



TRAINING ON GOOGLE EARTH ENGINE

MODULE 1 : INTRODUCTION to Google Earth Engine

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Coordinated from

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Geo-IT

**The Technology of Data Acquisition for Sustainable Development and Crisis Management
(Germany, Jordan, Lebanon and Syria)**

- MODULE 1 : INTRODUCTION to Google Earth Engine
- MODULE 2 : PROGRAMMING in Google Earth Engine
- MODULE 3 : GEOMETRY in Google Earth Engine
- MODULE 4 : IMAGE in Google Earth Engine
- MODULE 5 : IMAGE COLLECTION in Google Earth Engine
- MODULE 6 : GEE Application in Agriculture
- MODULE 7 : GEE Application in Water Resources
- MODULE 8 : GEE Application (DATASET)

MODULE 1

Fundamental of Remote Sensing

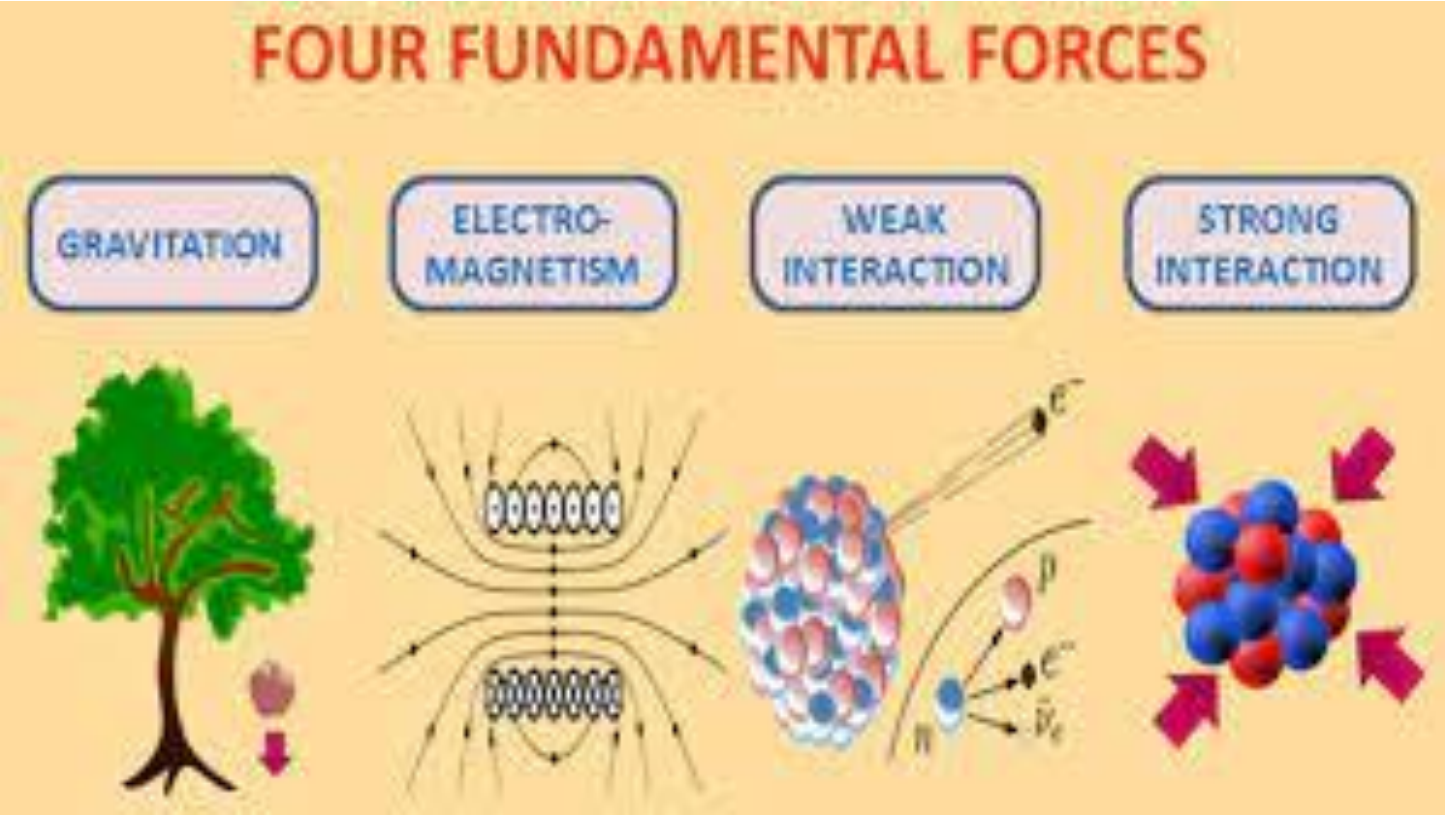
Satellites Missions & Datasets

Google Earth Engine Basic

Google Earth Engine Explore

Google Earth Engine Datasets

Examples and exercises



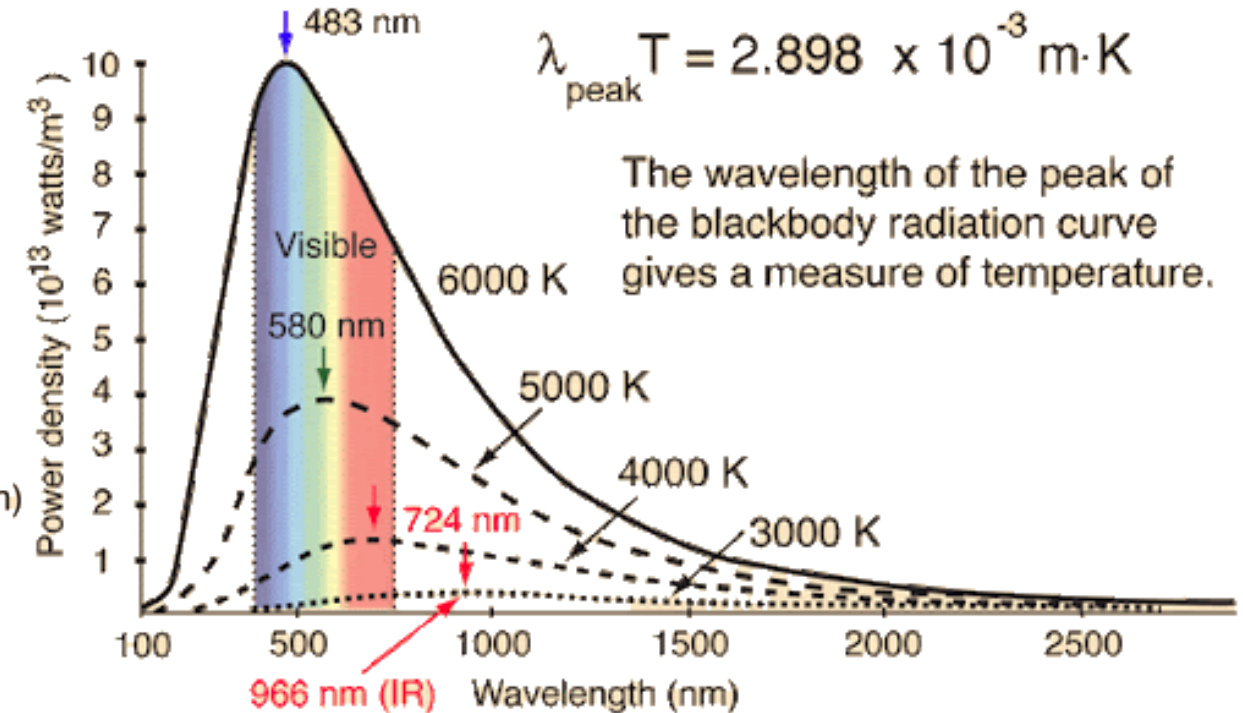
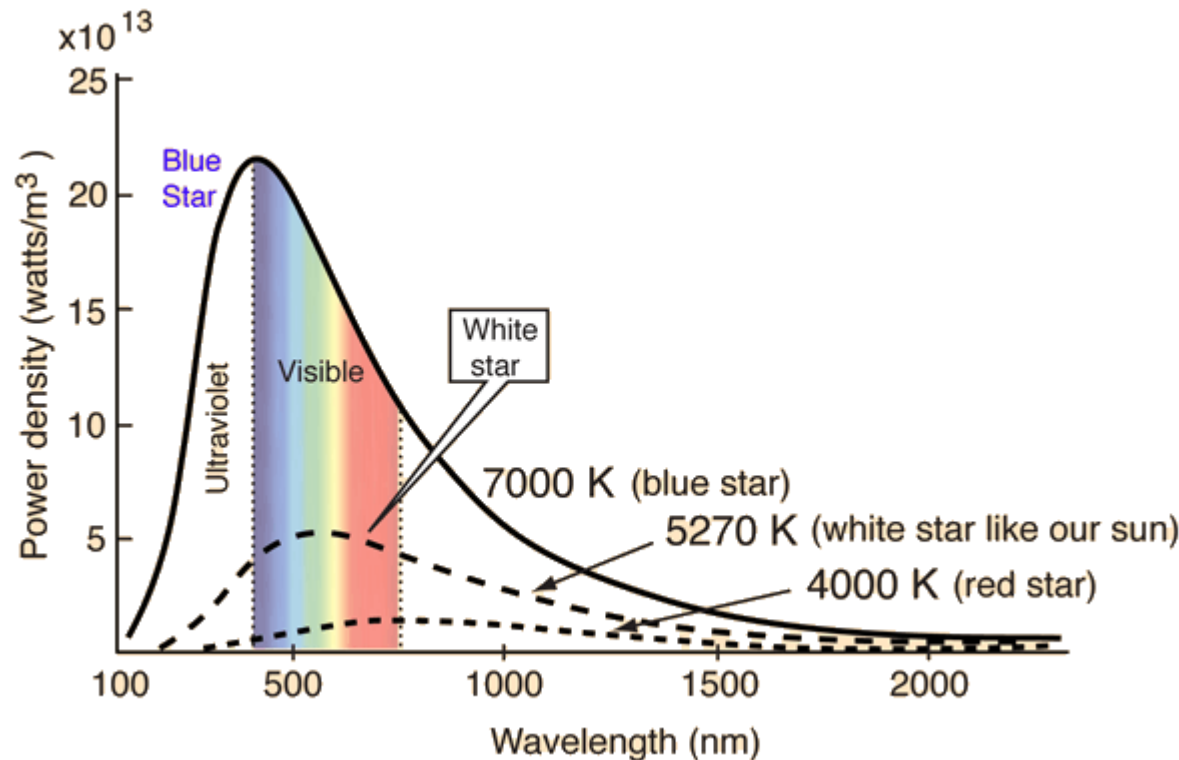
Fundamental Force Particles

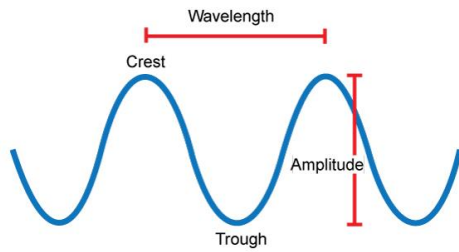
Force	Particles Experiencing	Force Carrier Particle	Range	Relative Strength*
Gravity acts between objects with mass	all particles with mass	graviton (not yet observed)	infinity	much weaker ↓ much stronger
Weak Force governs particle decay	quarks and leptons	W^+, W^-, Z^0 (W and Z)	short range	
Electromagnetism acts between electrically charged particles	electrically charged	γ (photon)	infinity	
Strong Force** binds quarks together	quarks and gluons	g (gluon)	short range	

BLACK BODY

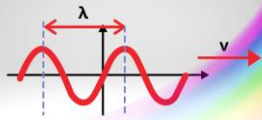
$$P = e\sigma AT^4$$

Power radiated (Watts) → P
 emissivity (no units) → e
 Surface area (m^2) → A
 Stefan-Boltzmann constant $5.67 \times 10^{-8} W m^{-2} K^{-4}$ → σ
 Temperature (Kelvins) → T



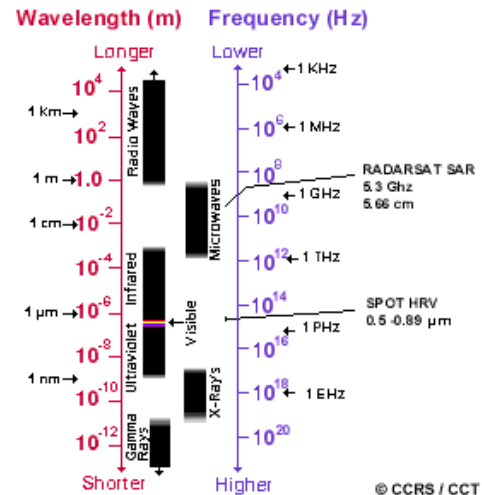


Wavelength to Frequency

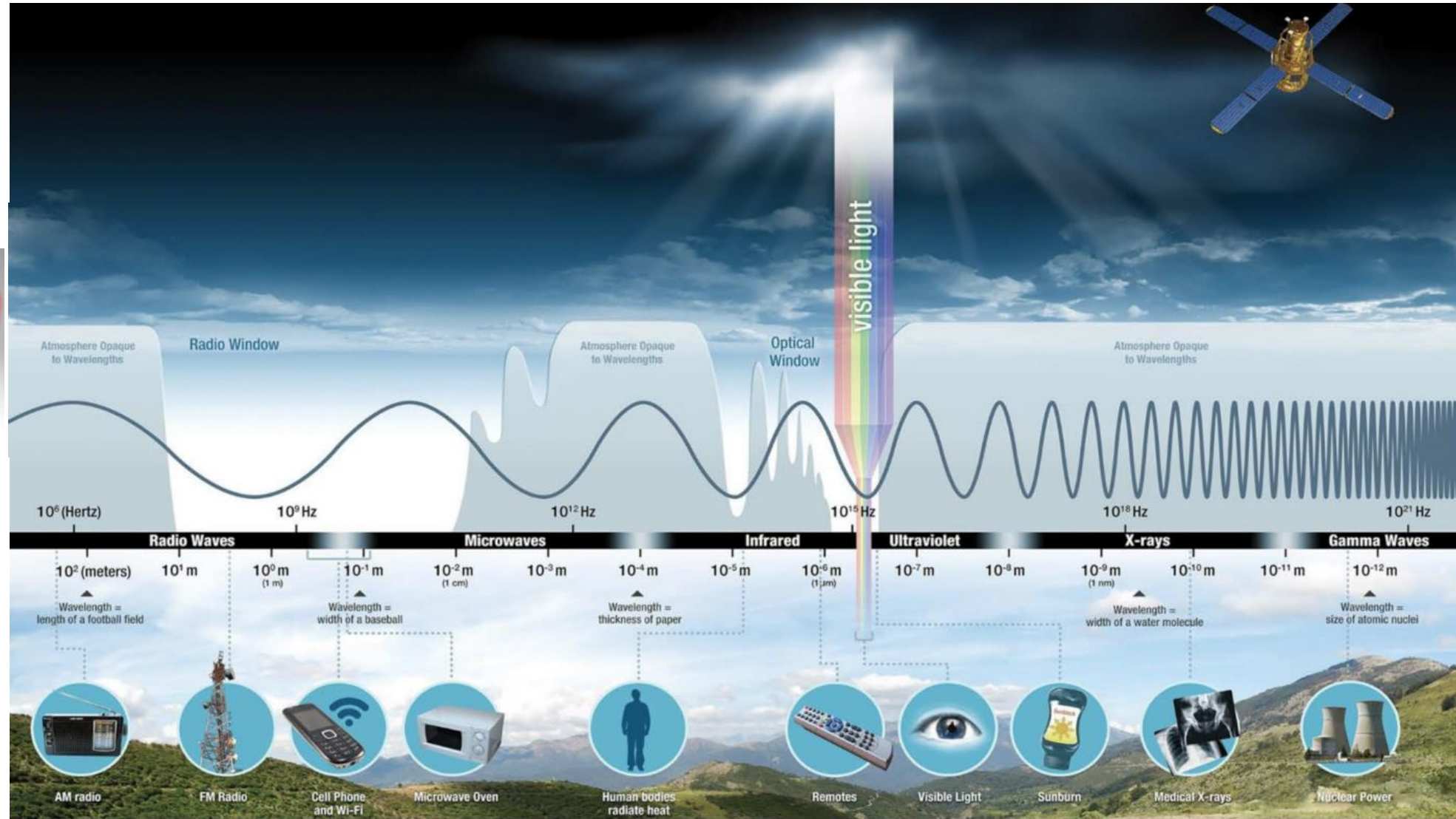


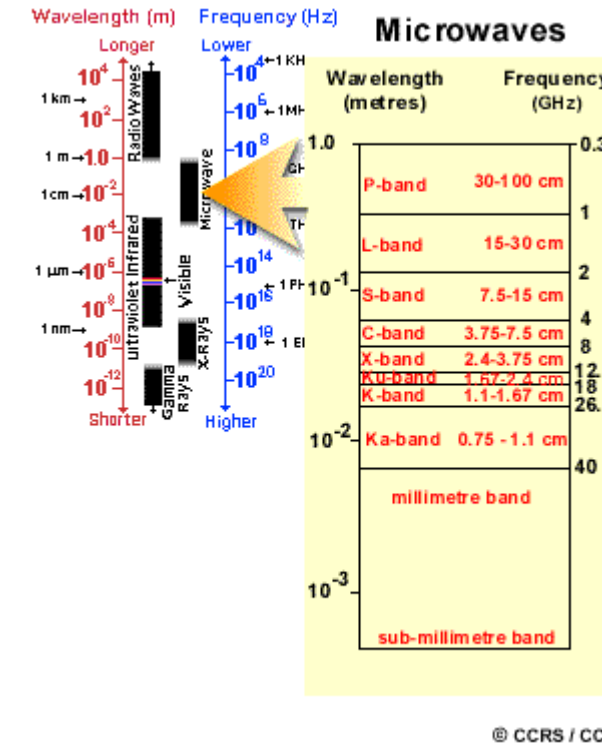
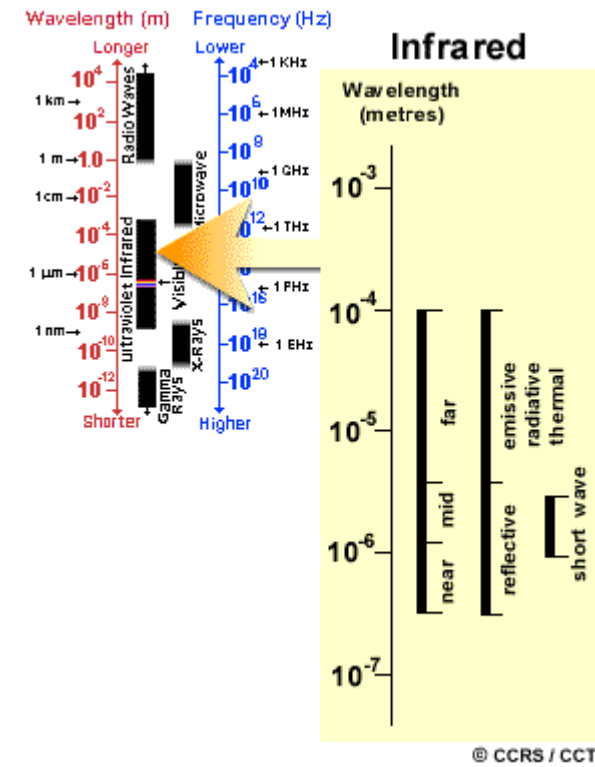
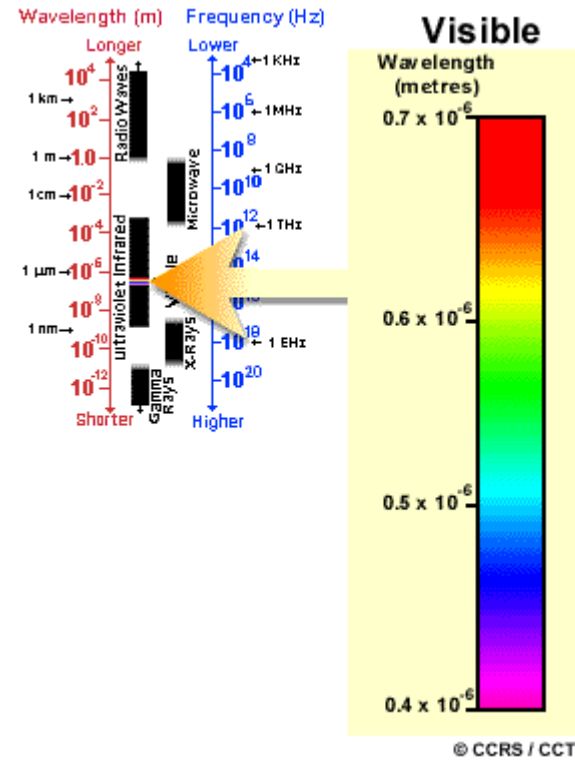
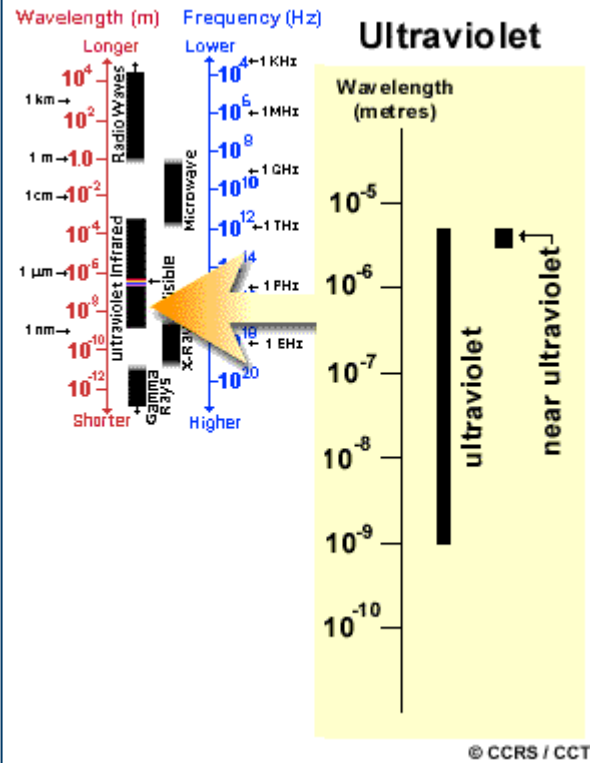
$$v = \lambda f$$

v = wave speed (c for light in a vacuum)
 λ = wavelength

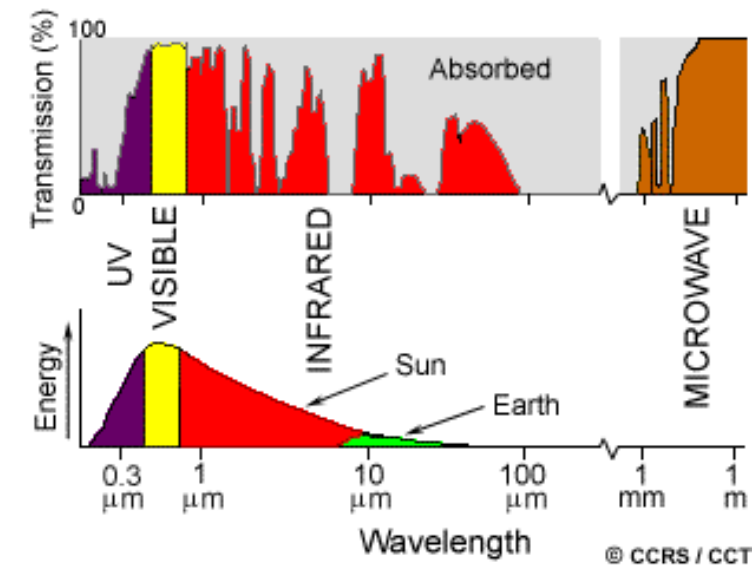
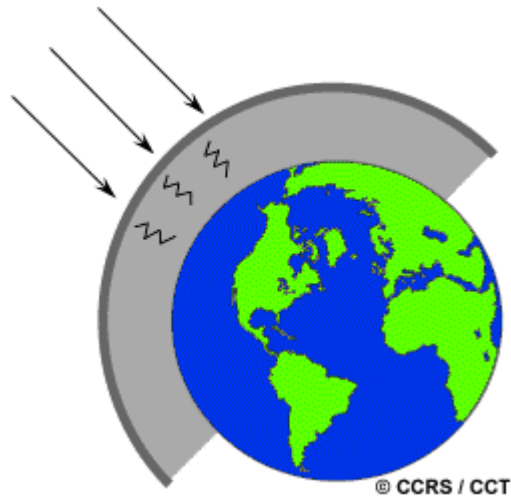
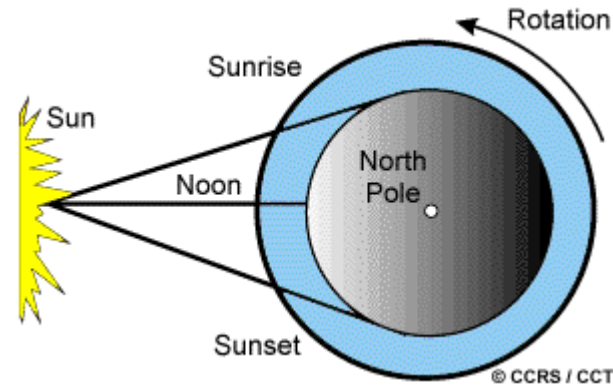
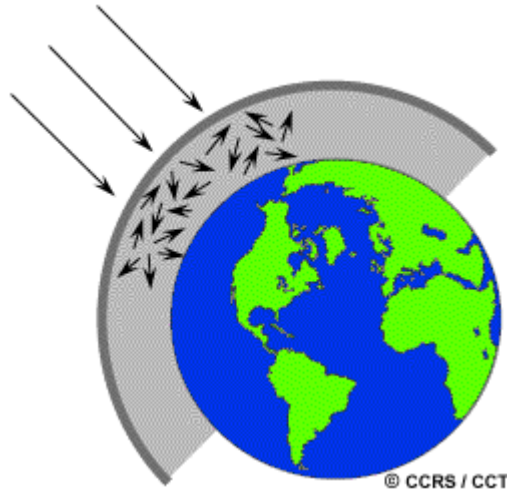


© CCRS / CCT



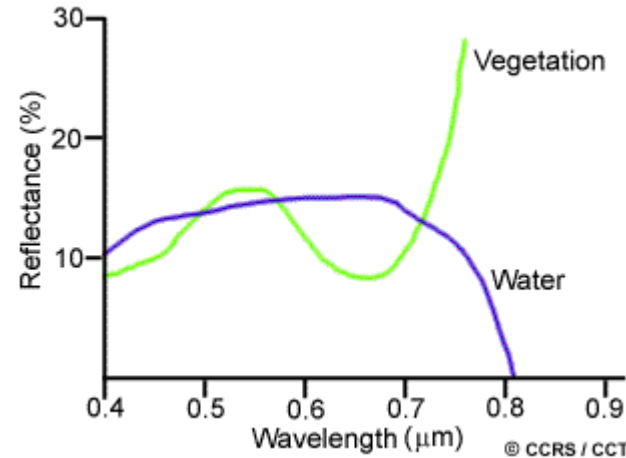
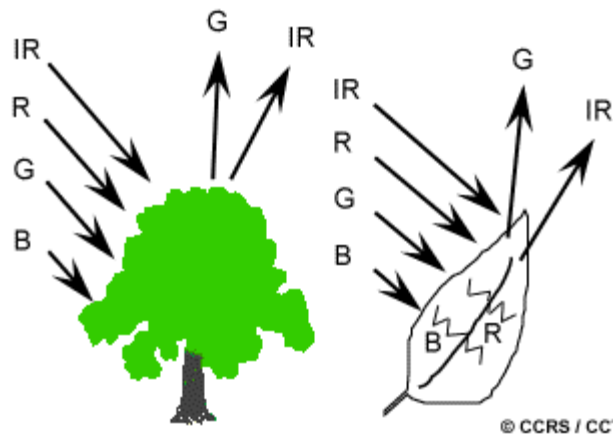
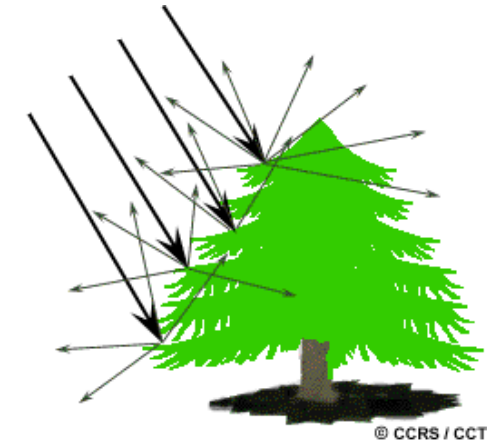
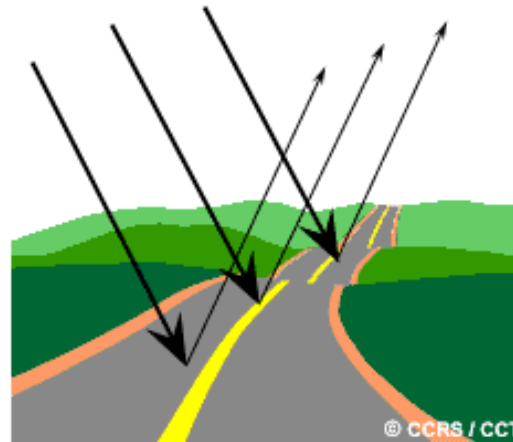


Interactions with the Atmosphere Scattering - Absorption

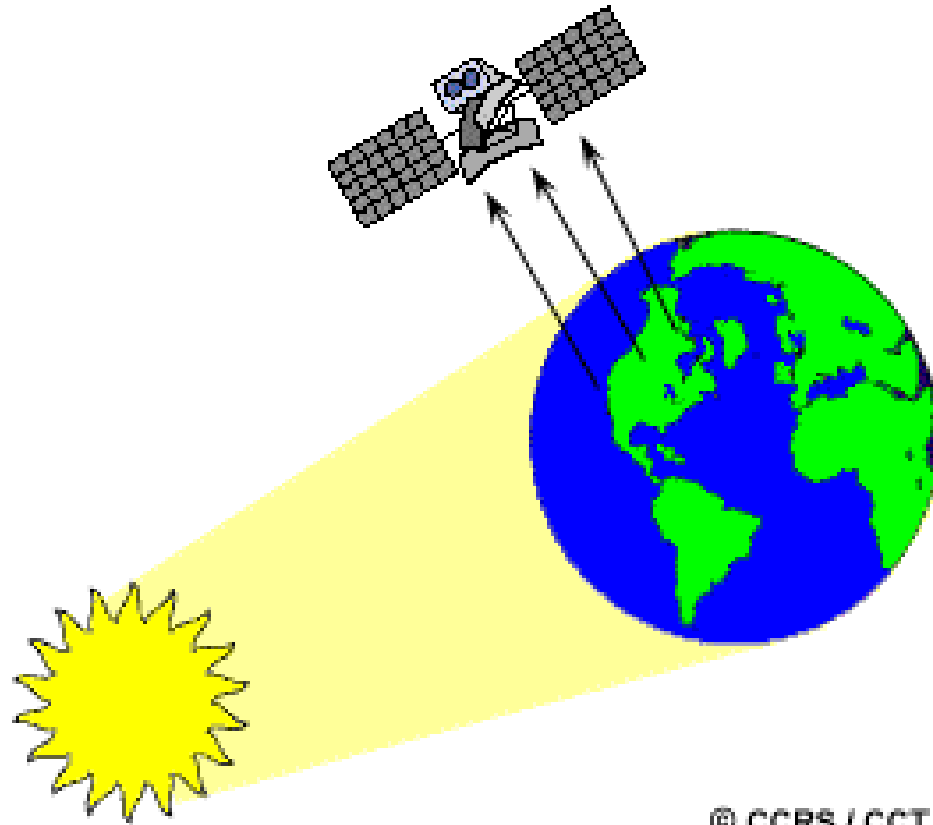


Radiation - Target Interactions

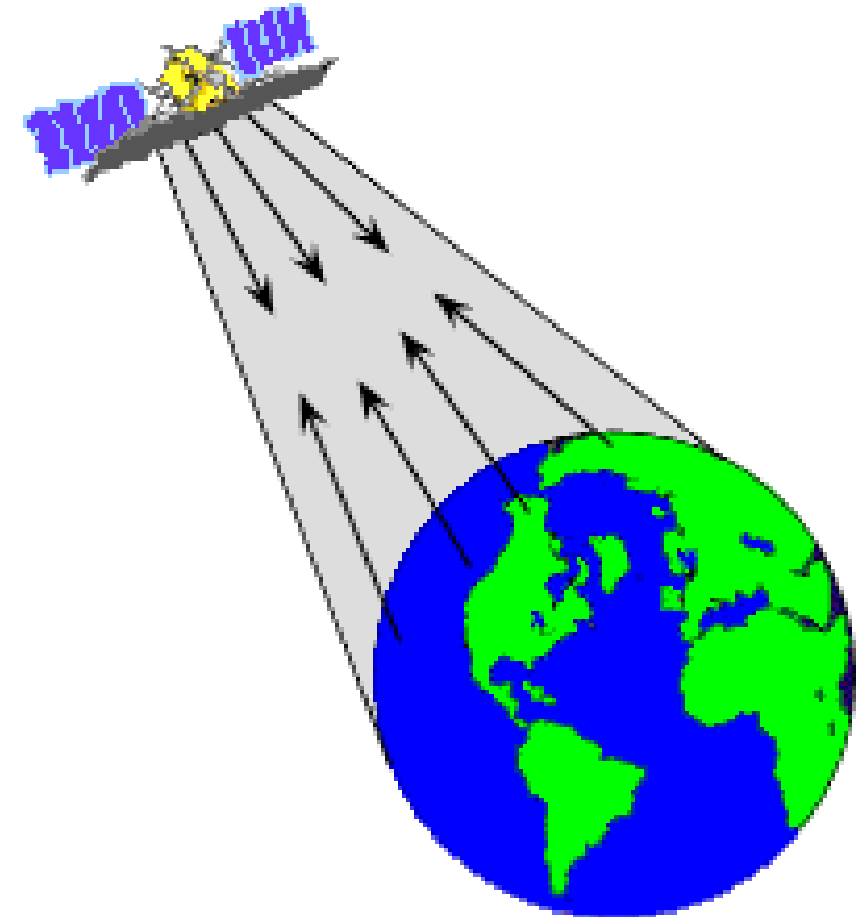
incident (I) absorption (A) transmission (T) and reflection (R)



Passive vs. Active Sensing

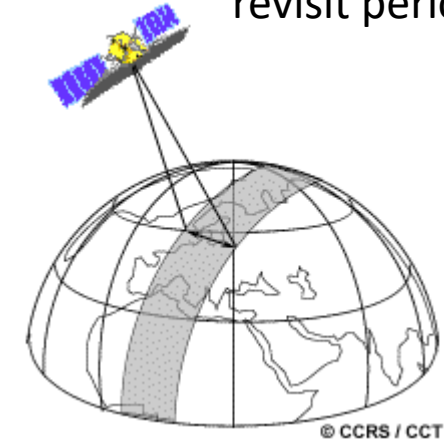
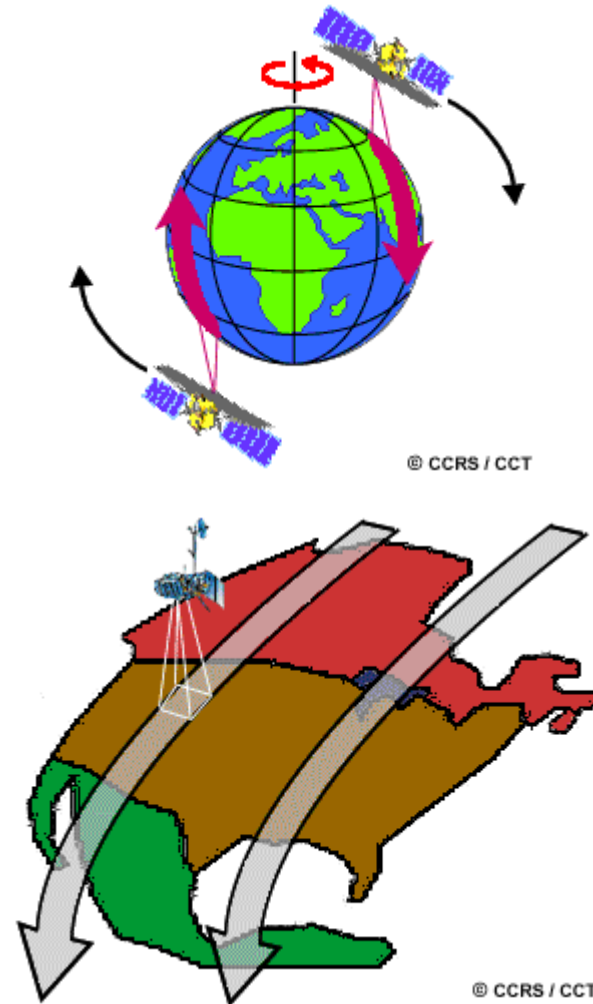
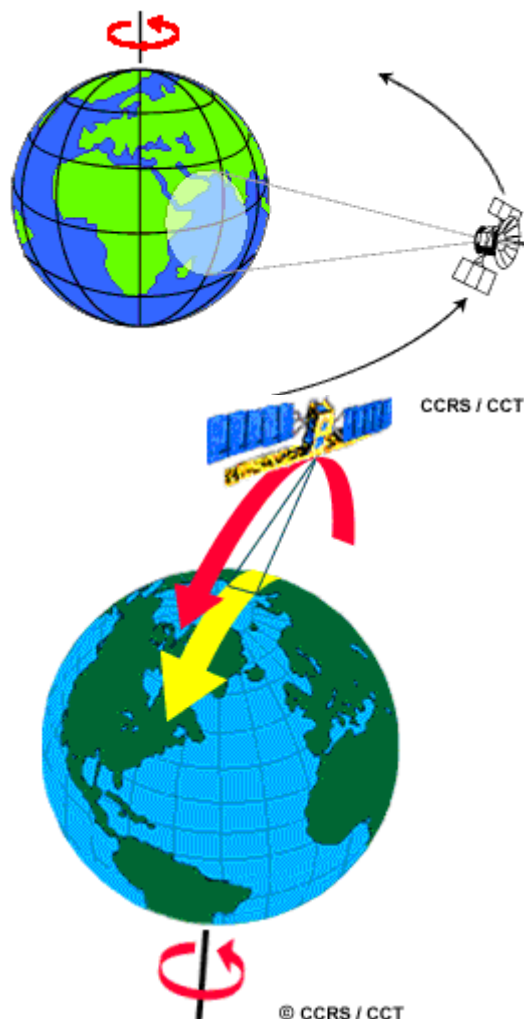


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Satellite Characteristics: Orbits and Swaths exercises



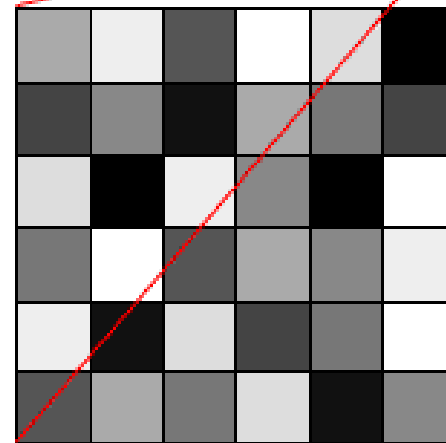
geostationary orbits
near-polar orbits
sun-synchronous
local sun time

Ascending and
Descending passes

swath
nadir
revisit period

Characteristics of Images

© CCRS / CCT

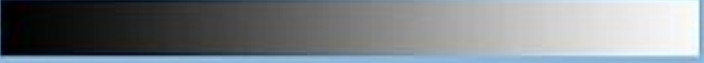


170	238	85	255	221	0
68	136	17	170	119	68
221	0	238	136	0	255
119	255	85	170	136	238
238	17	221	68	119	255
85	170	119	221	17	136

Image Resolution

- 1.spatial Resolution
- 2.temporal Resolution
- 3.Radometric Resolution

Radometric Resolution

Bits	Wertebereich	Grauwerte
1Bit	$2^1 = 2$ (0-1)	0  1
4Bit	$2^4 = 16$ (0-15)	0  15
8Bit	$2^8 = 256$ (0-255)	0  255

1 bit

2 Abstufungen

2 bit

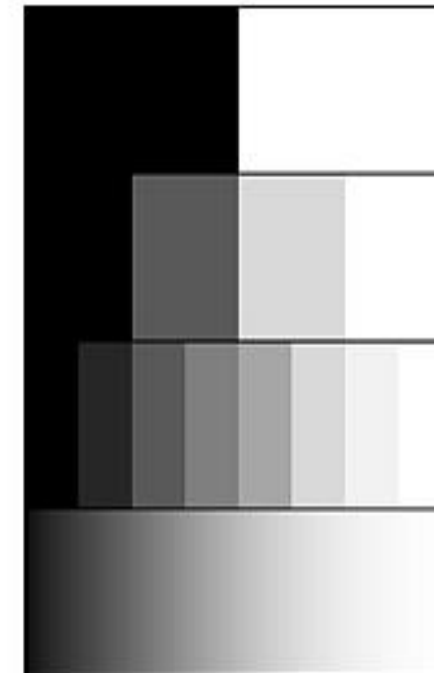
4 Abstufungen

3 bit

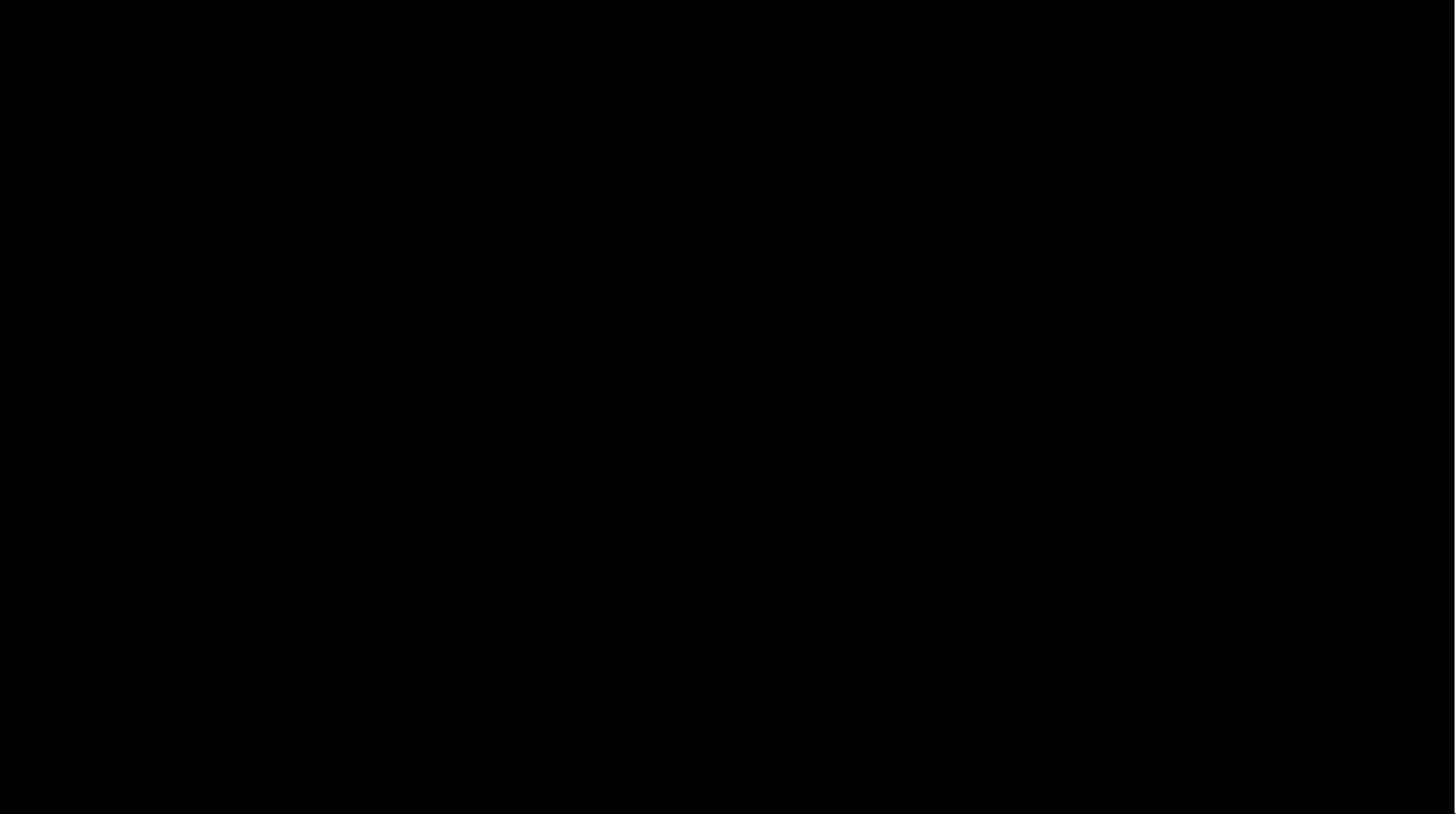
8 Abstufungen

8 bit

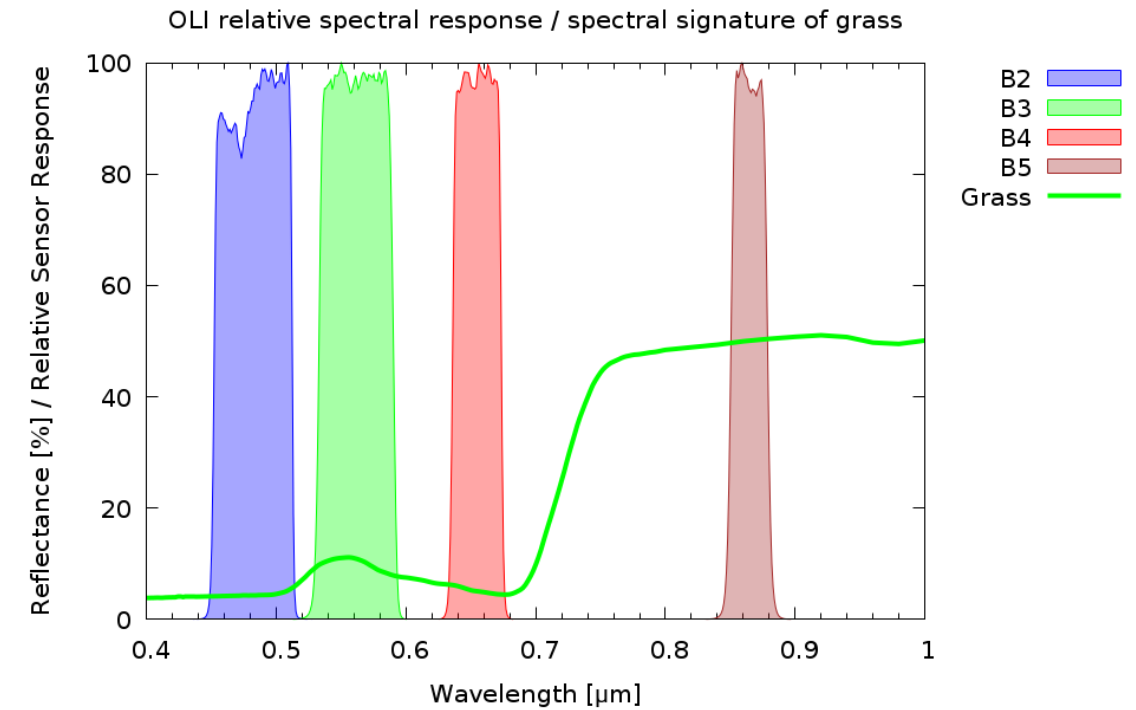
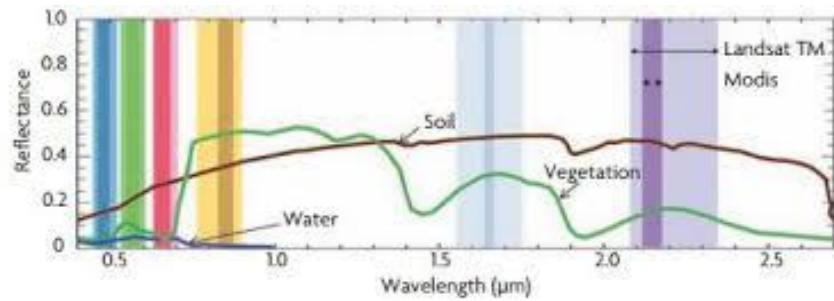
256 Abstufungen



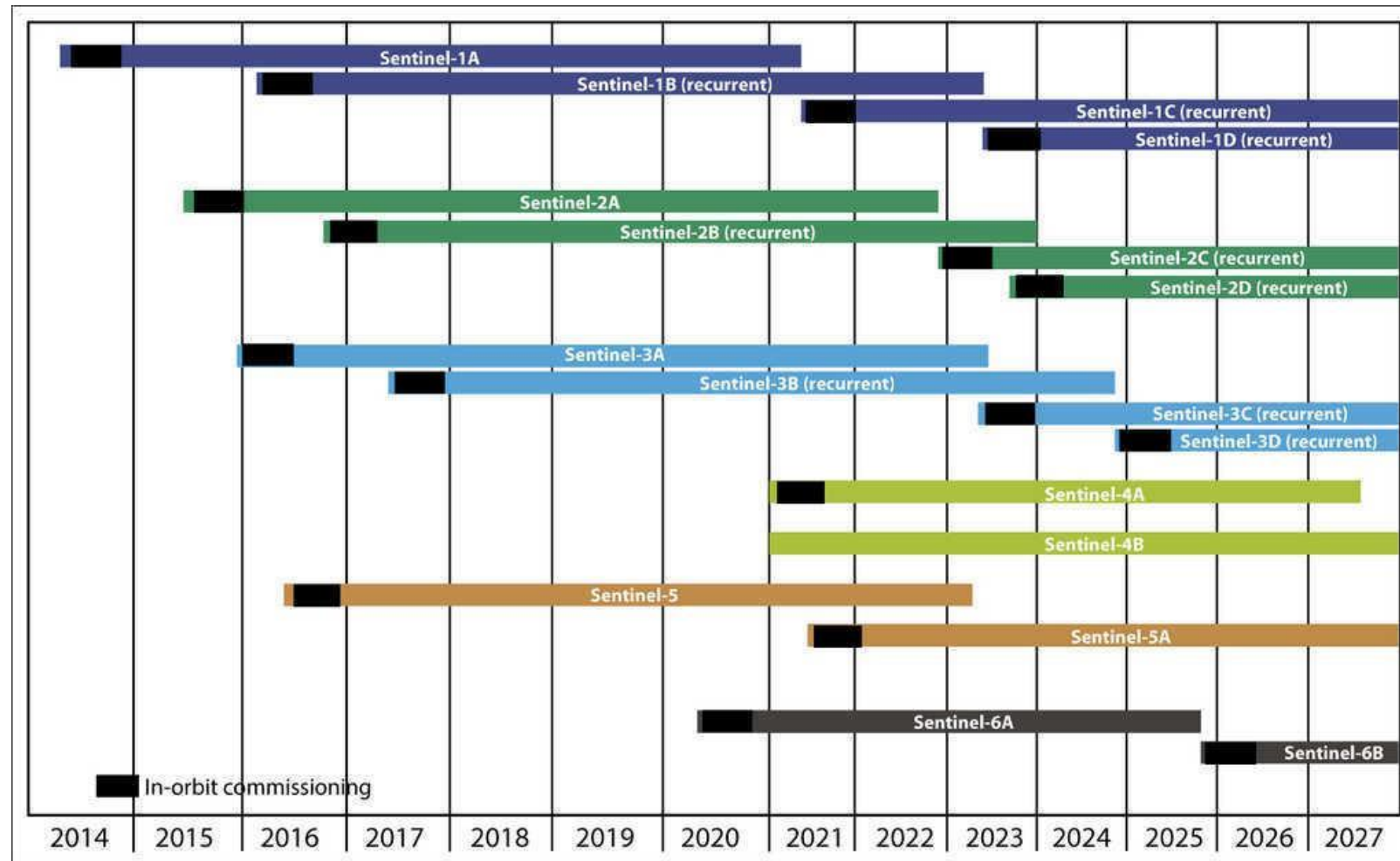
Landsat



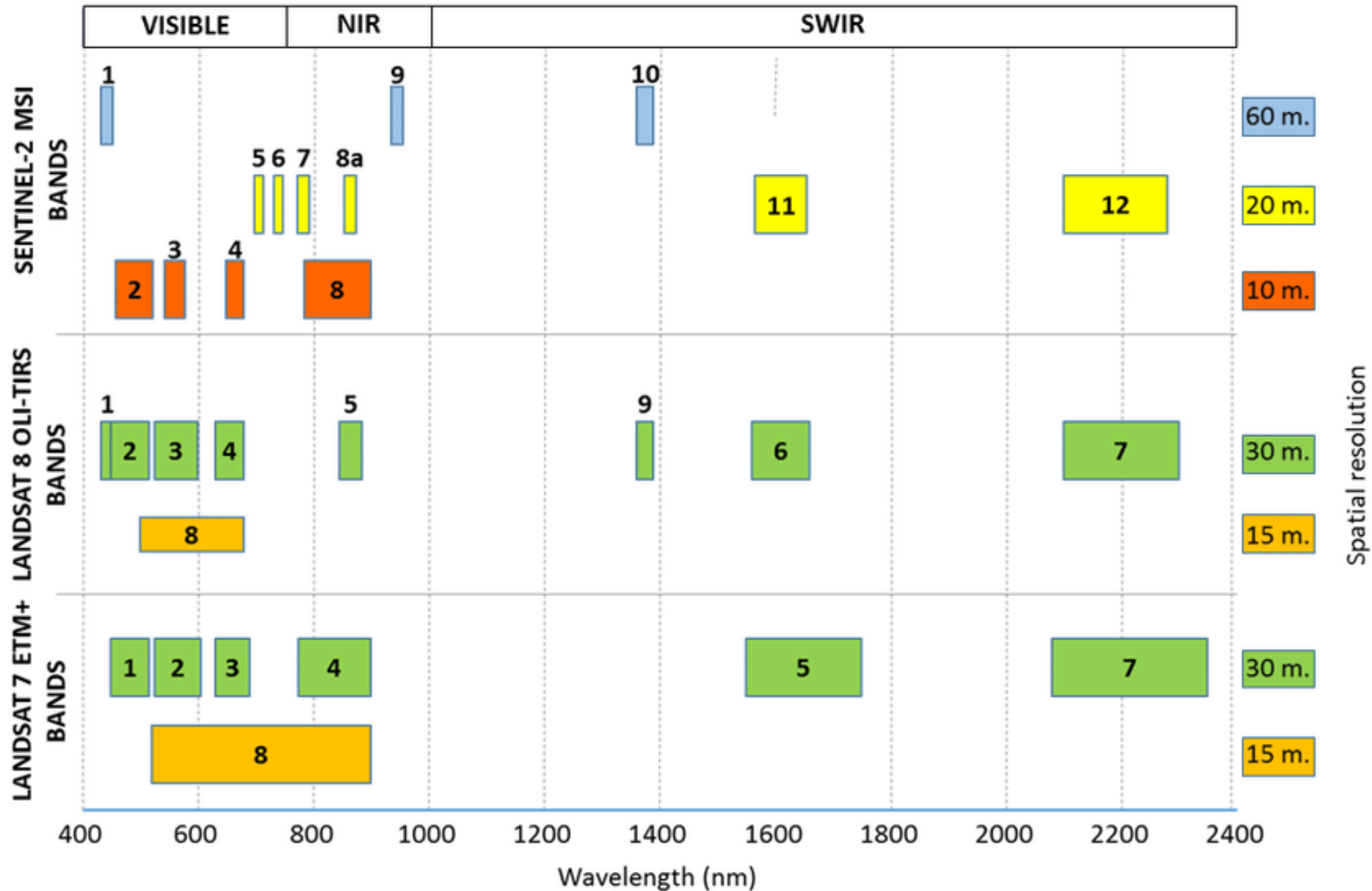
Landsat & Sentinel

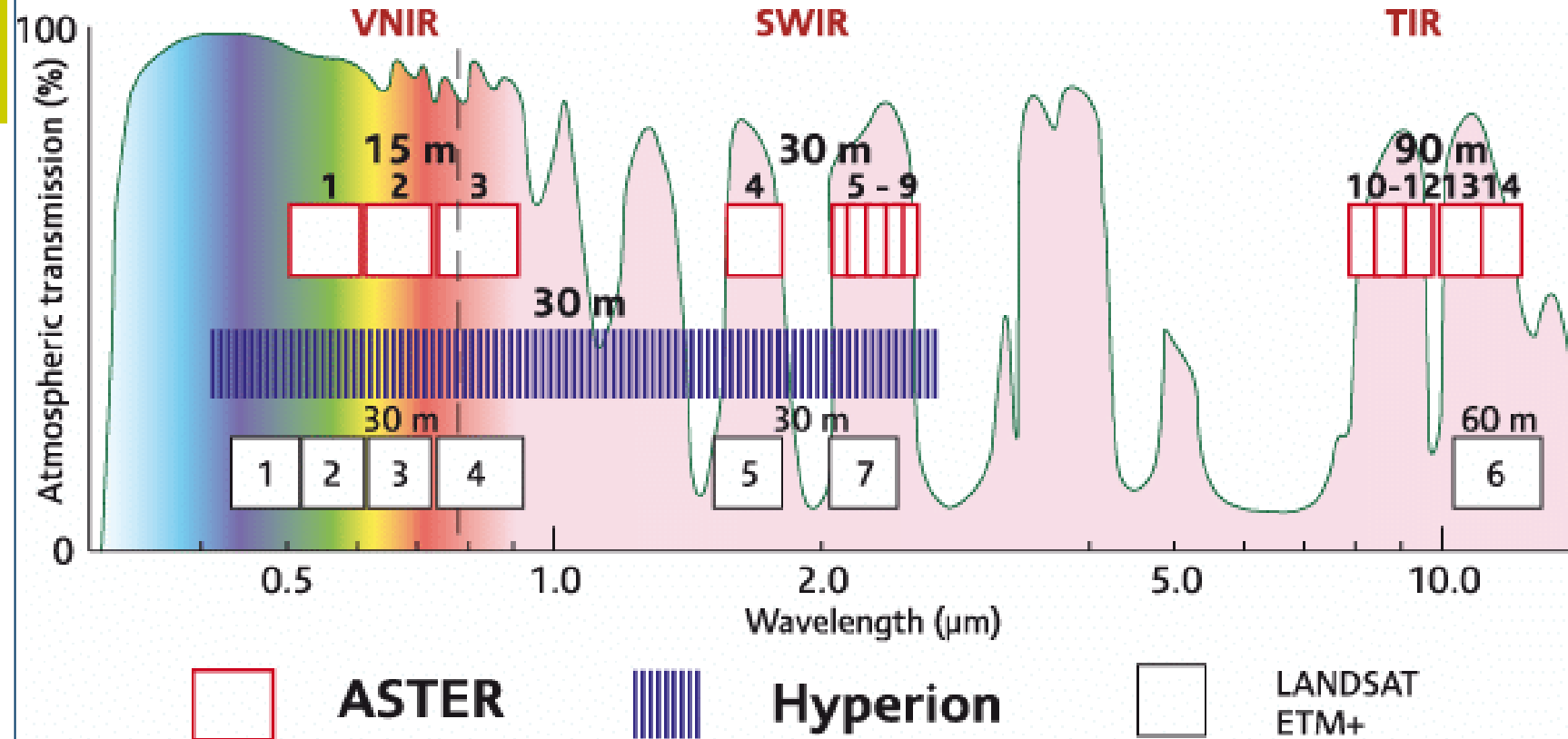


Copernicus = Sentinel



Investigaciones Geográficas, Boletín del Instituto de Geografía. 2016;2016:168-75





Sentinel-2 Swath width: 290 km Spatial resolution: up to 10 m	Landsat-8 Swath width: 185 km Resolution: up to 15 m
	WorldView-3 Swath width: 13.1 km Resolution: up to 0.31 m

Sentinel

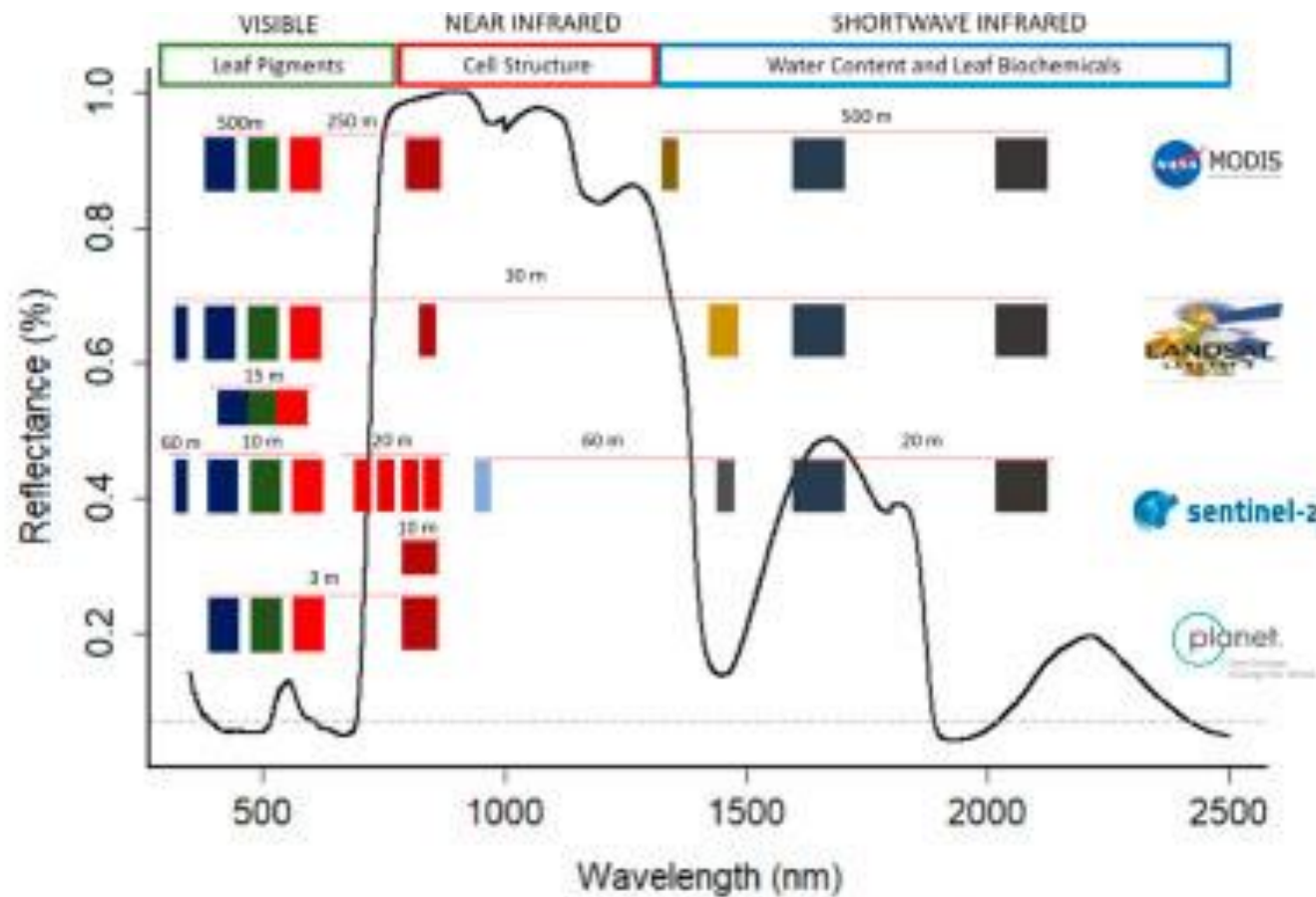
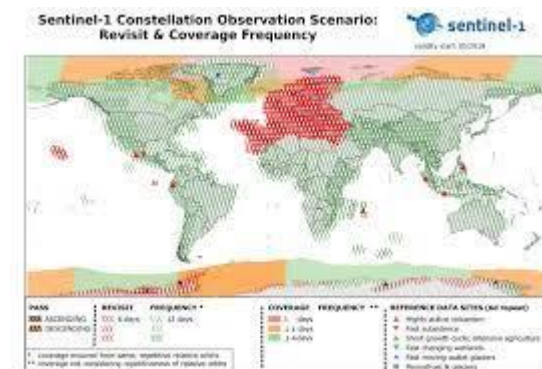
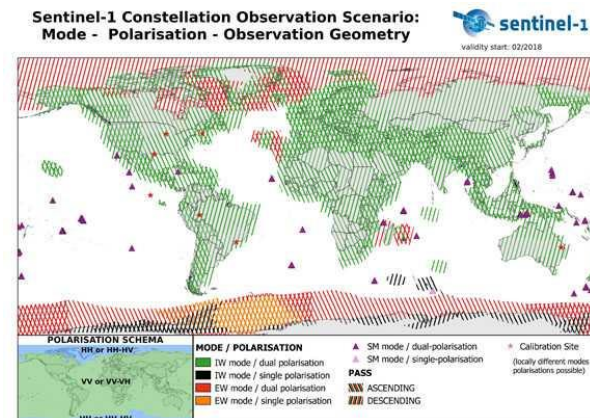


Figure 2. Crop reflectance spectral features, and representation of MODIS (Moderate Resolution Imaging Spectroradiometer), Landsat-8, Sentinel-2, and Planet multispectral bands and spatial resolution.



Google Earth Engine Basic

The Earth Engine (EE) Code Editor at code.earthengine.google.com is a web-based IDE for the Earth Engine JavaScript API.

Code Editor features are designed to make developing complex geospatial workflows fast and easy. The Code Editor has the following elements :

- JavaScript code editor
- Map display for visualizing geospatial datasets
- API reference documentation (Docs tab)
- Git-based Script Manager (Scripts tab)
- Console output (Console tab)
- Task Manager (Tasks tab) to handle long-running queries
- Interactive map query (Inspector tab)
- Search of the data archive or saved scripts
- Geometry drawing tools

Search for datasets or places

Script manager

API documentation

Asset manager

Get a link (URL) to the script

Save the script

Run the script

Help button

Feedback button

Code Editor

Task manager

Console output

Inspect locations, pixel values, objects on the map

Geometry Tools

Zoom

Map

Layer manager

The screenshot shows the Google Earth Engine web interface. At the top is a search bar labeled 'Search places and datasets...'. Below it are tabs for 'Scripts', 'Docs', and 'Assets'. The 'Scripts' tab is active, showing a list of scripts on the left and a code editor in the center. The code editor contains a JavaScript script for cloud masking. To the right of the code editor are panels for 'Inspector', 'Console', and 'Tasks'. The 'Console' panel shows output from the script. At the bottom is a map of a coastal area. On the left side of the map are 'Geometry Tools' and a 'Zoom' control. On the right side of the map is a 'Layer manager' panel.

Scripts Docs Assets

Filter scripts...

NEW

▼ Owner (1)

▼ users/username/default

■ aScript.js

► Writer (6)

► Reader (9)

► Examples

► Archive (18)

Scripts Docs Assets

NEW



▼ users/username

► subFolder

■ myVectorTable

■ myGeoTiff

■ myImageCollection

Playground.js

Get Link

Save

Run

Reset



▼ Imports (4 entries)

```
var imageCollection: ImageCollection "MYD09A1 Surface Reflectance 8-Day L3..."
  type: ImageCollection
  id: MODIS/MYD09A1
  version: 1431475889035000
  bands: []
  properties: Object (22 properties)
var geometry: MultiPoint, 7 vertices
  type: MultiPoint
  coordinates: List (7 elements)
  geodesic: true
var geometry2: MultiLineString
var geometry3: MultiPolygon, 10 vertices
```

```
1
2 // load the most recent MODIS composite
3 var modis = ee.Image(imageCollection
4
```


Inspector Console Tasks

▾ Point (-84.37, 57.23) at 20Km/px
 Longitude: -84.375
 Latitude: 57.231502991478905
 Zoom Level: 3
 Scale (approx. m/px): 19567.87924100512

▾ Pixels

▾ MODIS composite: Image (3 bands)
 vis-red: 195
 vis-green: 203
 vis-blue: 210

▾ Objects

▾ MODIS composite: Image (3 bands)
 type: Image
 ▸ bands: List (3 elements)
 ▸ properties: Object (5 properties)

Layer 1 visualization parameters

☒ 1 band (Grayscale)
 ☐ 3 bands (RGB)

elevation

Range

-65.091 - 920.471
 Stretch: 1 σ

Opacity

1.00

☐ Gamma
 ☒ Palette

Import Apply Close

Configure geometry import

Name

geometry3

Color

#ffc82d

Import as

Feature

Properties

☒ Property: foo

+ New property

OK Cancel

THANK YOU

Any Questions?