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EOCap4Africa

1 How to conduct a Remote Sensing case study

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



Learning objectives



- 1) Define *in situ* (field) data and its role in remote sensing
- 1) Understand why ground data is essential for validation and accuracy
- 1) Identify different types of in situ data used in case studies
- 1) Recognise challenges and best practices for integrating field data



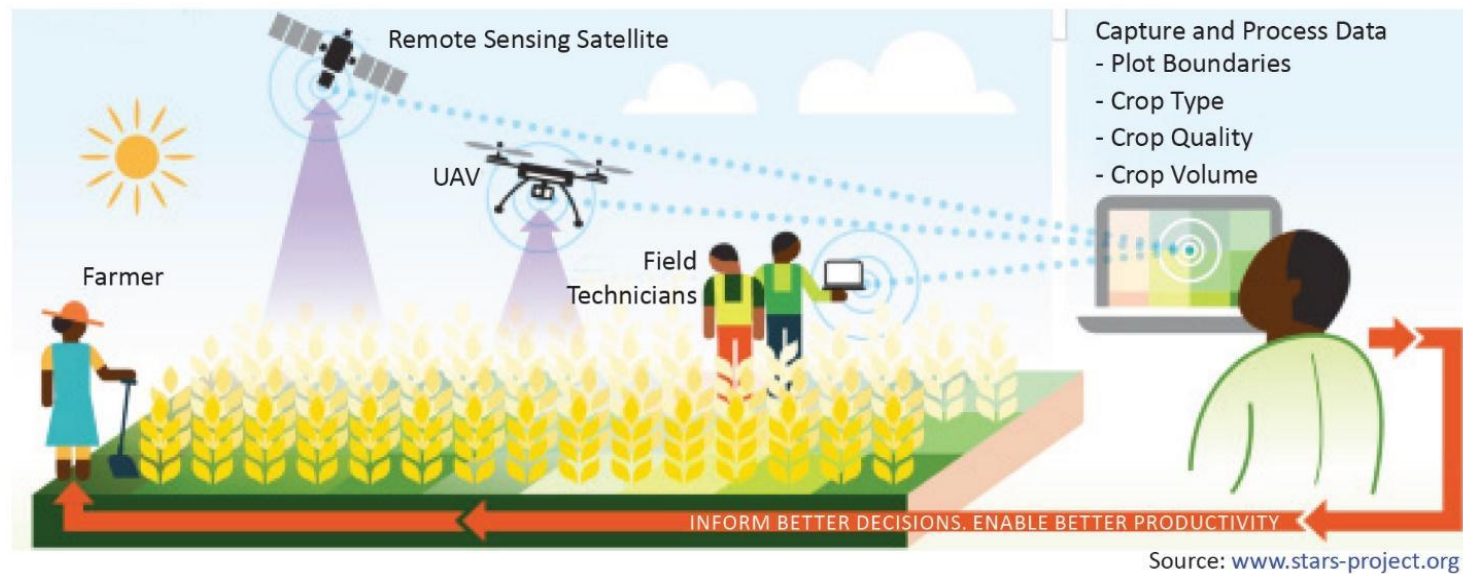
What is *in situ* data

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 squares 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

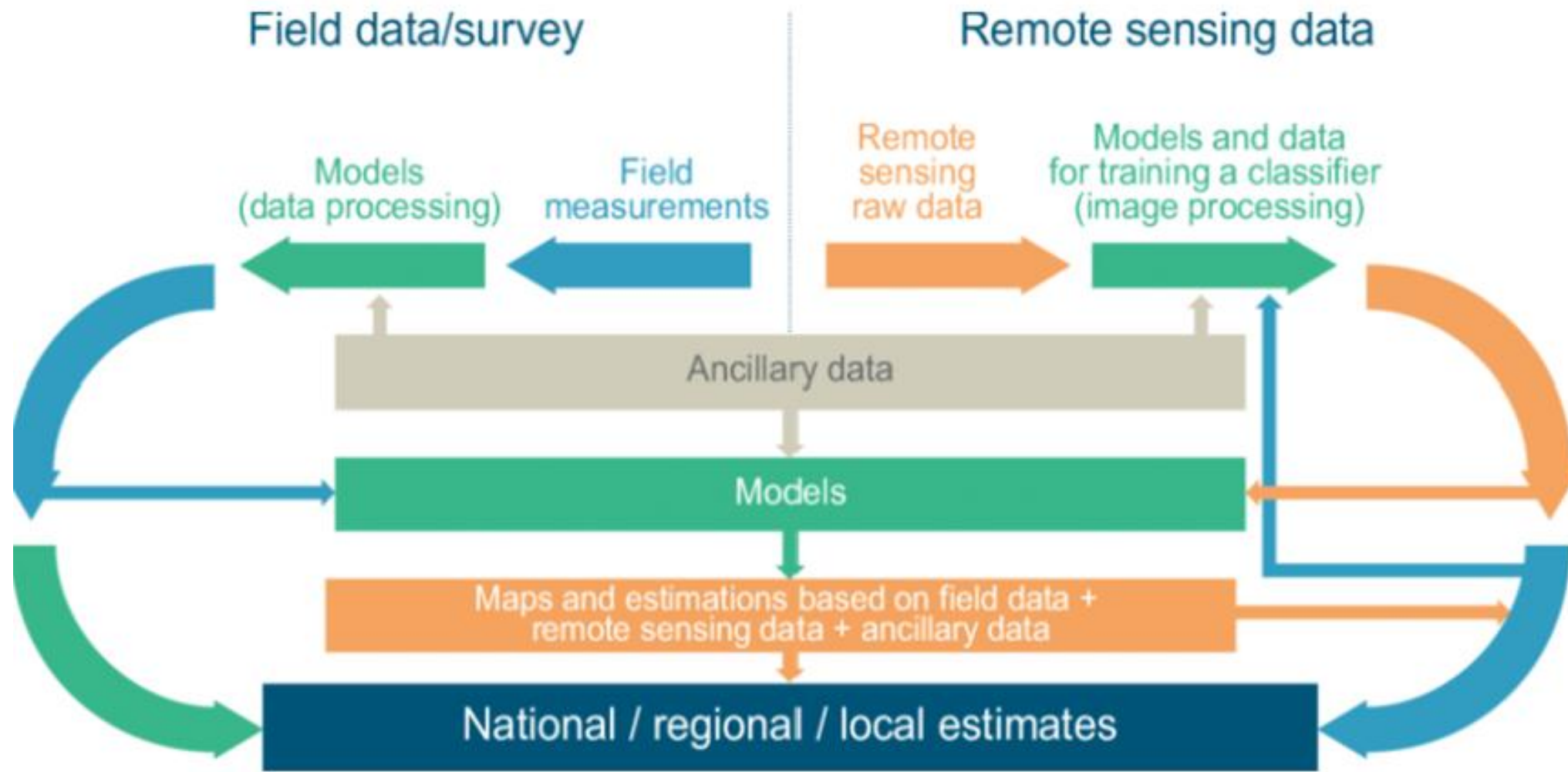
- **Purpose:** Provide real-time atmospheric corrections for satellite data
- **Example:** Temperature, humidity, and wind speed logs from weather stations

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!

Dr. Insa Otte, Hanna Schulten
(on behalf of the EOCap4Africa Team)
and colleagues

insa.otte@uni-wuerzburg.de



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HALLE-WITTENBERG



UNIVERSITY OF BOTSWANA



INES Ruhengeri
Institute of Applied Sciences

