



Electromagnetic Radiation Principles

Most citations come from the main text book: Jensen, J.R., 2007, Remote Sensing of the Environment: an Earth resource perspective, 2nd ed., Prentice Hall, 592p



Electromagnetic Radiation Principles

Electromagnetic Radiation Principles

- The Energy
 - is radiated by atomic particles at the source (the Sun)
 - travels through the vacuum of space at the speed of light
 - interacts with the Earth's atmosphere
 - interacts with the Earth's surface
 - interacts with the Earth's atmosphere once again, and
 - finally reaches the remote sensor, where it interacts with various optics, filters, film emulsions, or detectors
- Energy is the ability to do work.
- In the process of doing work, energy is often transferred from one body to another or from one place to another.



Electromagnetic Radiation Principles

Conduction, Convection, and Radiation

- Energy Transfer



Electromagnetic Radiation Principles

Electromagnetic Radiation Models

- Wave Model of Electromagnetic Energy
 - The electromagnetic wave consists of two fluctuating fields – one electric and the other magnetic.



Electromagnetic Radiation Principles

Electromagnetic Radiation Models

- Wave Model of Electromagnetic Energy
 - When electromagnetic radiation passes from one substance to another, the speed of light and wavelength change while the frequency remains the same.

The relationship between the wavelength (λ) and frequency (ν) of electromagnetic radiation.

- $c = \lambda\nu$
- $\nu = c/\lambda$
- $\lambda = c/\nu$



Electromagnetic Radiation Principles

Electromagnetic Radiation Models

- Wave Model of Electromagnetic Energy

Stefan-Boltzmann law

- $M_{\lambda} = \sigma T^4$

Wein's displacement law

- $\lambda_{\max} = k/T$



Electromagnetic Radiation Principles

Electromagnetic Radiation Models

- Electromagnet Spectrum and the Photon Energy of Visible Light



Electromagnetic Radiation Principles

Electromagnetic Radiation Models

- Energy of photons ranging from gamma rays to waves in the electromagnetic spectrum



Electromagnetic Radiation Principles

Atmospheric Energy – Matter Intersections

- Absorption



Electromagnetic Radiation Principles

Atmospheric Energy – Matter Intersections

- Reflectance



Electromagnetic Radiation Principles

Terrain Energy – Matter Intersections

- Reflectance



Electromagnetic Radiation Principles

Energy – Matter Intersections at the Sensor

- Target and Path Radiance