# DINOSAR: Integration of Copernicus Optical and Radar Satellite Images for Sugarcane Monitoring in the Cauca Valley

Diagnostic tool that INtegrates Optical, infrared and SAR data

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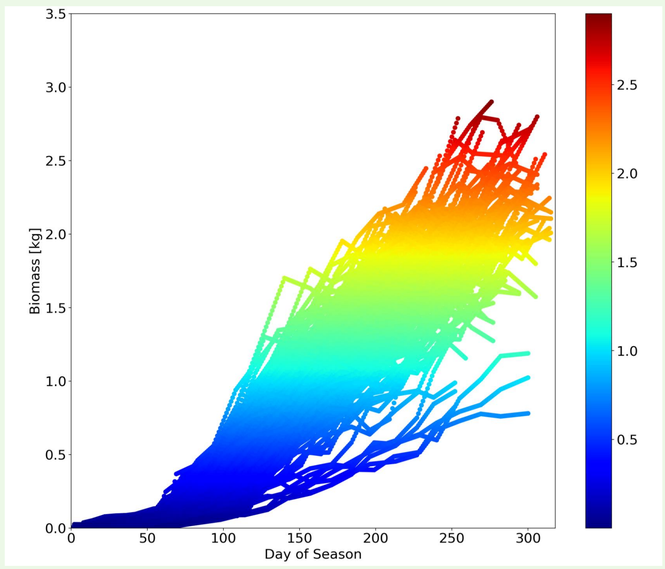
## Introduction

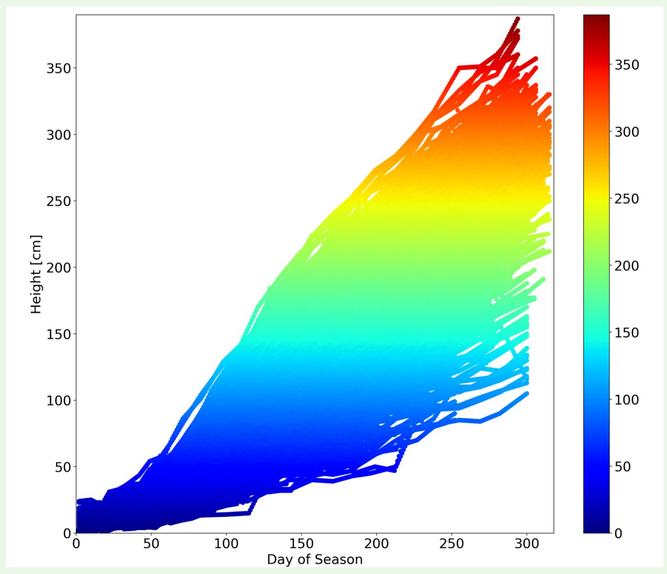
- **Earth Observation satellites** collecting both **optical and SAR imagery** deliver frequent, **essential data for monitoring crops throughout the growing season**
- Within the DINOSAR Project, we introduce an **innovative approach that integrates data from both sensor types**
- The method uses **Dynamical System's Theory** to optimally **fuse radar, optical**, and auxiliary data. It also enables the incorporation of **in-situ measurements** and crop growth models, resulting in more accurate and reliable crop monitoring
- The integration methodology is designed to **help farmers enhance productivity** while lowering costs related to fertilization, pesticide use, and water consumption, ultimately reducing environmental impact
- The integrated approach is being initially tested for **sugarcane monitoring in the Cauca Valley (Colombia), but it is planned to extend it to other crop types and geographic areas**

## Materials and Methods

### In-situ Campaign

- **A one-year long field work campaign** done in **34 fields (70 points)** spread over the area, **manually gathering multiple sugarcane variables** (such as **biomass** and cane **height** and diameter, among others)
- A **quality check** is applied on the measured data to ensure consistency and potential anomalies
- All these **measurements** allow to **model** the **expected crop evolution** and to **validate** the **integration method**
- The **model** adequately **considers** the **important variability observed** in the **temporal evolutions** of **measured points**

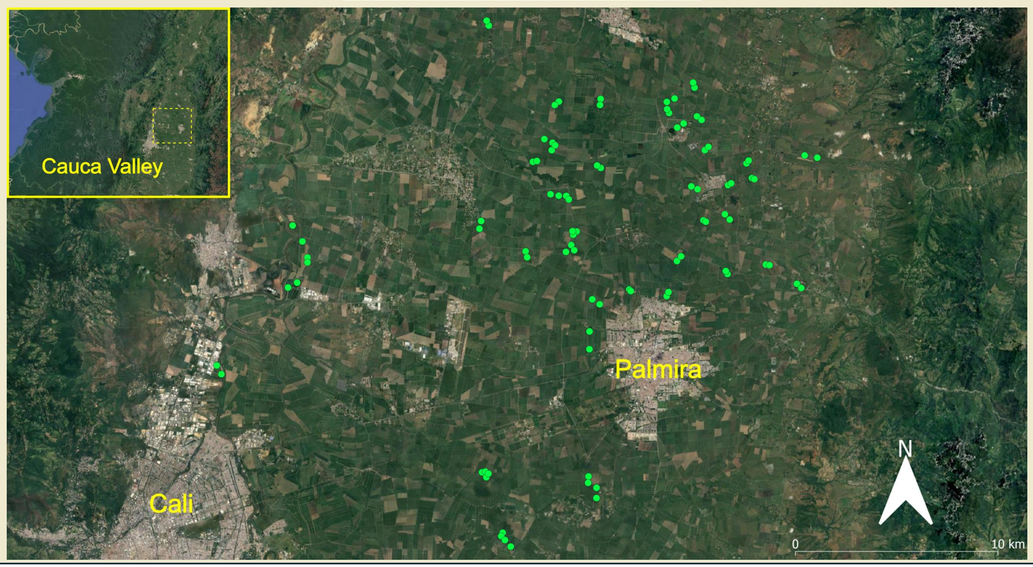



**Farm "La Paz"**

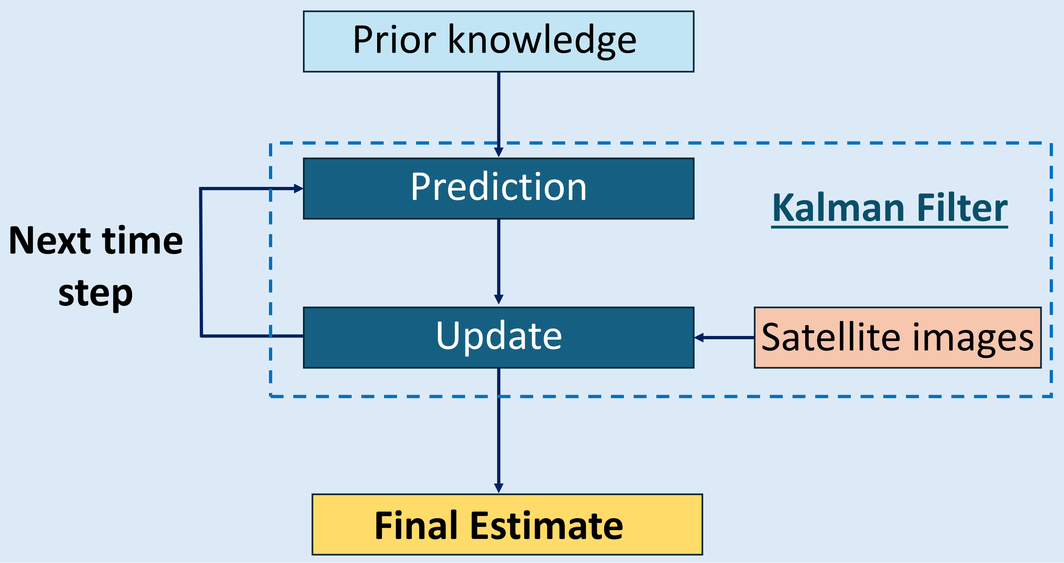



### Selected Study Area

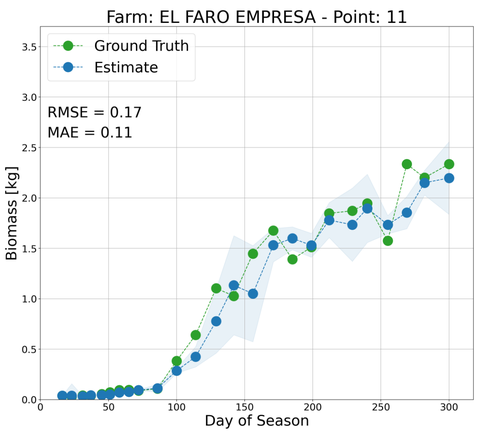


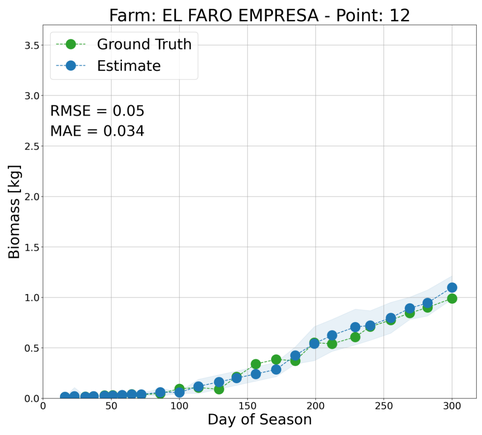

### Integration Algorithm

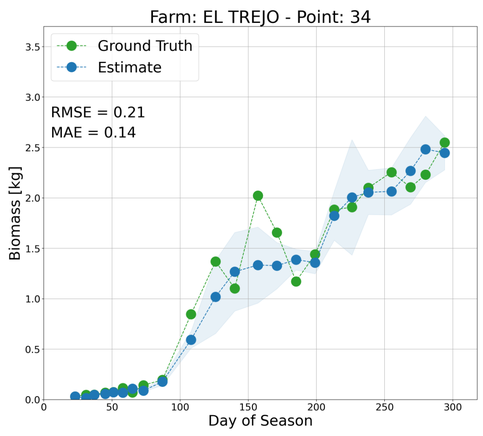
- **Combination** of the expected **crop evolution** (evolution model) and **satellite observations** , optical and SAR images, (observational model)
- These two models are integrated into a **single framework that delivers final estimates** based on the **Kalman Filter**

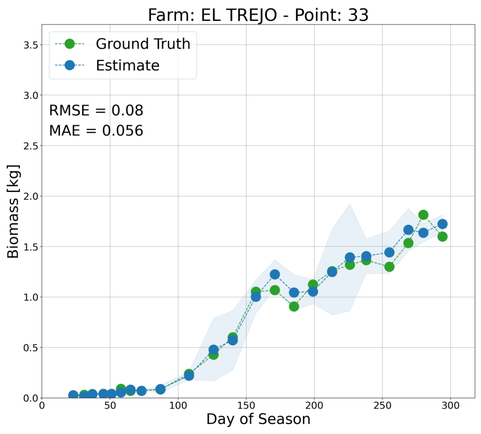


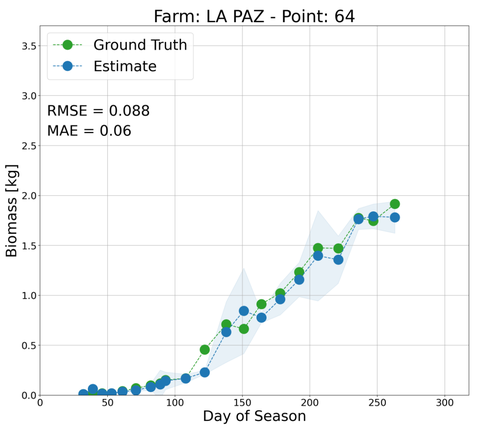

## Results




## Conclusions and Future Work

- **An integration framework has been implemented to monitor sugarcane crops using satellite images provided by Copernicus Sentinels**
- **It leverages different information sources, coming from both SAR and optical sensors to enhance monitoring capabilities**

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