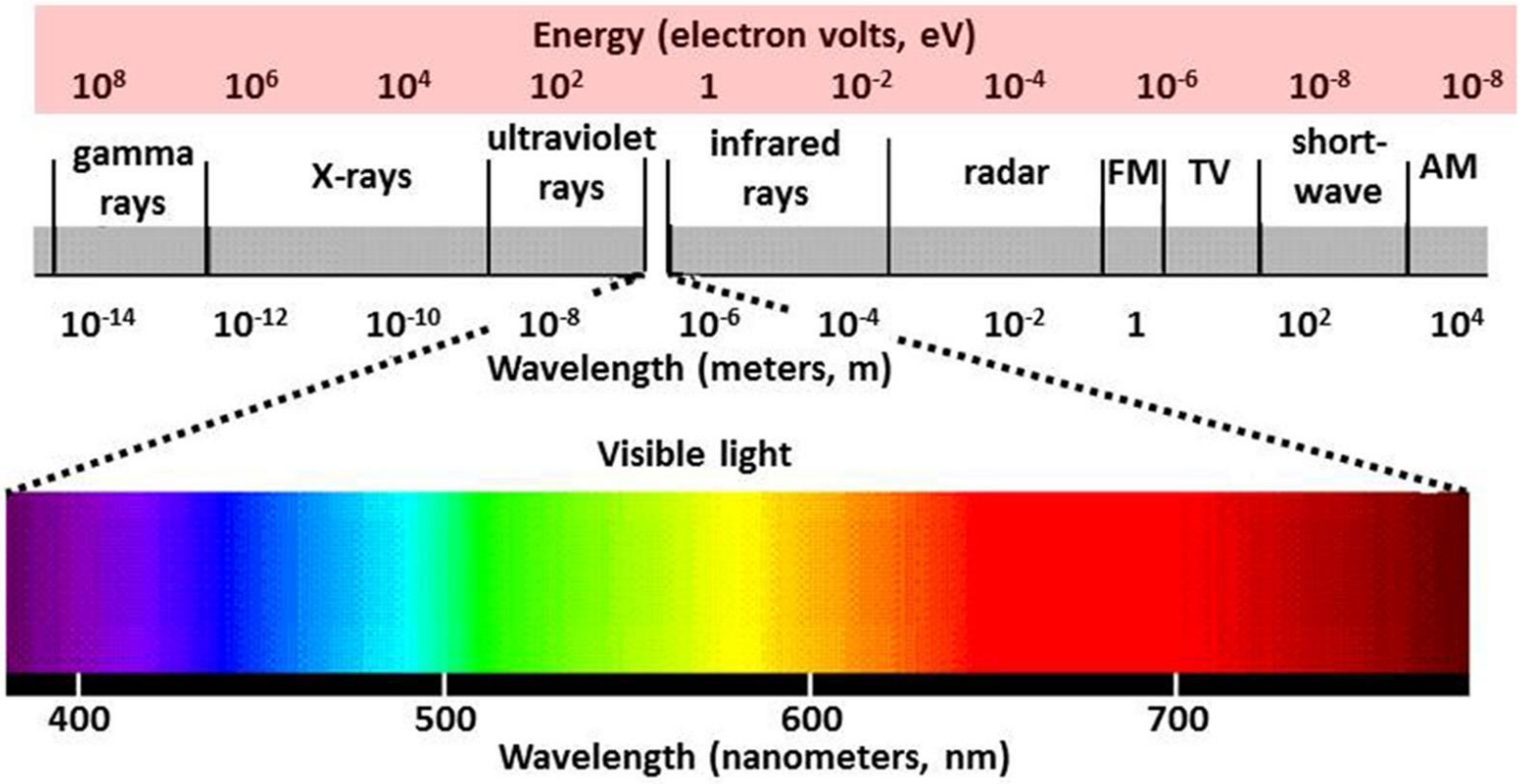
The Electromagnetic Radiation

1. This energy is in the form of electromagnetic radiation.
2. It 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. Both these fields travel at the speed of light (c).
3. C= λ*v



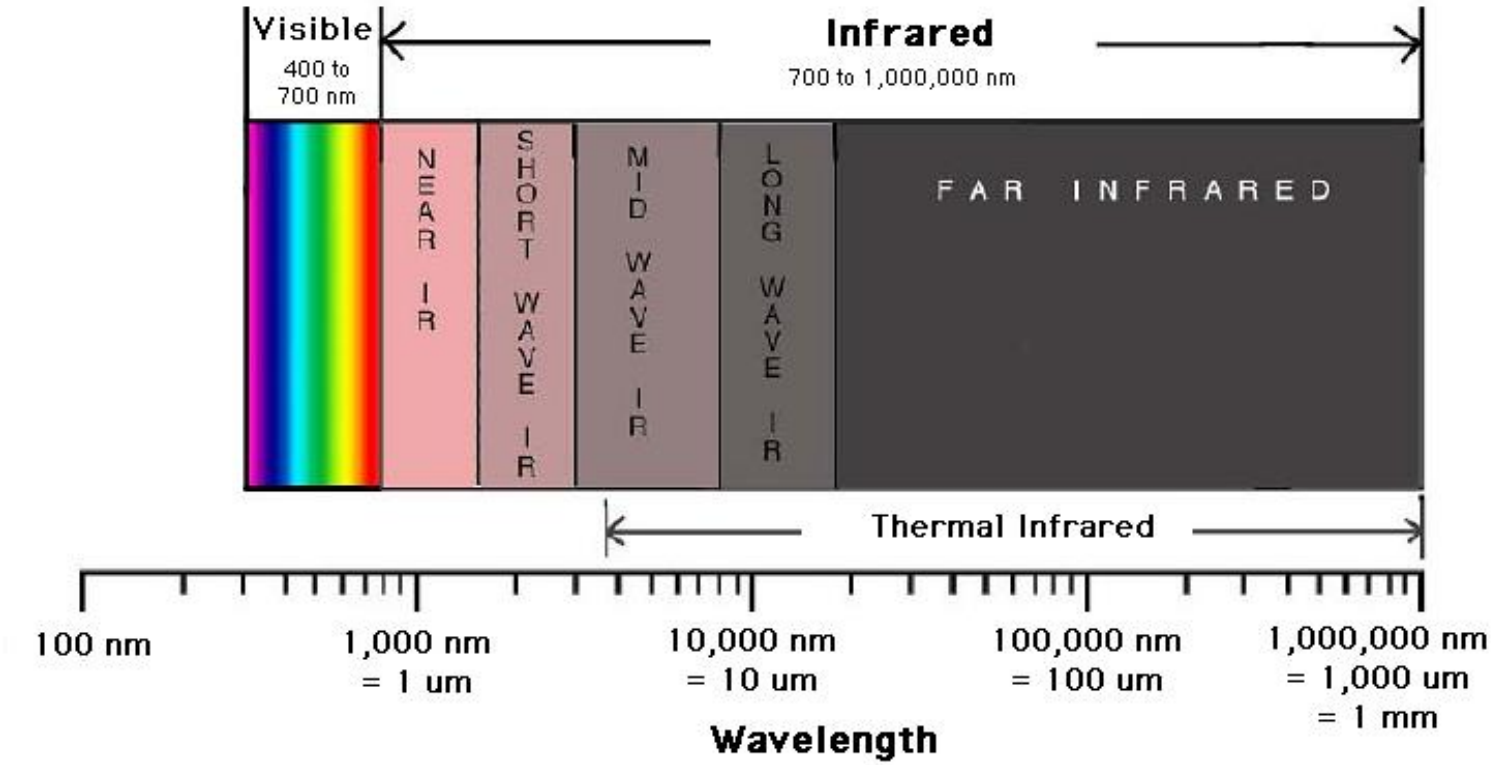
The Electromagnetic Spectrum

1. Visible spectrum 0.4-0.7 μm.



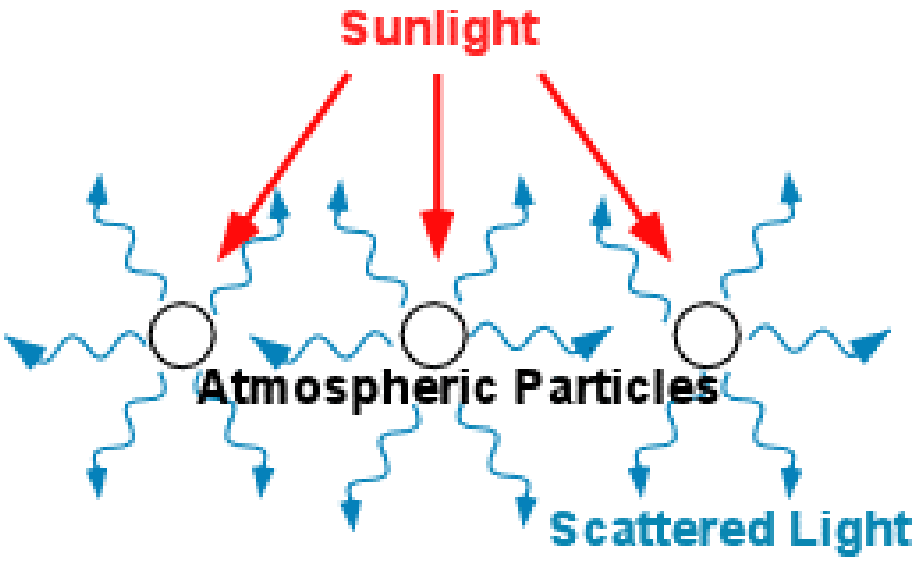
The infrared (IR) region Spectrum

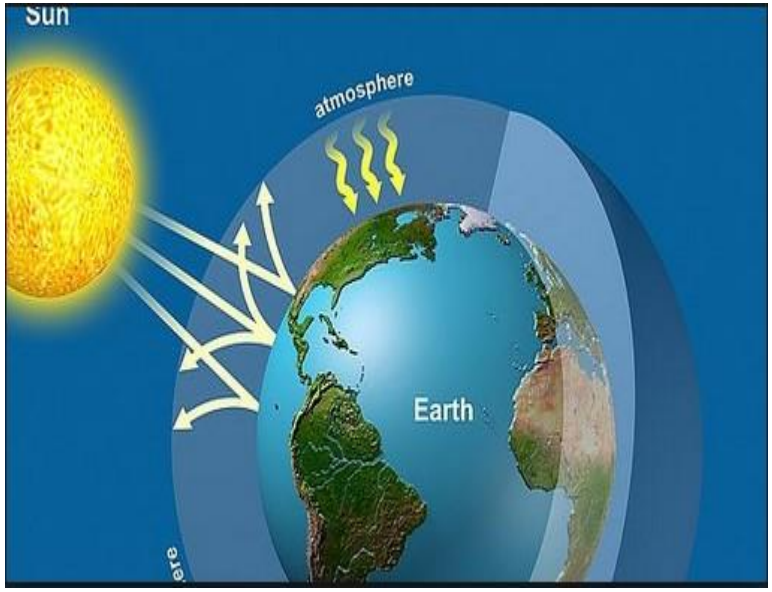
1. From 0.7 μm to 100 μmm.
2. Can be divided into the reflected IR, and the emitted or thermal IR.



The Interactions with the Atmosphere

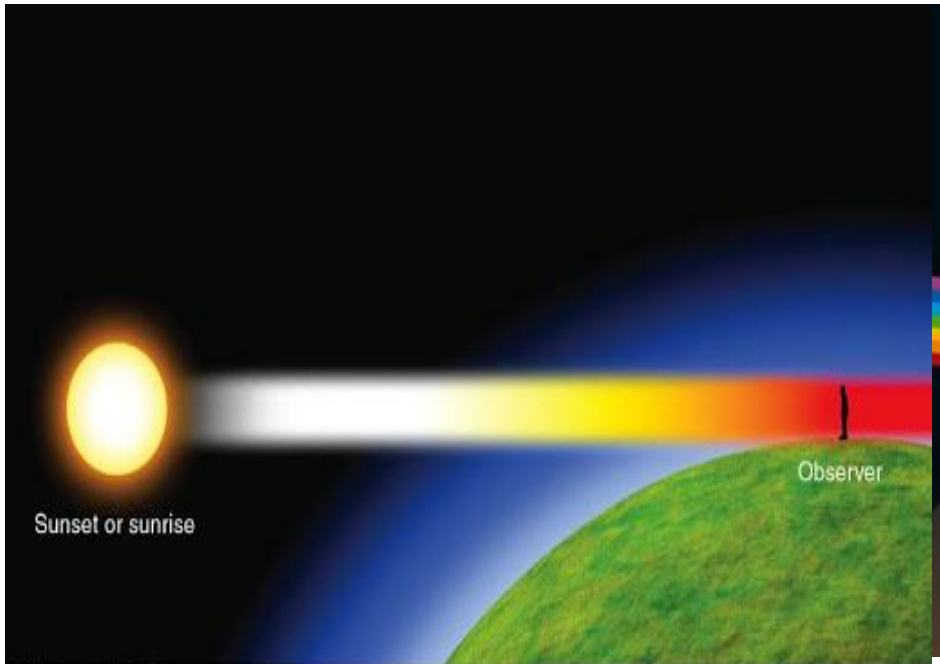
1. Particles and gases in the atmosphere can affect the incoming light and radiation through scattering and absorption.

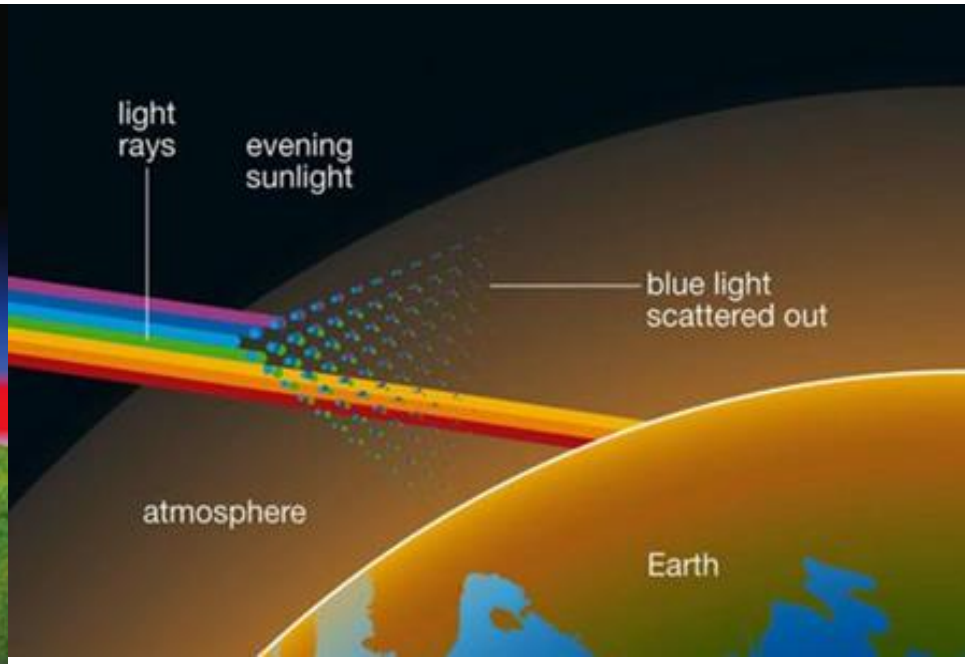




The Rayleigh scattering

1. particles are very small compared to the wavelength of the radiation. These could be particles such as small specks of dust or nitrogen and oxygen molecules. Rayleigh scattering causes shorter wavelengths of energy to be scattered much more than longer wavelengths. The blue and orange of the sky caused by it.





The Mie scattering

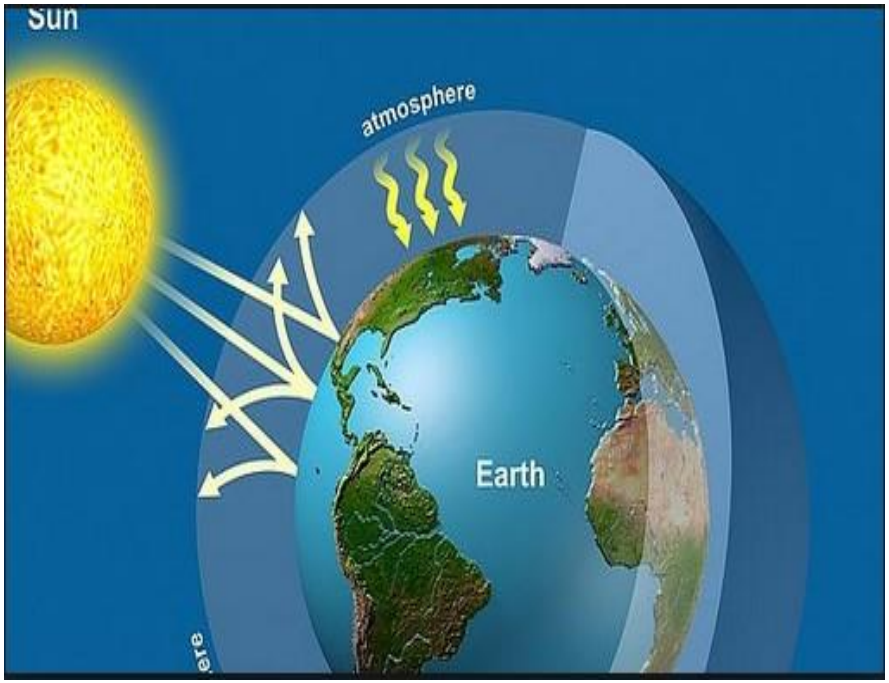
1. the particles are just about the same size as the wavelength of the radiation. Dust, pollen, smoke and water vapour are common causes of Mie scattering which tends to affect longer wavelengths than those affected by Rayleigh scattering.

The Nonselective scattering

1. This occurs when the particles are much larger than the wavelength of the radiation. Water droplets and large dust particles can cause this type of scattering.
2. This type of scattering causes fog and clouds to appear white to our eyes

The Absorption

1. This phenomenon causes molecules in the atmosphere to absorb energy at various wavelengths. Ozone, carbon dioxide, and water vapor are the three main atmospheric constituents which absorb radiation.



The Radiation - Target Interactions

1. These are: absorption (A); transmission (T); and reflection (R).
2. In remote sensing, we are most interested in measuring the radiation reflected from targets. We refer to two types of reflection, specular reflection and diffuse reflection.
3. When the surface is smooth we get specular or mirror-like reflection
4. When the surface is rough Diffuse reflection occurs and the energy is reflected almost uniformly in all directions.

Supplementary files:

- https://www.youtube.com/watch?v=EYQsXs1Jr0Y
- https://www.youtube.com/watch?v=PL9MnjUXy3Q&list=PLLy_2iUCG87ADRApV6xRnmEegxSz1XqnY&index=4
- https://www.youtube.com/watch?v=-4D1-eSEWXw&list=PLwdnzlV3ogoUdLSIGNmXpnDLrnEqcNbaI

Thanks

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