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1 How to conduct a Remote Sensing case study

c) Importance of field (in situ) data in Remote Sensing

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EARTH OBSERVATION RESEARCH

Learning objectives

1) Define *in situ* (field) data and its role in remote sensing

2) Understand why ground data is essential for validation and accuracy

3) Identify different types of in situ data used in case studies

4) Recognise challenges and best practices for integrating field data

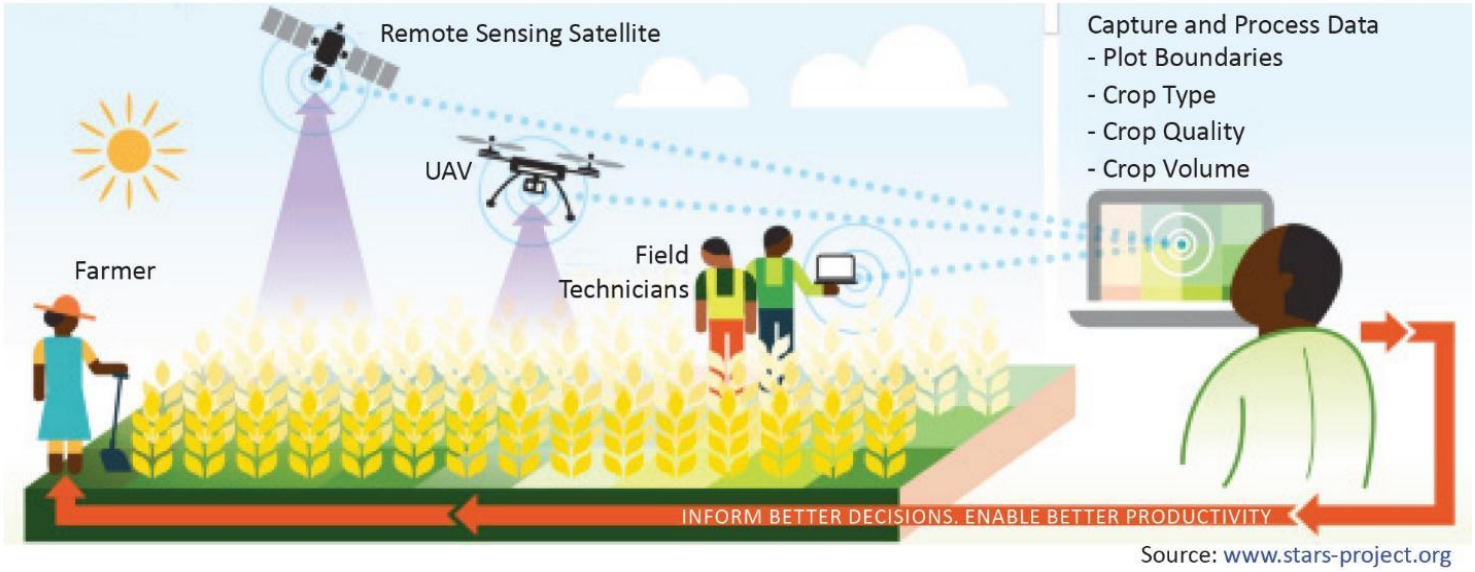
What is *in situ* data

Definition

- Field data collected directly from the ground to provide real-world reference points
- Used to validate, calibrate, and enhance remote sensing analysis

Why is it important?

- Remote sensing provides indirect measurements (e.g., NDVI for vegetation health)
- Field data confirms what is really happening on the ground



(Alkindi 2022)

The Role of *in situ* data in remote sensing

Why remote sensing data alone is not sufficient for your RS* case study

- Atmospheric effects, sensor limitations, and data resolution can introduce errors
- Ground truthing helps improve classification accuracy
- Allows correlation between spectral values and real-world conditions

How *in situ* data will enhance the value of your RS case study

- Step 1: Collect satellite data (e.g., Sentinel-2)
- Step 2: Identify study areas requiring ground validation
- Step 3: Conduct field surveys, record data, and take GPS-tagged photos
- Step 4: Compare field measurements with remote sensing results

*RS = Remote Sensing

Types of *in situ* data

Which types of In-Situ data can you think of?

(Zhang et al. 2022)

Types of *in situ* data

Vegetation & land cover surveys

- **Purpose:** Validate land classification (forest, agriculture, wetlands)
- **Example:** Using quadrats to measure tree canopy density

Soil & moisture measurements

- **Purpose:** Improve analysis of agricultural and hydrological studies
- **Example:** Ground sensors measuring soil moisture vs. satellite estimates

Water quality sampling

- **Purpose:** Validate satellite-based water turbidity, algae, and pollution levels
- **Example:** Taking pH and chlorophyll samples for lake monitoring

Types of *in situ* data

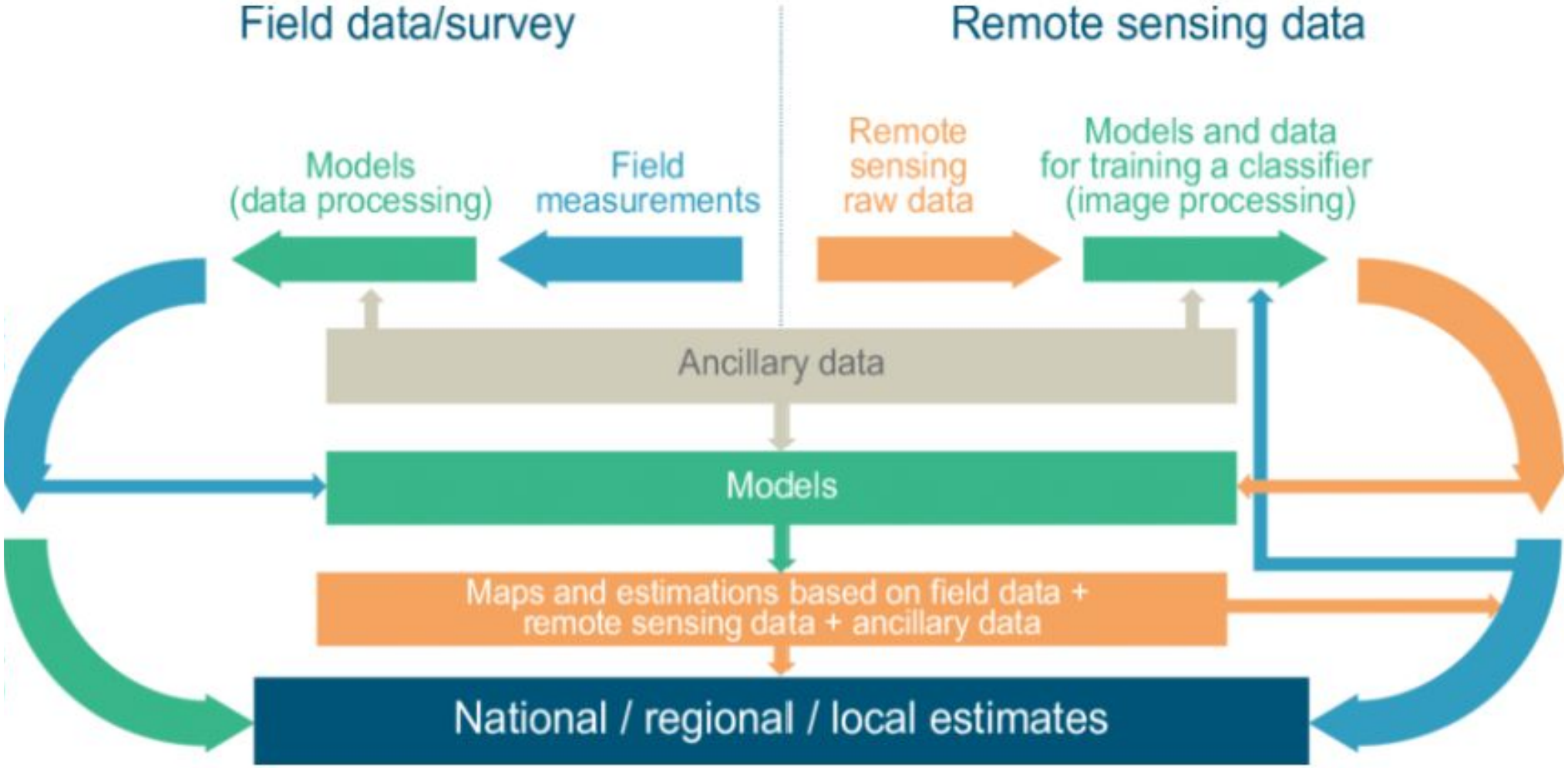
Climate & weather data

- **Purpose:** Provide real-time atmospheric corrections for satellite data
- **Example:** Temperature, humidity, and wind speed logs from weather stations

GPS & drone surveys

- **Purpose:** Provide high-resolution reference images for validating satellite classifications
- **Example:** Drones capturing ultra-high-resolution imagery of deforestation sites

Combining *in situ* and satellite data



(Morales-Hidalgo et al. 2017)

Challenges in collecting and using *in situ* data

Time-consuming & expensive

- Requires field teams, specialized equipment, and travel costs.

Data collection errors

- Inconsistent sampling methods can introduce biases.

Scalability issues

- Field surveys cover limited areas, whereas satellites provide regional/global coverage

Weather & environmental barriers

- Remote areas, harsh terrain, and seasonal access limitations

Best practices for using *in situ* data

Use standardized protocols

- Follow global methodologies for data collection (e.g., FAO Land Cover Classification)

Ensure spatial alignment

- Match field data coordinates with satellite imagery

Automate data collection

- Use GPS, sensors, and mobile apps for accuracy

Combine multiple data sources

- Improve validation by integrating drone imagery, government datasets, and historical records

Document metadata

- Record who collected data, when, and under what conditions

Choose *in situ* data for your own case study

Within the next 20 minutes:

- Think of at least **three types of *in situ* data** you can use to make your case study better!
- Go outside, **take your phone with you**, and do some in-situ sampling (GPS tagged pictures, Quick Capture [needs to be prepared by supervisor])

Summary & key Takeaways

***In situ* data is essential for validating** remote sensing analysis

Ground truthing improves classification accuracy and interpretation

Challenges include **cost, errors, and limited coverage,** but best practices help improve reliability

Sources

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Thank you for your attention!

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