(RSG) -> Quiz prep → Unit - 3

(1) Indian remote sensing satellites

(i) IRS series
(IRS-1A, IRS-1B)
(IRS-1C, IRS-1D) * imp.

(ii) Resourcesat series
Resourcesat-1, 2, 2A

(iii) Cartosat series
Cartosat-1, 2,

(iv) RISAT series (Radar Image Satellite)
RISAT-1, RISAT-2

(v) EOS series (Earth Observation Satellite)
EOS-01

(2) IIIT Allahabad [24.4294°N, 81.7702°E]

(3) Geospatial data: Contains info about geographic location on Earth's surface.
↳ can include both vector and raster data.

Raster data: The spatial information as a grid of pixels or cells, with each cell storing a single value of attribu

Vector data: Spatial information is stored using points, lines and polygons.

→ GIS (Geographic Information system)
↳ To capture, store, manipulate, analyze, manage and present spatial or geographic data.

→ GPS (Global positioning System)
↳ Satellite based navigation system
↳ Provides location and time info. on or near Earth's surface

→ Information and Communication Technology (ICT)
↳ refers to tech for communication and information processing.

→ Telematic devices
↳ electronic devices that combine tele com... and informatics capabilities to remotely monitor, track, and manage vehicle, assets.

→ Spatial data
↳ Data which ha a geographic component

→ Attribute data
↳ No spatial data. Refers to info. associated with spatial features

→ SPOT satellite → by → French space agency (CNES)

Ocean color monitor → Measure color of ocean water by analyzing light reflected from ocean surface.
For Phytoplankton monitoring, water quality etc.

Qui: Why IRS does not have blue band?
Ans: Because blue band is affected by large atmospheric scattering.

IRS-1C/1D: Repetition cycle : 24 days
Spatial resoultion

PAN band : → 10 metre
LISS-III bands:
(Green) B2 →
(Red) B3 →
(NIR) B4 →
(SWIR) B5 →
} 23.5m (VNIR) to 70.5m (SWIR)

WiFS → 188m
(Wide Field Sensor)
→ repetition cyle : 5 days

Interaction of EMR with atmosphere:
Absorption: Ozone absorbs → (UV)
Water vapour, CO_2, CH_4 → IR
Scattering: Deflect or redirect incoming radiation in diff. direction.
Ex: Rayleigh scattering → size of particle much smaller than wavelength of radiation
Mie scattering → comparable size of particle and wavelength.

Reflection: Due to land, water or ice, angle of incidence → the EMR bounces back.

Transmission → Pass through atmosphere and get absorbed

Spectral signatures
↳ Unique pattern or curve that represents how object reflect, emits or absorbs (EMR) across diff. wavelength of spectral bands.

Rayleigh Scattering: Size of particle much smaller than wavelength of radiation.
- Blue and violet are affected.
- Responsible for blue color of sky

Mie Scattering: Size of parcile comparable to wavelength of radiation
- All wavelengths are scattered equally
- Responsible for fog, haze etc.

Que: Any Indian satellite that can do thermal imaging?
→ Yes, ISRO's INSAT series (Indian National Satellite System)

Que: Examples of Indian satellites:

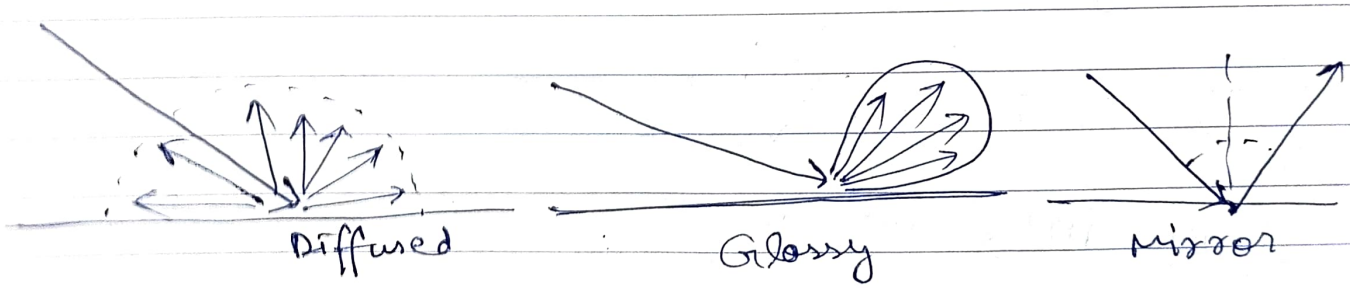
Active
RISAT-1, RISAT-2 (Radar Image Satellite

Passive
Resourcesat, Cartosat

SAR sensors: → uses RADAR to create high resolution image of Earth's surface.
- → operates on microwave portion of EMR
- → All weather capability: operate day or night.
- → Penetration: can penetrate clouds, vegetation even some types of soil and land.
- → High resolution

Q.: First Indian satellite with active sensor?
Ans: IRS - 1A

(BRDF): Bidirectional Reflectance Distribution Function (BRDF)
↳ It describes how light is reflected by a surface in different directions under various lighting and viewing conditions.



Swath of scene: Width of ground area that can be imaged

Nadir view: View from position directly overhead of earth surface

IRS - 1C

- PAN: 5.8 m spatial resolution
  70 km ground swath at nadir view
- LISS III: 70.5 m spatial resolution
  (SWIR) : 148 km ground swath
  fourth band
- LISS (III) : 23.5 m spatial res.
  first three bands : 114 km ground swath
- WiFS → Spatial res. → 188 m
  → Ground swath : 810 km

A full PAN scene consits of nine subscenes, each with a dimension of 23.5 km x 23.5 km

LISS III → Green, Red, NIR, SWIR

Image data formats

BSQ (Band Sequential)

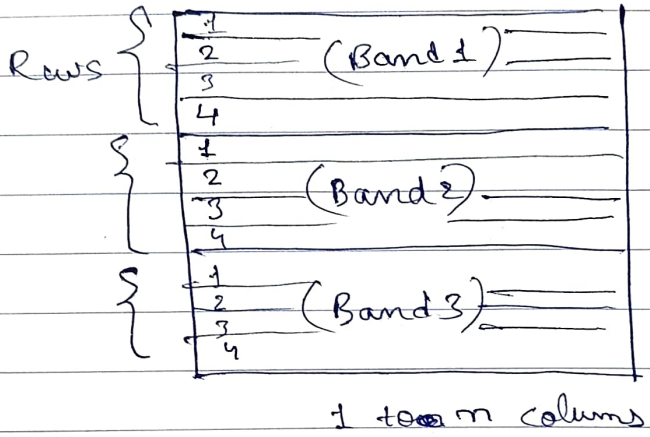
- Pixel value of each band are stored sequentially, one band after another.
- Entire image is stored band by band

BIP (Band Interleaved by Pixel)

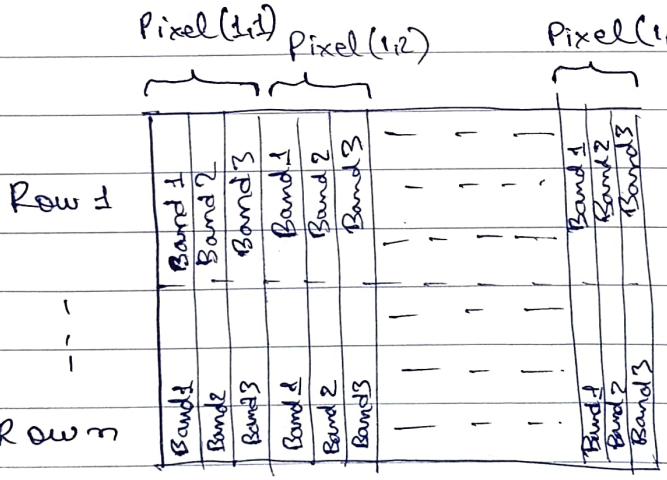
- The value of each pixel across all band stored together
- ~~Each pixel value~~

RLE (Run Length Encoding)
↳ Compression to reduce storage.

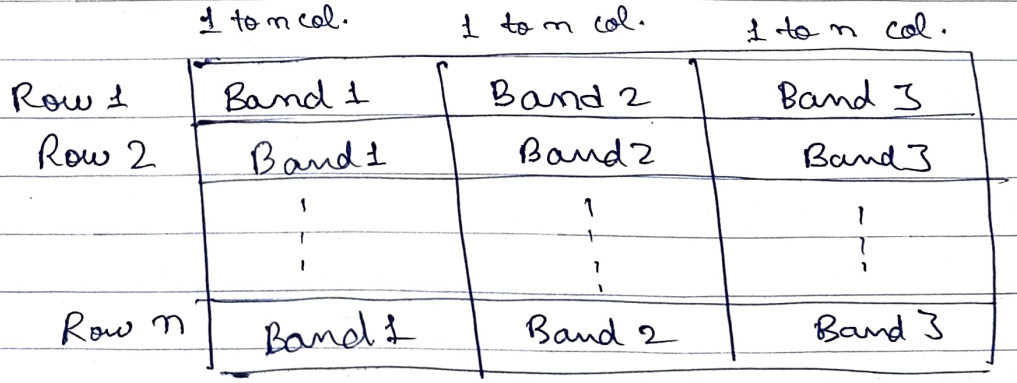
BIL (Band Interleaved by Line
- Value for each pixel in each band are stored togther for each row or line of image



BSQ



BIP



BIL

NRSA formats:

- Fast format
- LGSOWG format
- GeoTIff
- HDF

Levels of processing:

Level 0 : Raw data
Level 1 : Radiometrically and geometrically corrected only for Earth Rotation.
Level 2 : Fully radio. and geo. corrected
Level 3 : Special processing like merging
- - - .

Spectral resolution: ° Ability to distinguish b/w different wavelength or spectral bands of EMR
° Determies the number and width of of spectral bands that a sensor can capture.

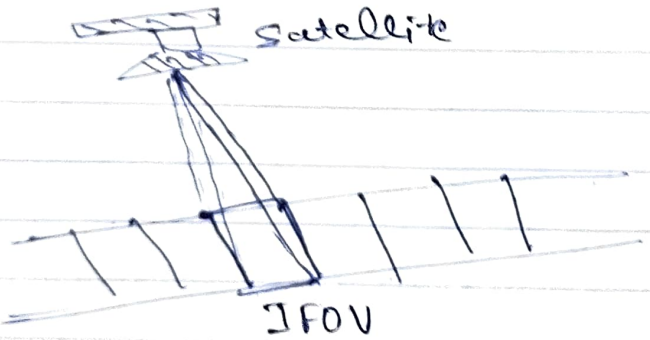
Spatial Resolution: ° Level of clarity in spatial ~~resolution~~ representation of object and features.
° Determined by size of individual pixels in image.

Radiometric resolution: • Ability to differentiate b/w various intensity levels of EM
- It quantifies the number of discrete intensity levels that can be represented for each pixel.

Temporal resolution: frequency at what remote sensing system revisits and acquires images of same area on Earth's surface over time.

Instantaneous Field of View (IFOV)

It is the angular size of ground area observed by single detector element or pixel in sensor.



$$IFOV = \frac{\text{Pixel size}}{\text{Sensor distance}} \text{ radians}$$

Pixel size → Spatial resolution
Sensor distance → altitude

$$IFOV = \frac{\text{Detector dimension}}{\text{Focal length}} \text{ rad.}$$

Ground resolution element: Area on Earth's surface represented by a single pixel

GRE = H x IFOV

↳ Flying height.

Framing systems: ∘ Method or framework used for organizing spatial data.

- It includes coordinate system, data models, and standards.
- Common framing system include
  - Cartesian coordinate system
  - Projected coordinate system (UTM)
  - Geodetic Datums (WGS84)

Ariel photography: Capturing image of Earth's surface from elevated position using drone or aircraft.

Multispectral scanning: Capturing images in multiple wavelengths

Along track: Parallel to path of sensor as it moves over earth surface.

Across track: Perpendicular to the path of sensor.

High Dwell time: • Refers to the duration for which a sensor focuses on a specific area on Earth's surface.
• It enhances spatial and temporal resolution.

Pushbroom Sanners: • Remote sensing instruments that uses linear arrays of sensors to capture imagery of Earth's surface as the sensor platform moves forward.
• High spatial resolution, wide swath coverage and reduced distortion

Thermal imaging: • Capturing EMR emitted by objects in thermal infrared portion of spectrum.
• Enables visualization and analysis of temperature variations and heat distribution on Earth's surface.

Radiometric Corrections: Correcting sensor response, atmospheric effects, surface reflectance properties.

Geometric corrections: • Orthorectification, resampling.
• To remove geometric distortions caused by sensor, terrain relief. and earth's curvature

KAPPA analysis :

- KAPPA coefficient or Cohen's KAPPA statistics is measure of agreement or concordance between two categorical datasets.
- It ranges from -1 to $+1$ where values closer $+1$ indicate higher agreement beyond chance, 0 indicate agreement equal to chance.

User's accuracy and Producer's accuracy :

User's accuracy : Probability that an object classified as a specific class in a classification is correctly identified.

Producer's accuracy : Probability that an object in ground truth dataset is correctly classified in classification

Indian hyperspectral satellite

→ Hyperspectral Imaging Satellite (HySIS)

→ Nov 2018