SequOIA-CAM-Feasibility study

A brief overview - 2023

SequOIA-CAM
ESA Kickstart & Demo-Project

SequOIA-CAM – the Sequestration Optimization Interface for Afforestation and Carbon Accounting Monitoring, our end-to-end biological carbon accounting, monitoring and sequestration optimization solution for sustainable cities, regions, forest & land owners, and forest-related companies.

Kickstart Partners:

- Stadtwerke Garbsen und KWH 4.0

Timeline:

- 6 Months (till- January 2023)

Objectives:

- The goal of the kick-start activity is to understand the market fit, technical feasibility of the proposed services and the economic scalability.

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SequOIA-CAM – Functionality overview

- The key building blocks on the system architecture includes
  - SequOIA-CAM subscription based services
  - Sentinel-hub based data acquisition
  - Cloud based automated data processing modules and AI engines
  - Access to interactive web-platform and dashboard
 - Export desired outputs in several formats
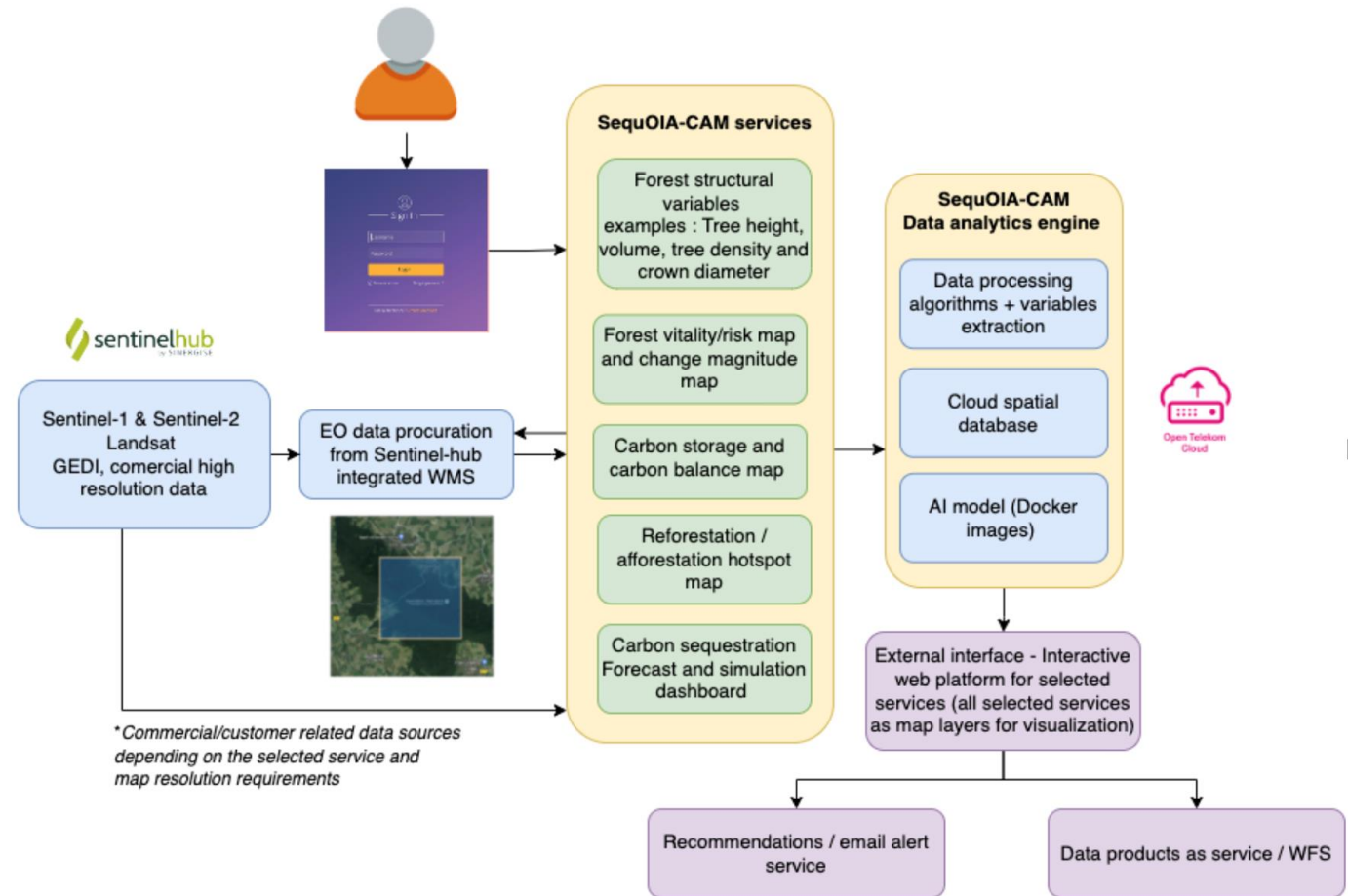
SequOIA-CAM system architecture (OmegaLambdaTec GmbH)

Technical feasibility

- Satellite data quality check
- Sentinel-1 and Sentinel-2 data processing modules
- Tree detection module
- Forecasting vegetation condition
- Forest change detection module
- Forest risk area mapping
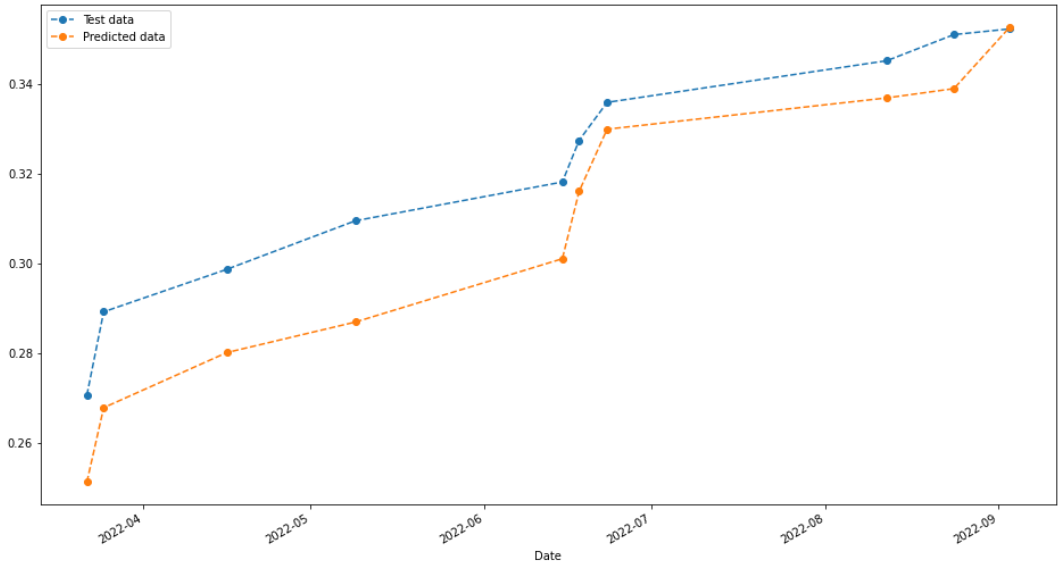- Carbon storage simulation for forests

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Tree detection

- Detecting tree cover from sentinel-2 RGB image composites
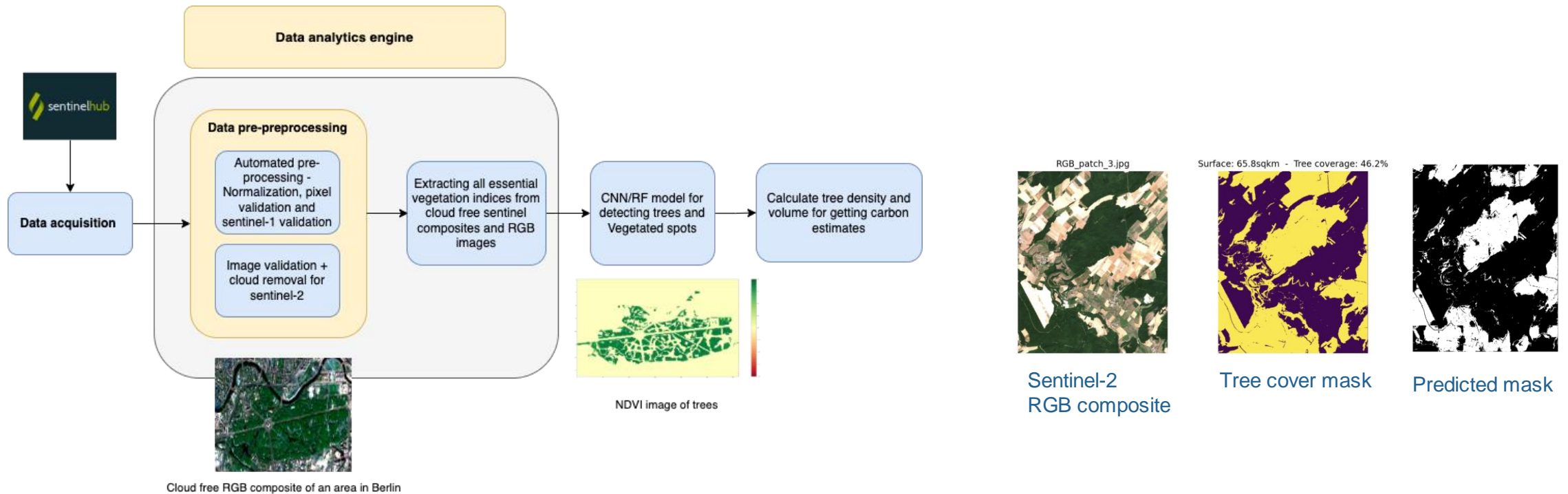
Tree detection pipeline (source : OmegaLambdaTec *GmbH)*
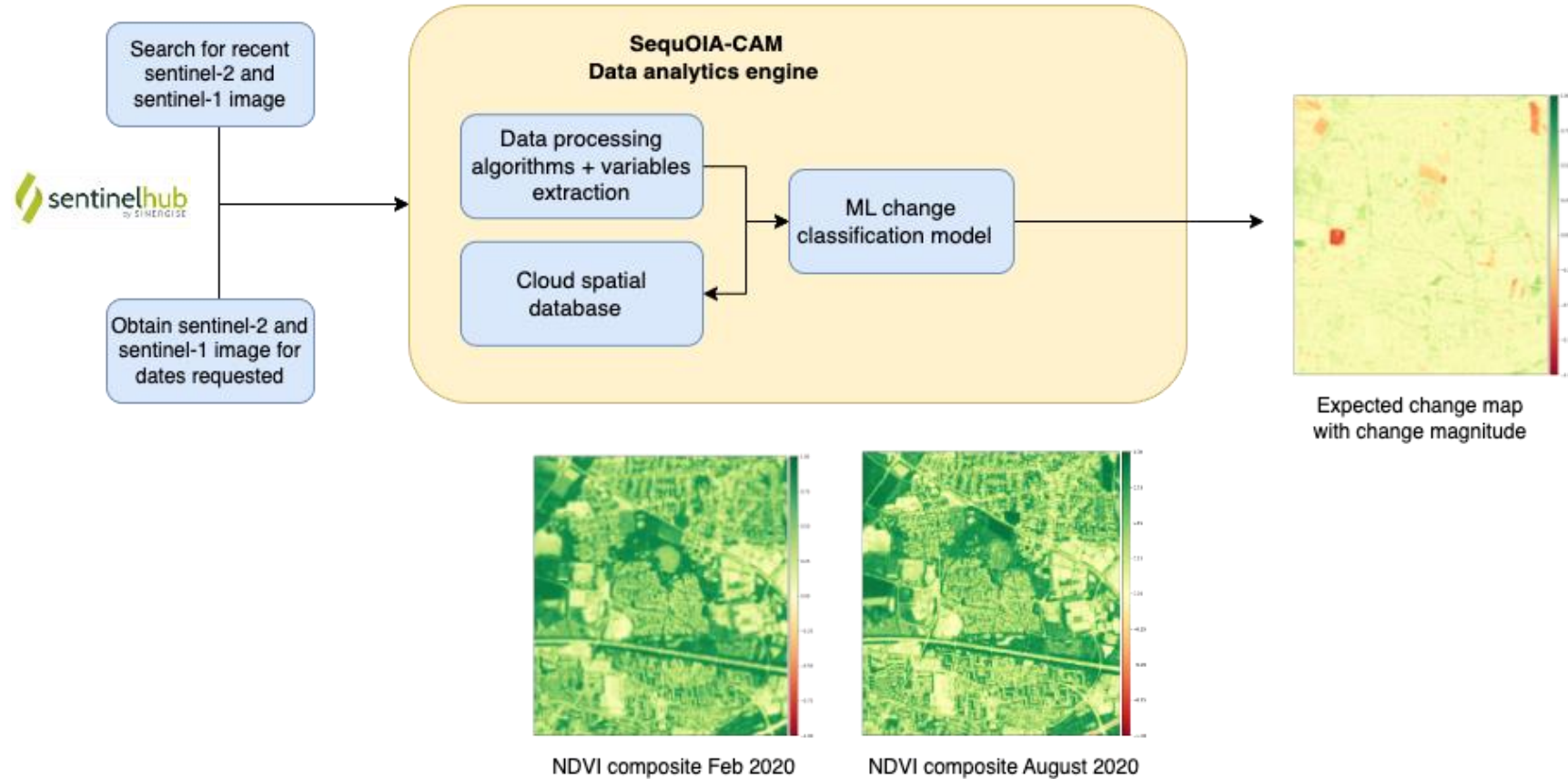
Forecasting vegetation conditions

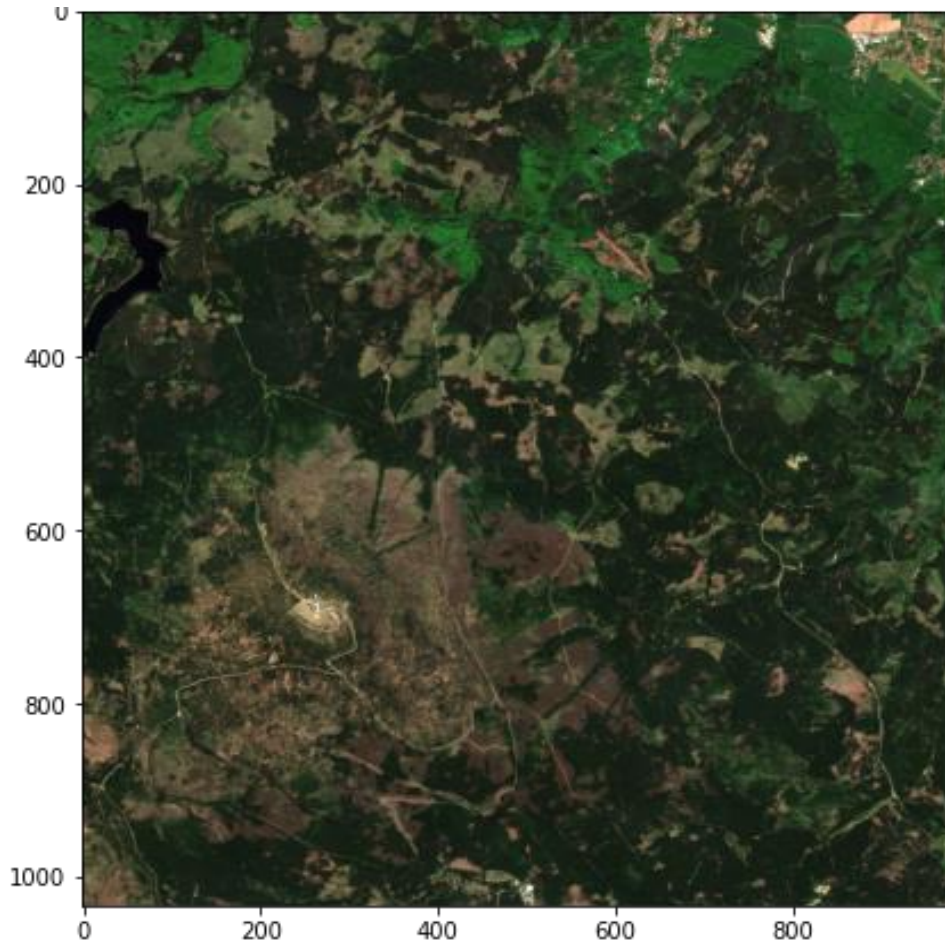NDVI time series forecasting (source :OmegaLambdaTec)

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Change detection

*Both the recently obtained image and images acquired on requested dates are classified using the ML algorithm and compared to identify changes

Search for recent sentinel-2 and sentinel-1 image

sentinelhub
by SINERGISE

Obtain sentinel-2 and sentinel-1 image for dates requested

SequOIA-CAM
Data analytics engine

Data processing algorithms + variables extraction

Cloud spatial database

ML change classification model

Expected change map with change magnitude

NDVI composite Feb 2020

NDVI composite August 2020

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Example - Sentinel-2 forest area change

Sentinel 2 RGB composite 2018

Sentinel 2 RGB composite 2020

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Temporal changes in vegetation

03.2020

05.2020

06.2020

07.2020

03.2021

05.2021

06.2021

07.2021

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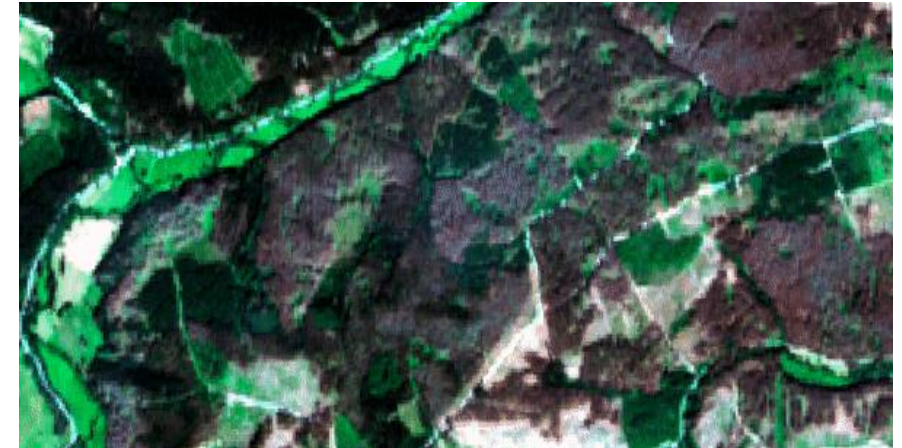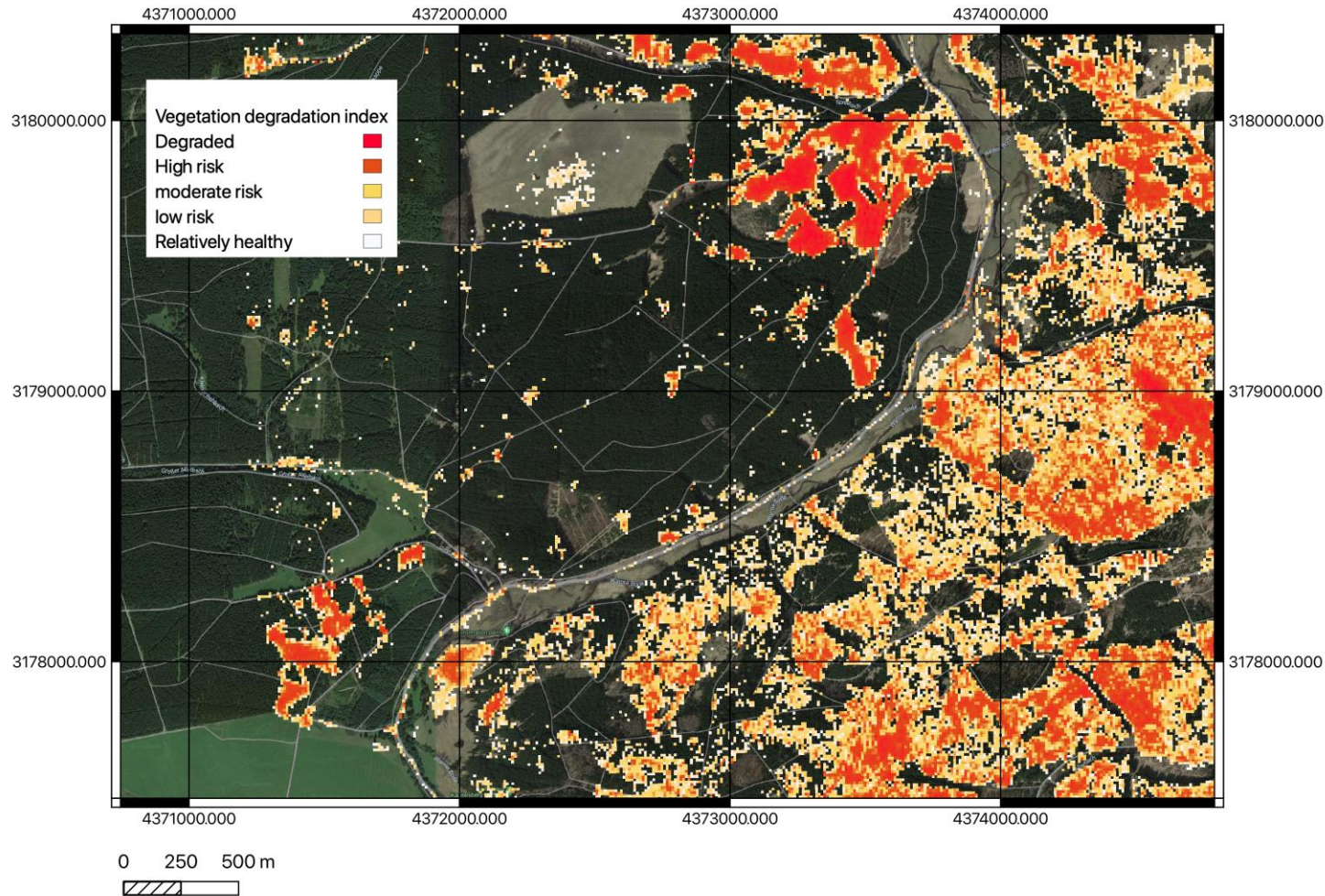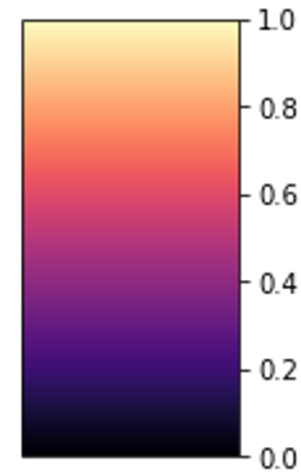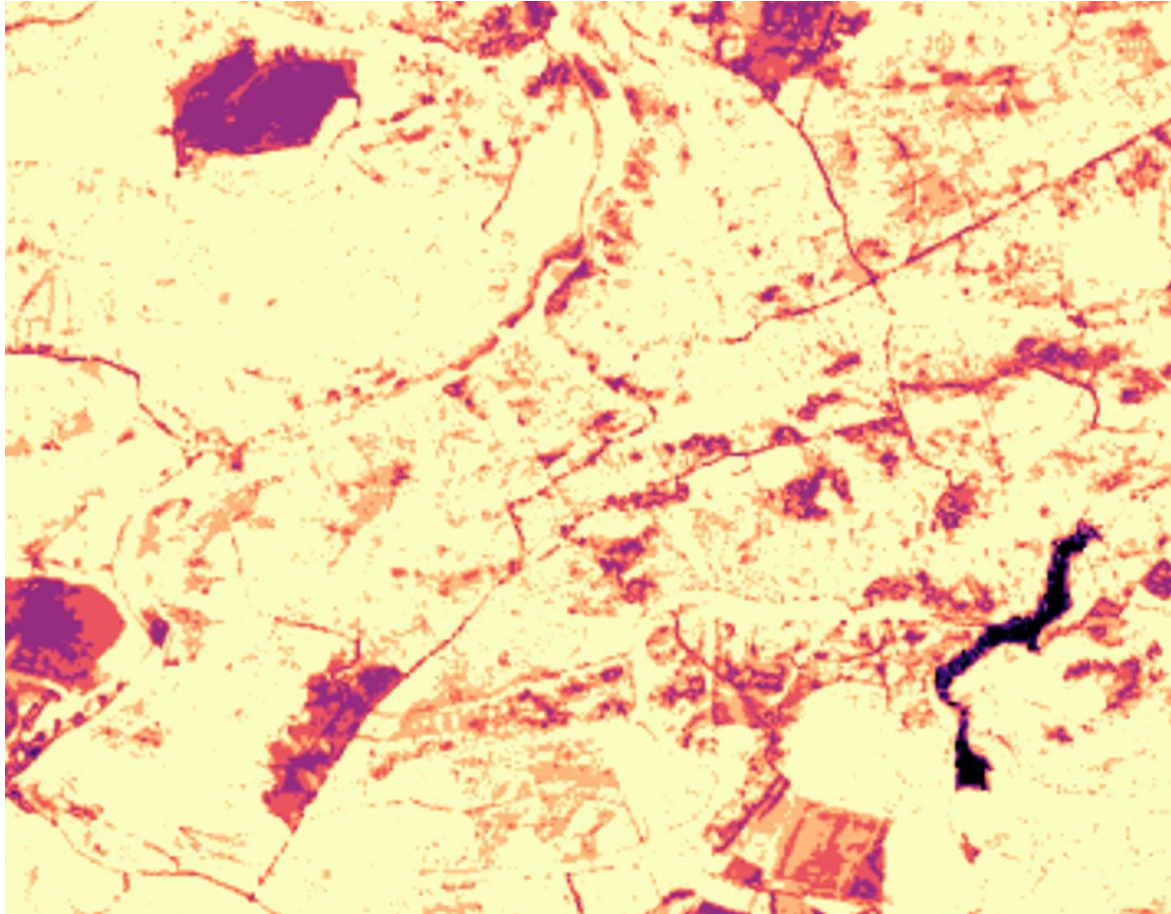
Forest risk mapping

The risks are classified based on both GLI (Green leaf index) and LAI (Leaf area index) into 5 classes depending on the relative variation between last two months of observation in the same AOI

Carbon storage potential

Storage potential measured in tons

*Normalized values – need to be calibrated with appropriate ground truth data
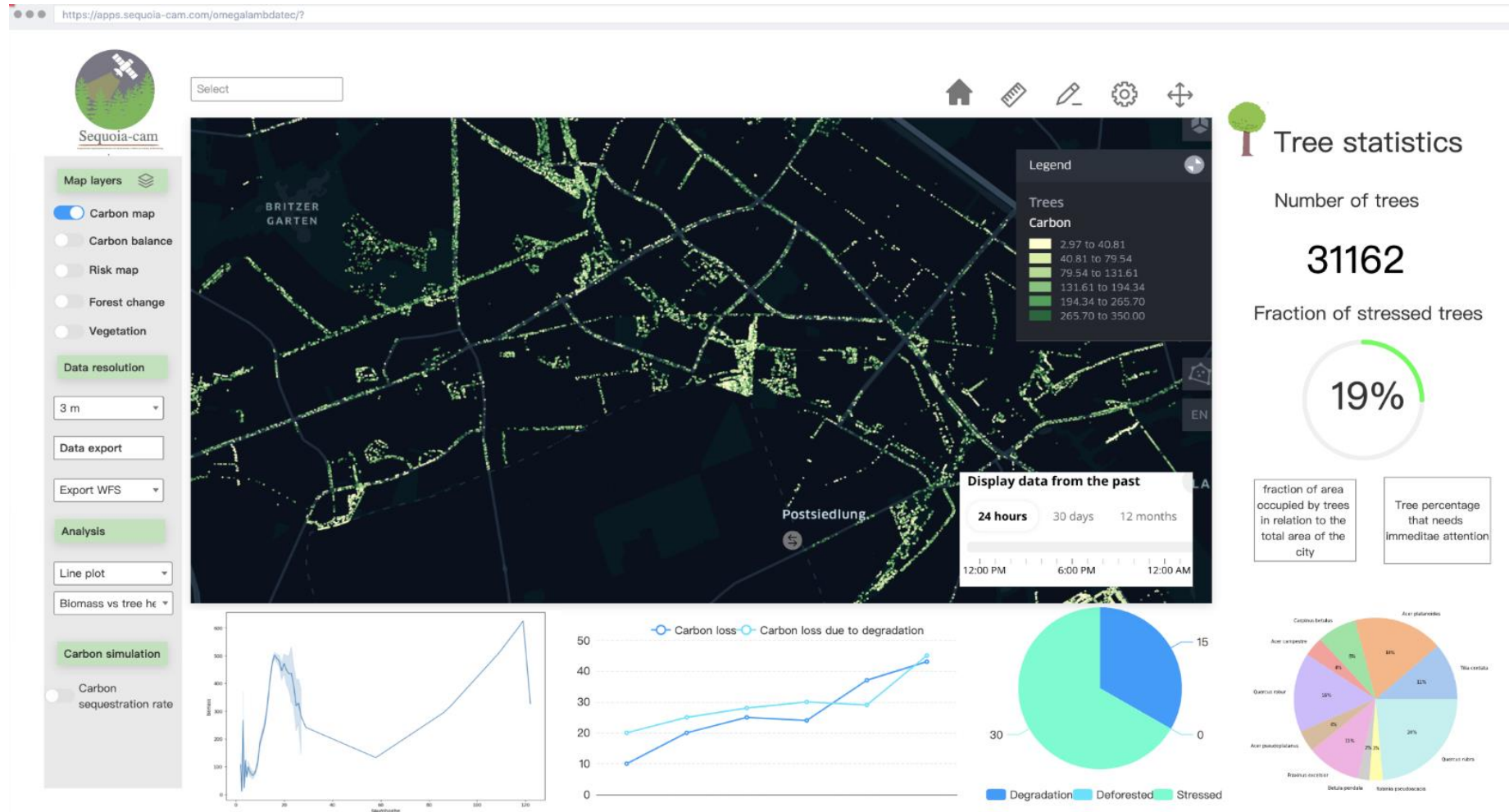
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SequOIA-CAM mock-up (I)

Fig – 1: SequOIA-CAM Mock-up (Version-1.1) showing tree detection and carbon stored per tree in the city of Berlin (source: OmegaLambdaTec GmbH)

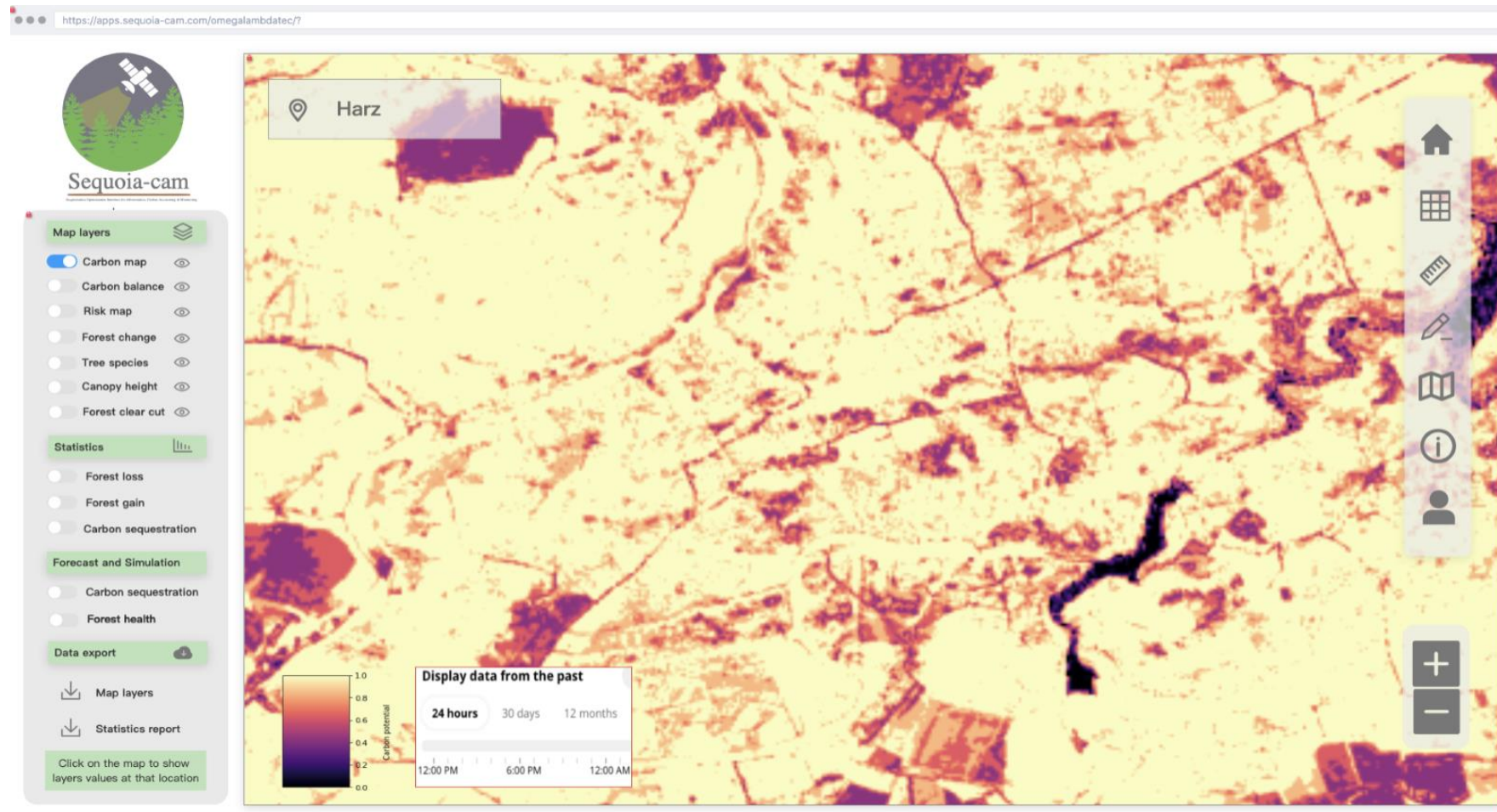OmegaLambdaTec

SequOIA-CAM mock-up (II)

Fig –2:-SequOIA-CAM Mock-up _(Version-1.2)_ showing carbon distribution across an AOI in Harz, Germany. The colour bar in the bottom left of the map depicts the carbon storage quantity, with dark colour indicating lower capacity and light colour indication higher storage capacity (source: OmegaLambdaTec GmbH)

Accomplished milestones

- Core **working modules** for SequOIA-CAM were developed and tested
- **Data sources** – finalized data sources is a crucial aspect of defining system concept and internal building blocks
- **User engagement** activities with potential users and pilot partners
- Established **business case** and project **timeline**
- **Service implementation roadmap** - Defining product road map and coordinating of the services in a potential demonstration project
- **Economic viability** - Identifying the economic viability of SequOIA-CAM and get interested customers and organization for a demonstration project

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SequOIA-CAM – Path forward

- Integration of Planet dove (3m resolution) data into SequOIA-CAM

- Follow-up application for the demonstration project

- Cooperation activities to identify suitable associate partners to obtain relevant field and ground truth data to train core AI modules

- Further development of technical modules and scenario simulation implementation

     Presenter

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