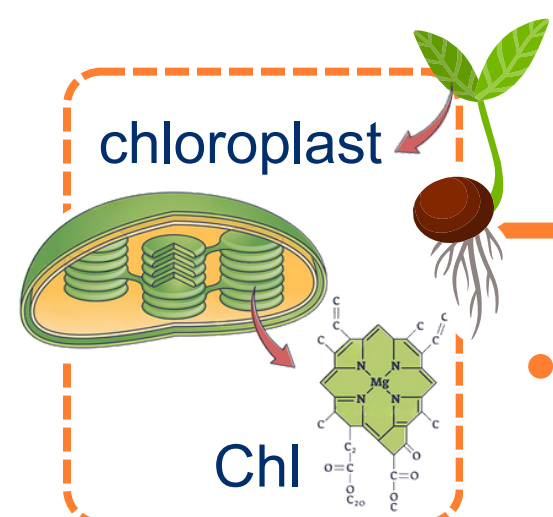


Can Crop Simulations Transform Agriculture?

Biophysical parameter retrieval through the inversion of simulated hyperspectral vegetation data

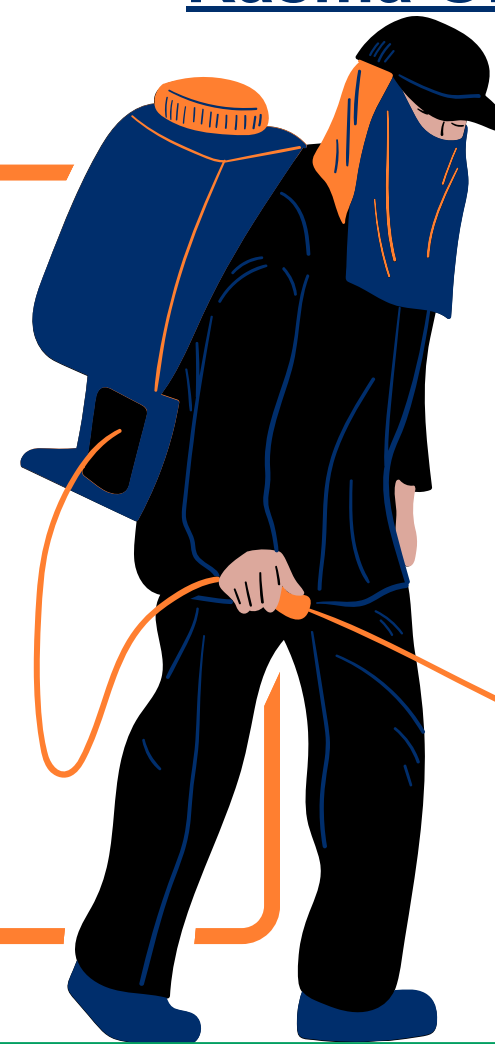
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Why?

- Satellites and drones enable the retrieval of parameters such as **chlorophyll (Chl)**, helping monitor ecosystems and mitigate climate change.
- **Radiative Transfer Models** simulate light rays in plant canopies, allowing global Chl estimates to boost agricultural productivity and sustainability.
- To test the assumptions behind these models, we simulate the real-world **Earth Observations** and compare outputs.



impact

- **Nitrogen (N)** fertilisers contribute to global warming
- **Chl** is closely related to N
- Tracking Chl optimises fertiliser use in **precision farming**
- Which supports **UK's Net Zero & food security goals**

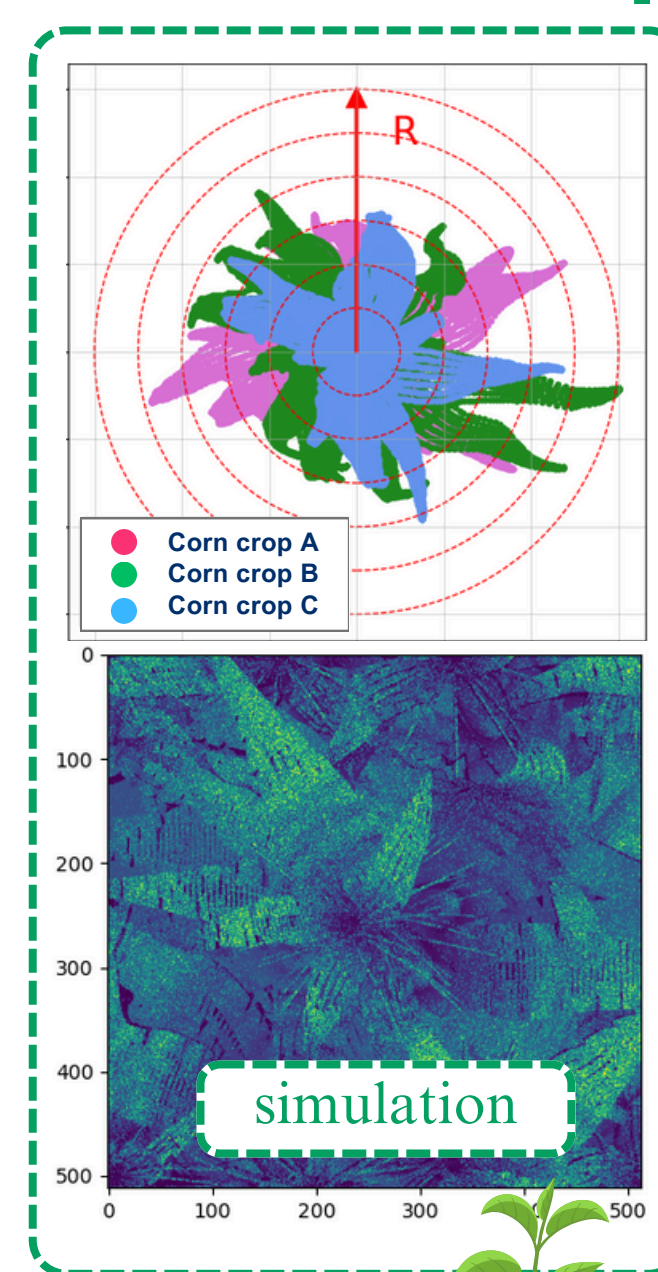
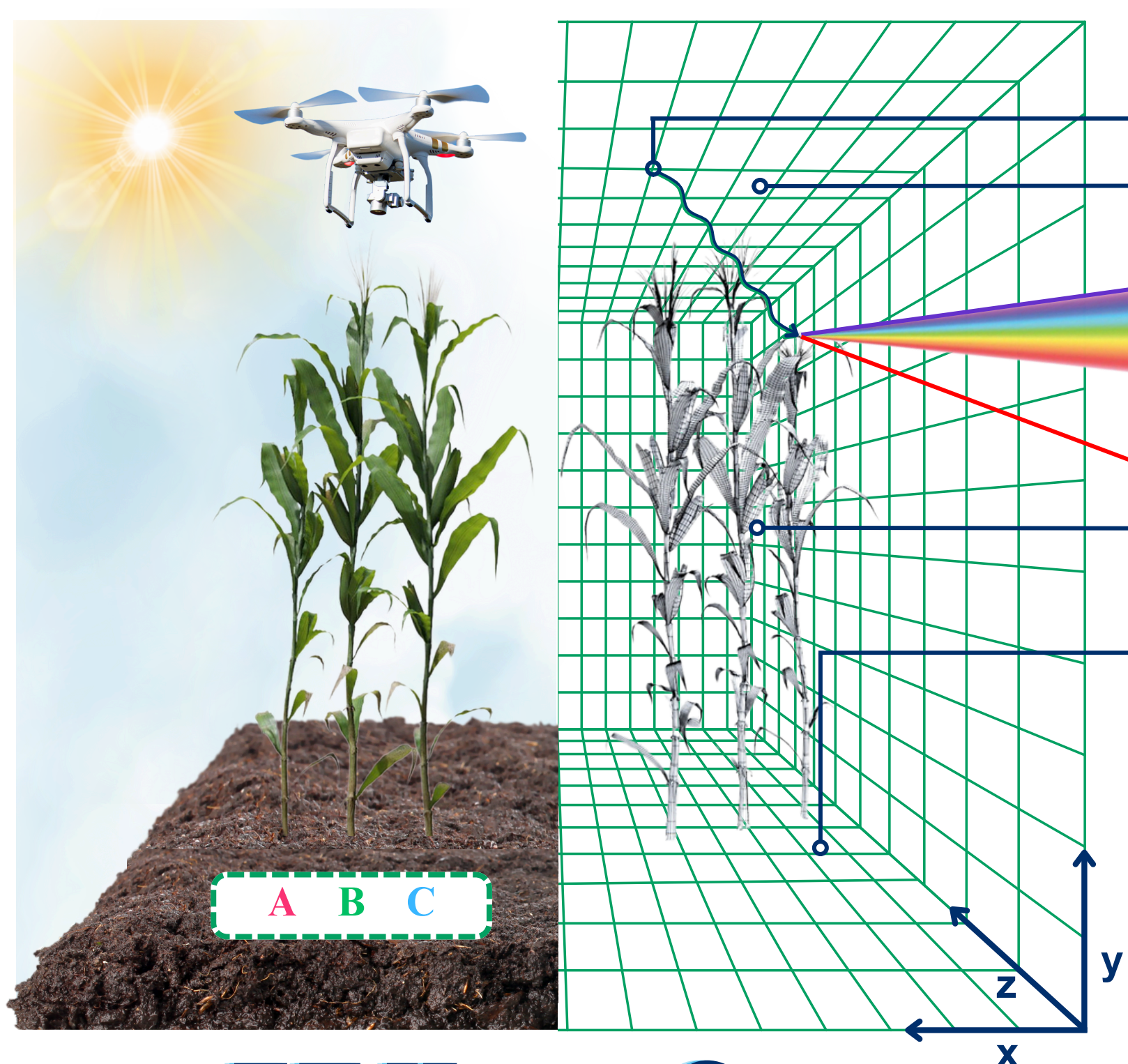
How?

real life vs. simulation →

Simulate a realistic corn field using a multi-stage model.

components:

1. **Light source:** daylight is reflected off crops
2. **Drone:** VNIR/SWIR sensor collects reflectance
 - VNIR: visible & near infrared
 - SWIR: short-wave infrared
3. **Vegetation:** 3 crop variations **A, B & C**
4. **Background:** real-life soil measurements

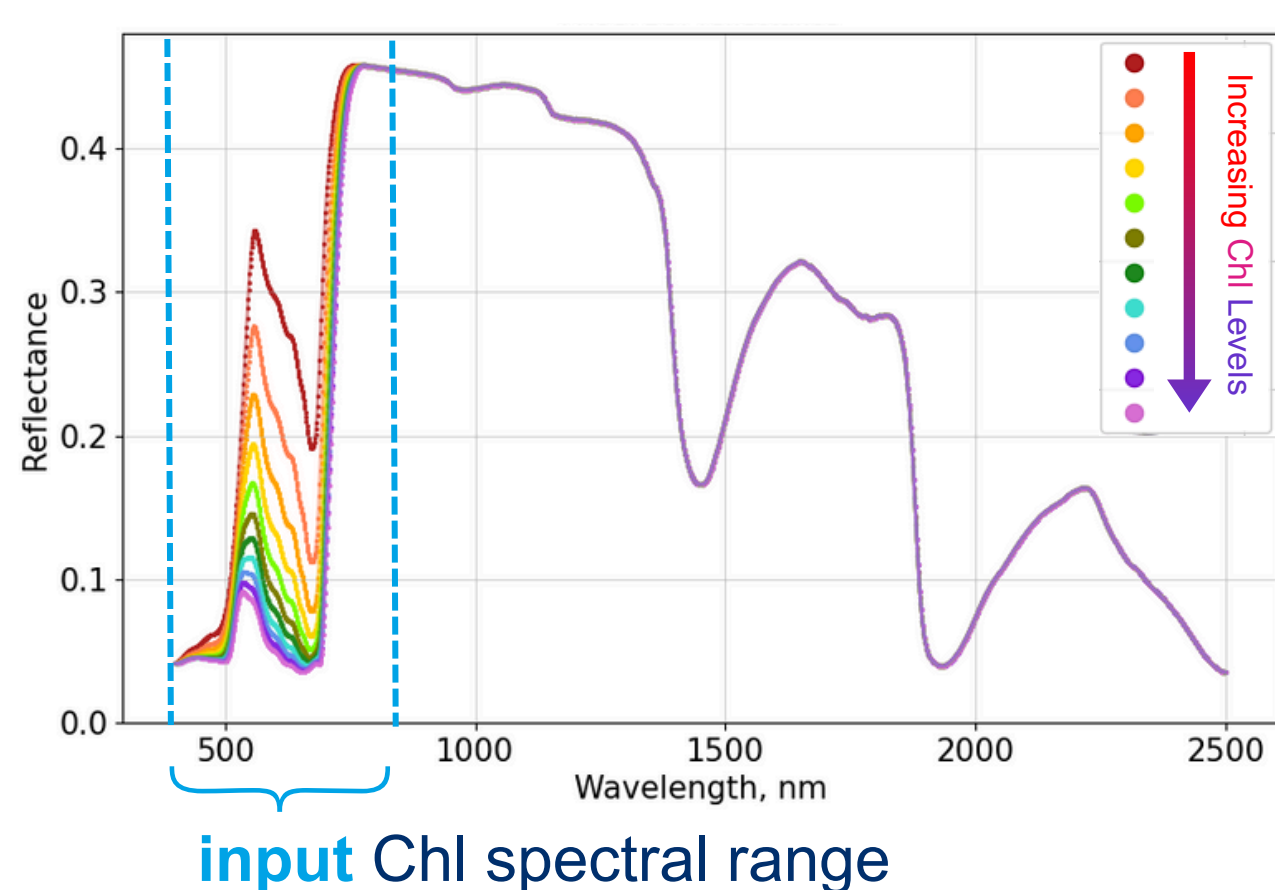


instructions:

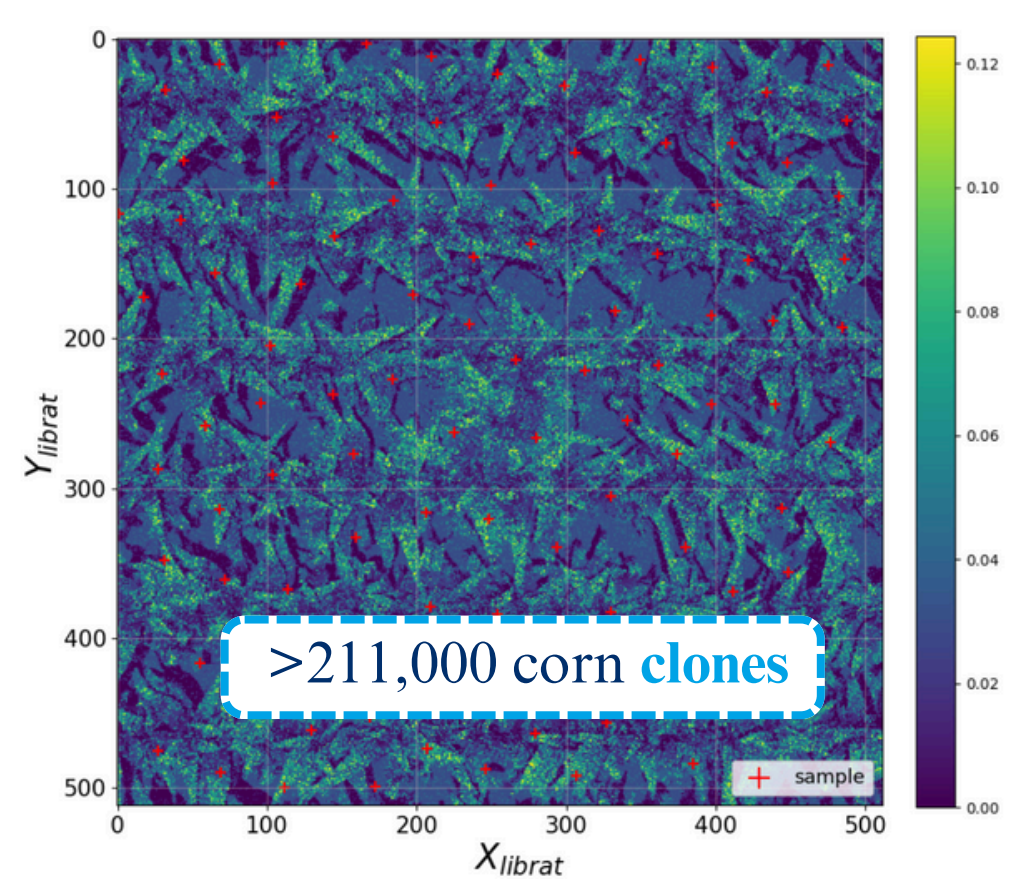
1. Simulate **input** leaf reflectance
2. Simulate a 3D corn field
3. Measure simulated **output** reflectance
4. **Compare** input & output reflectance

What?

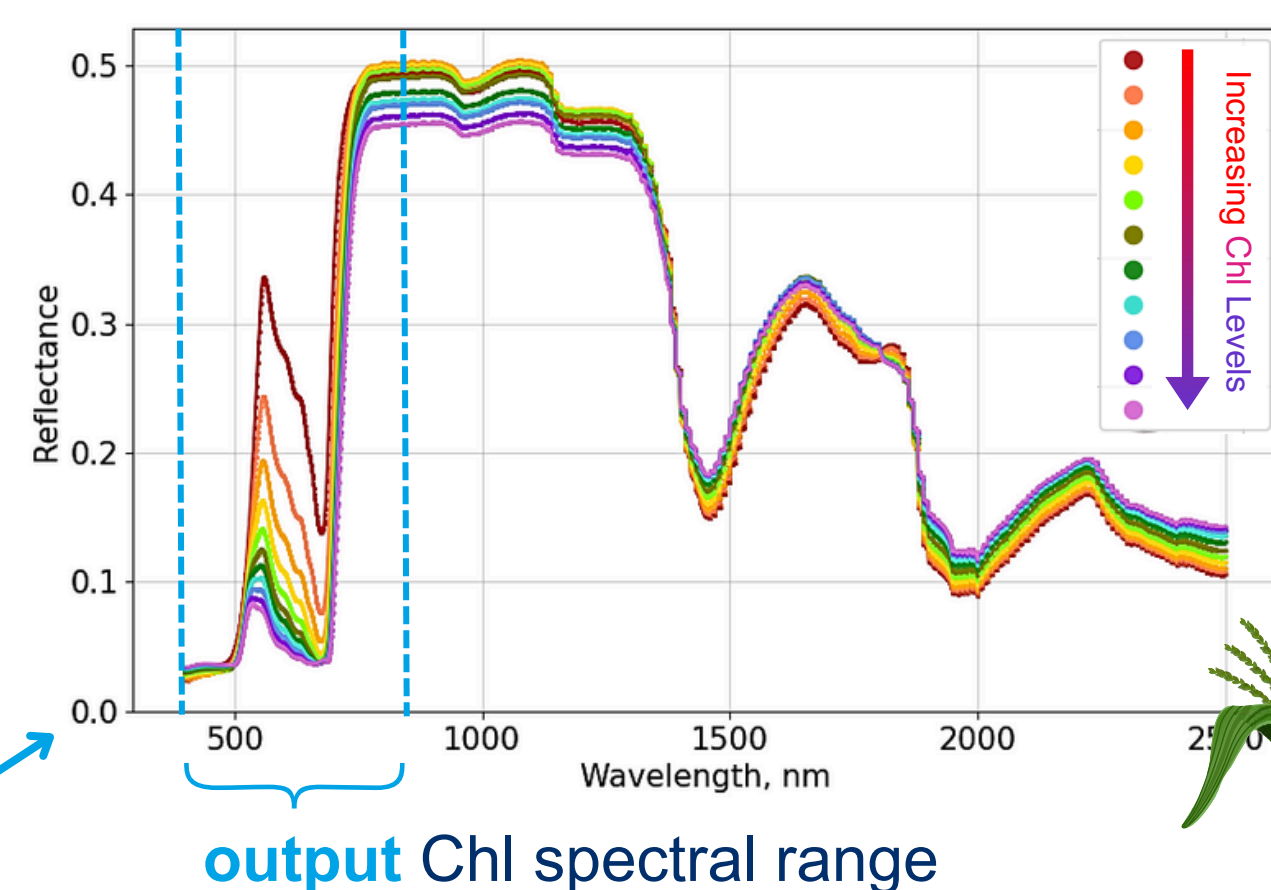
1. leaf reflectance simulation



2. corn field simulation



3. field reflectance simulation



4. compare

So what?

next steps

- **Optimising** simulations
- **Validating** outputs with real life measurements
- **Comparing** real life and simulations
- **Understanding** uncertainties

- ✓ Successfully developed a multi-stage model to simulate realistic crop fields to improve the quality of **Earth Observation** analytics.
- ✓ Better **chlorophyll** retrievals enable smarter fertiliser use and lower emissions.
- ✓ Precision farming supports the **UK's Net Zero & food security** goals.
- ✓ Next, we will refine the simulations and **validate** them with real-life data.

