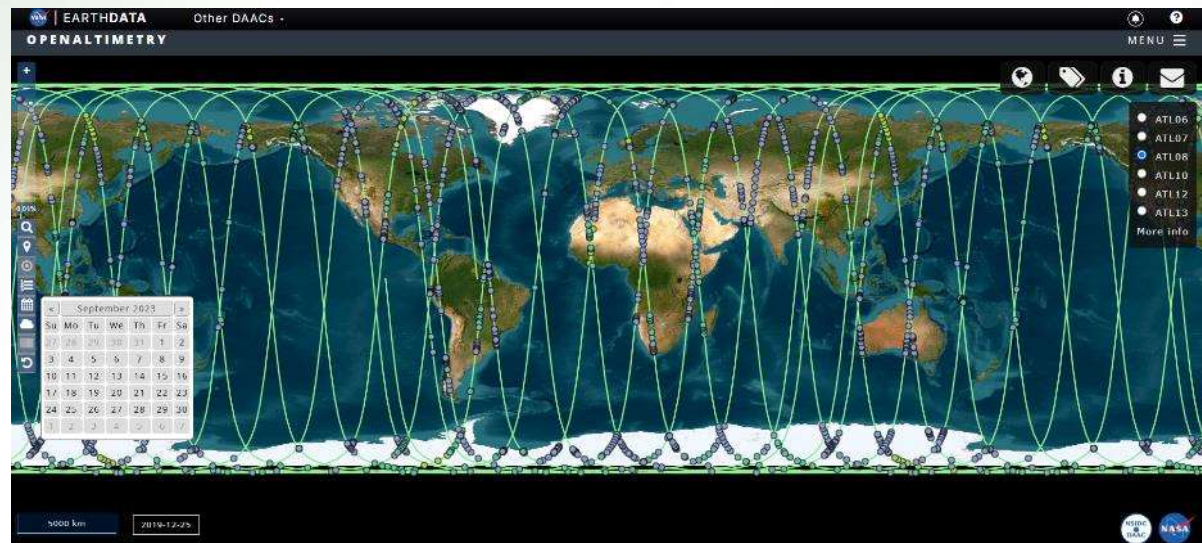


Carbon cycle from Earth surface to the Space



Mentors to students:
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- Students:
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 - Esma Šabanović
 - Josip Ferenčina
 - Luka Škrtić
 - Lana Blažan

The Best of GLOBE Europe & Eurasia 2025.

Introduction

- Karlovac Promenade – located on the west side of Karlovac Star



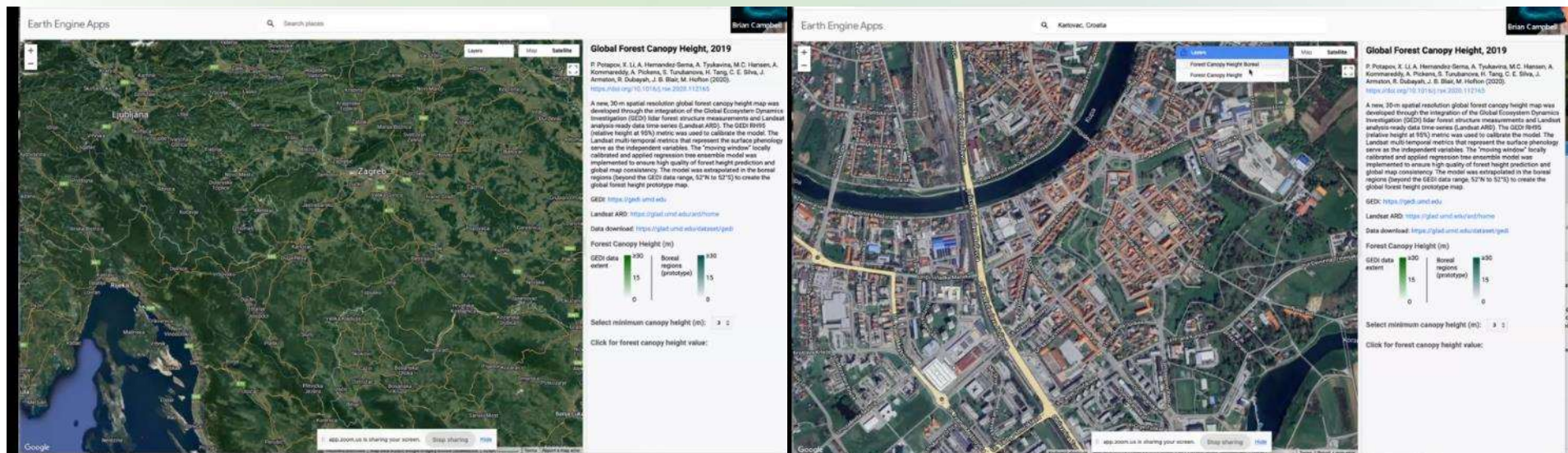
- treeline consisting of wild chestnut trees (*Aesculus hippocastanum* L.) and a few linden trees (*Tilia* sp.)
- place of city manifestations
- place of citizen gathering who enjoy the city greenery

Research questions

- How old are the trees in the Karlovac Promenade and when were they planted?
- How much carbon did the trees in the Karlovac Promenade store?
- How much CO₂ did the trees in Karlovac Promenade absorb?
- Can tree height be measured using satellite platforms and compared with on-site measurements?



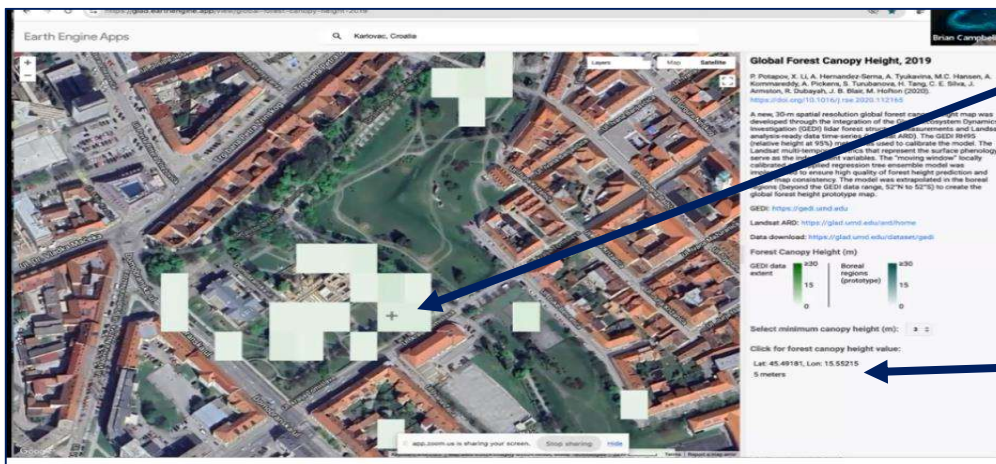
Data search on satellite platforms: Earth Engine apps (GEDI satellite - **Global Ecosystem Dynamics Investigation**, measures canopy height)



<https://glad.earthengine.app/view/global-forest-canopy-height-2019>

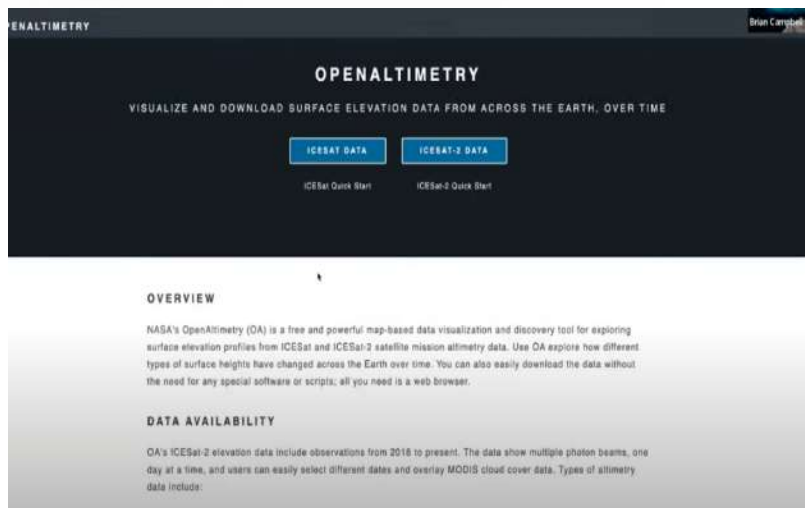


By zooming in on the map, pixels in varying shades of green appear, representing canopy height



By selecting and marking a pixel, only the average height of the entire pixel is obtained, not that of specific tree

Database search on the satellite platform: OPENALTIMETRY (ICE Sat 2)



OPENALTIMETRY

VISUALIZE AND DOWNLOAD SURFACE ELEVATION DATA FROM ACROSS THE EARTH, OVER TIME

ICESAT DATA ICESAT-2 DATA

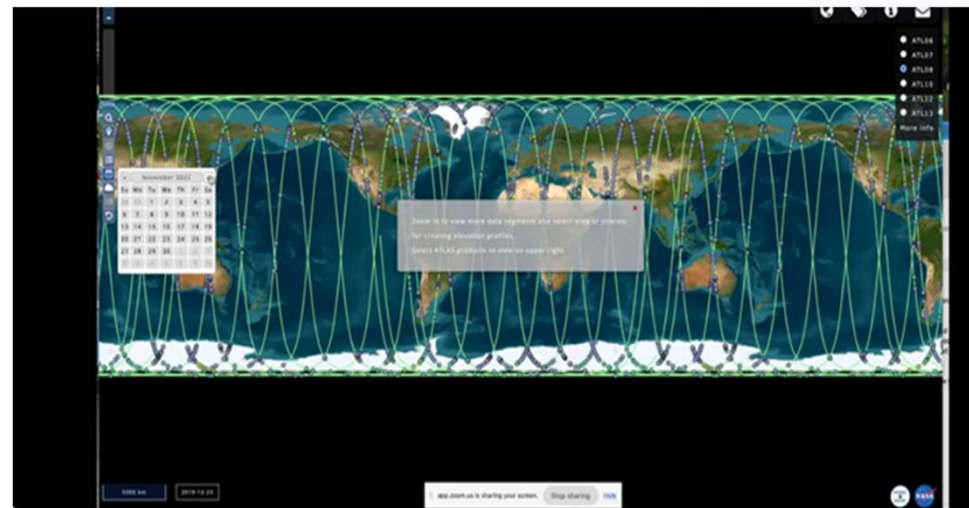
ICESat Quick Start ICESat-2 Quick Start

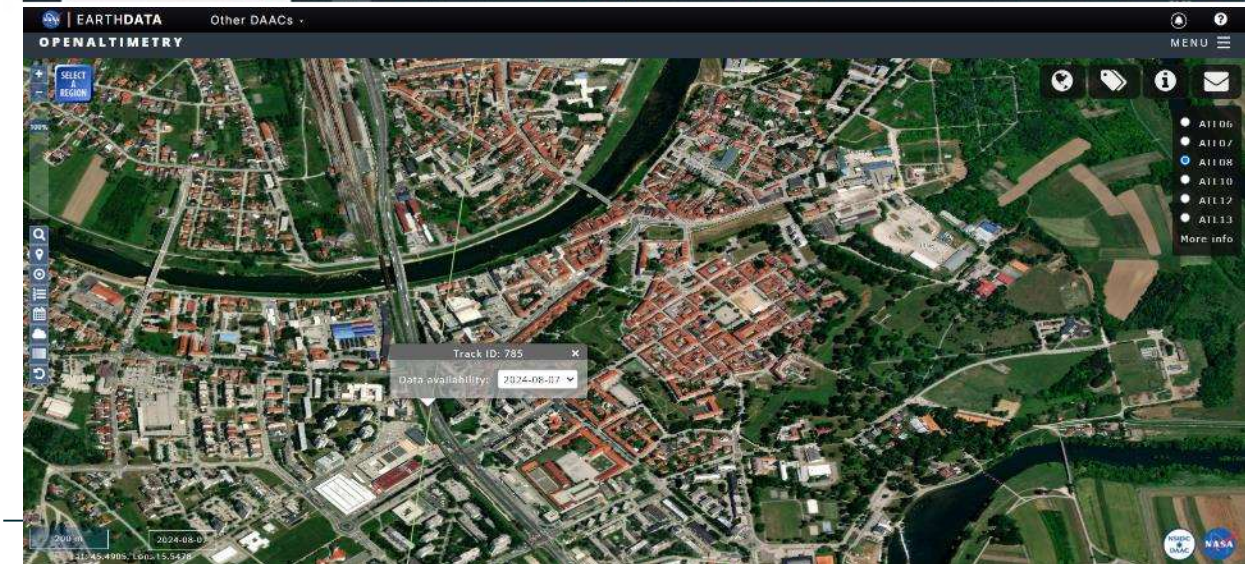
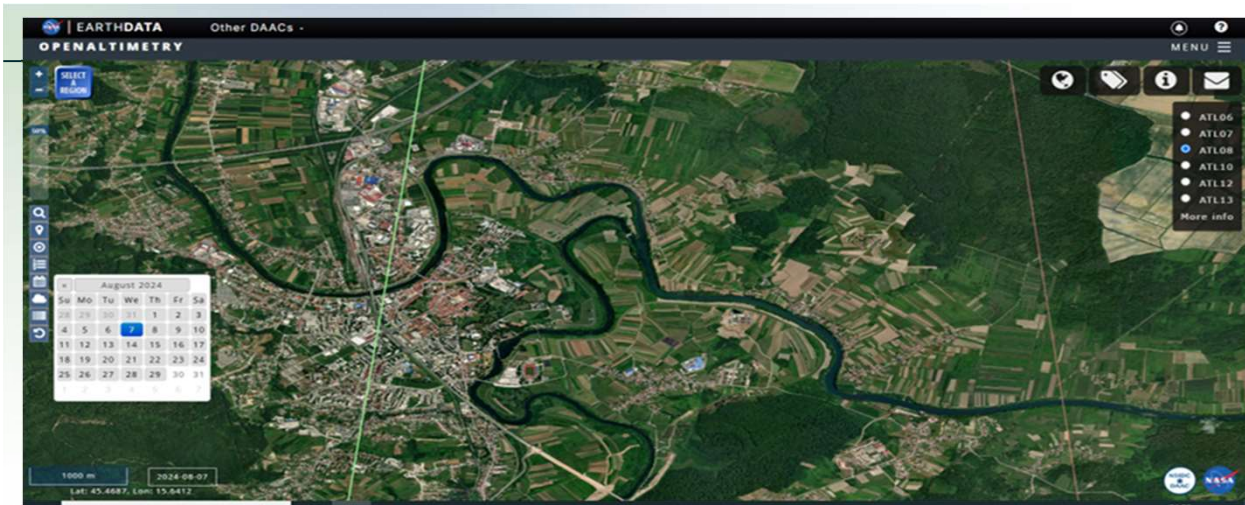
OVERVIEW

NASA's OpenAltimetry (OA) is a free and powerful map-based data visualization and discovery tool for exploring surface elevation profiles from ICESat and ICESat-2 satellite mission altimetry data. Use OA explore how different types of surface heights have changed across the Earth over time. You can also easily download the data without the need for any special software or scripts; all you need is a web browser.

DATA AVAILABILITY

OA's ICESat-2 elevation data include observations from 2016 to present. The data show multiple photon beams, one day at a time, and users can easily select different dates and overlay MODIS cloud cover data. Types of altimetry data include:





The satellite paths did not capture the canopy over the area of the Karlovac Promenade

Did satellites capture and measure the height of the Karlovac Promenade?



Talking with Brian Campbell (NASA scientist) on webinar how satellites record the Earth surface

ICE Sat 2 : **NO**, as the recording lines were not on the location.
GEDI: **PARTIALLY**, measuring the average canopy height per pixel.

Research methods

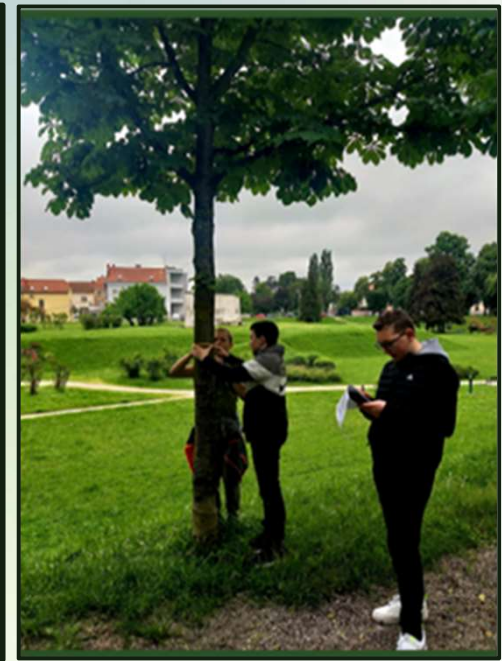
Biometry measurements were conducted on all 120 trees on the Promenade

GLOBE protocols:

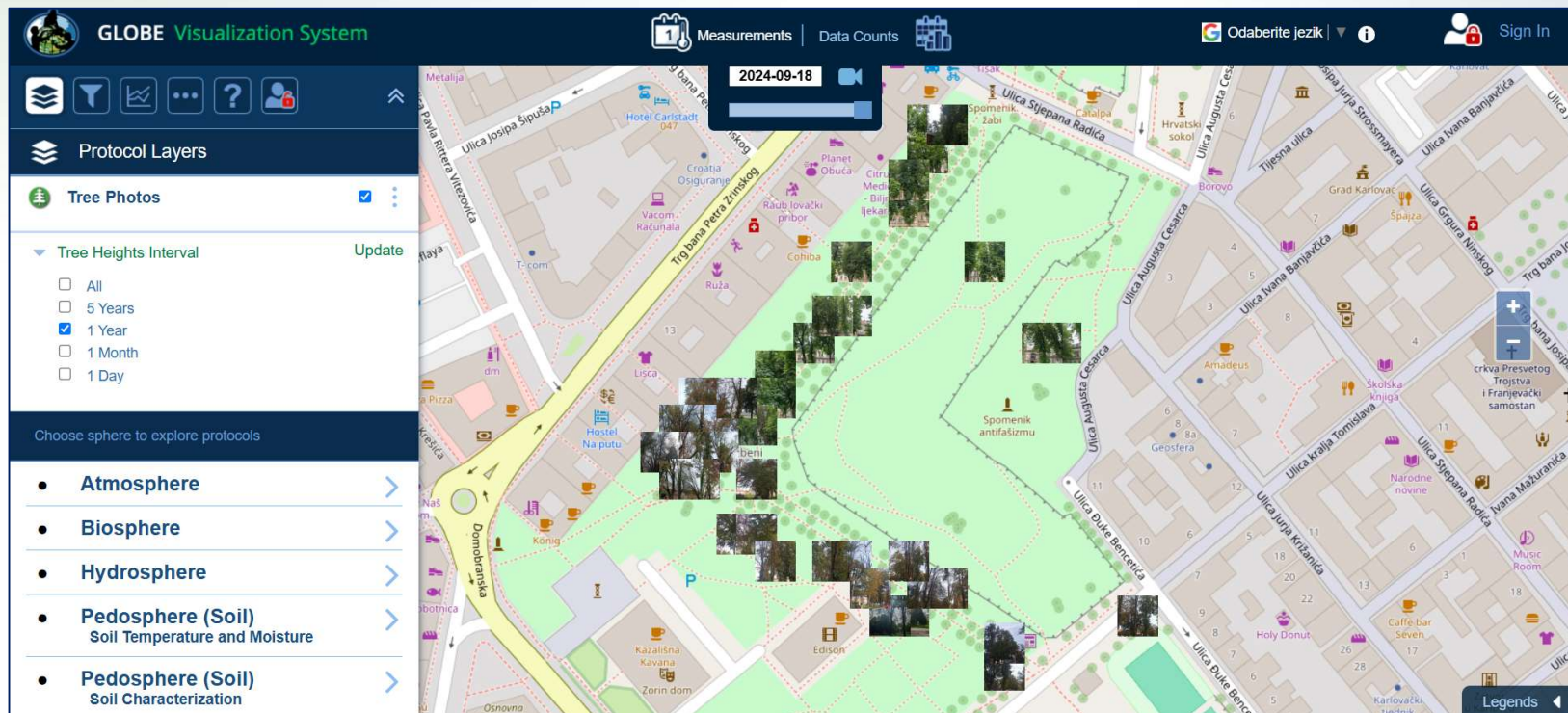
- tree circumference
- tree age

GLOBE *Observer*

- tree height and location

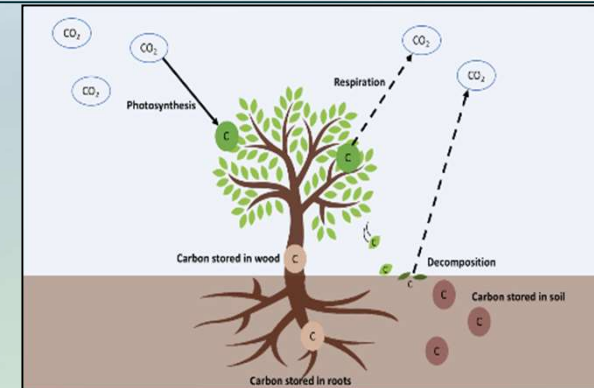


The measured values can be accessed in the GLOBE database



The following values were calculated in the classroom


- **diameter/cm** = $\frac{\text{circumference of tree}}{\pi}$
- **green weight - GW/ kg**
 $GW = 0.0346 \cdot d^2 \cdot h$ (if the $d > 28 \text{ cm}$)
 $GW = 0.0577 \cdot d^2 \cdot h$ (if the $d < 28 \text{ cm}$)
- **dry weight - DW/kg** = $\frac{GW}{2}$
- **carbon storage - CC/kg** = $\frac{DW}{2}$
- **absorbed CO₂ /kg**
Carbon storage $\cdot 3.67$ jer je $\frac{Mr(CO_2)}{Ar(C)} = 3.67$



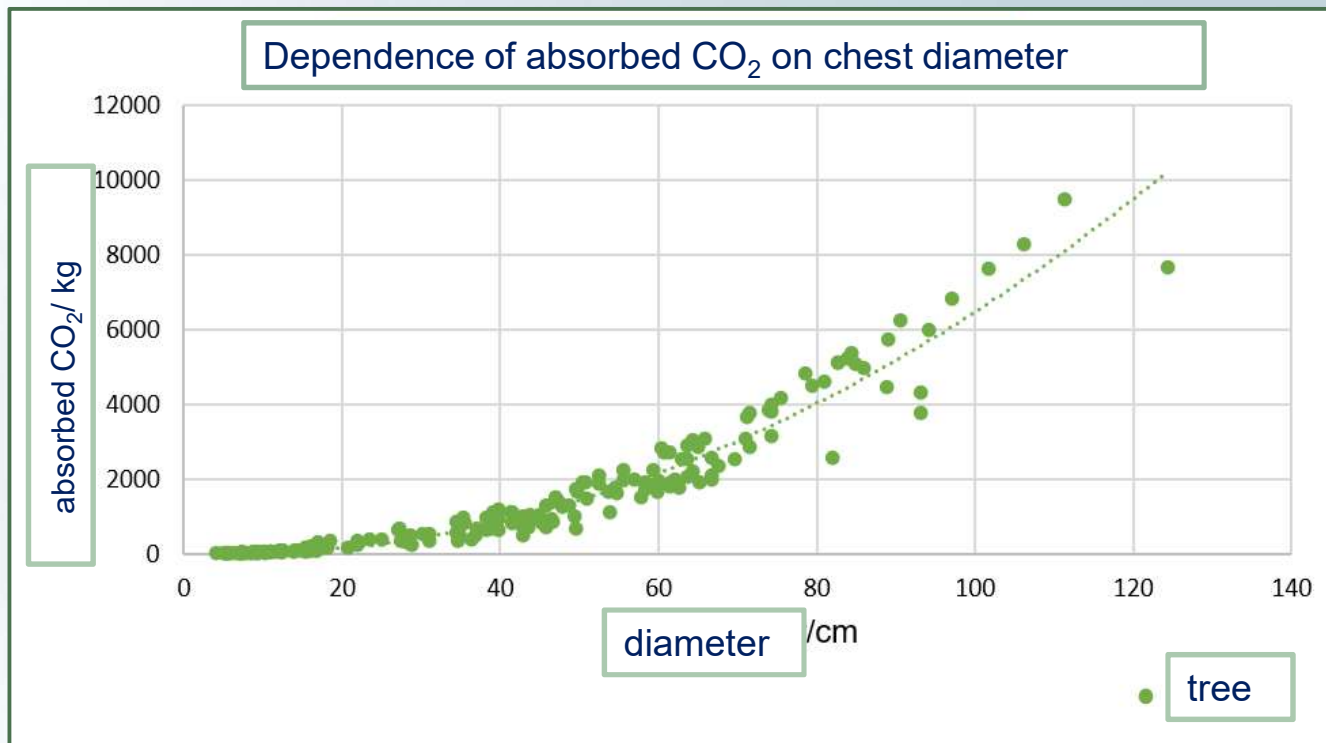
Results

- The stored carbon and absorbed CO₂ in the Promenade are presented in intervals based on tree diameter

interval of tree diameter /cm	interval of tree age /years	number of trees	stored carbon /kg	absorbed CO ₂ /kg
1 - 50	1 - 62.5	120	12 896	47 328
51 - 100	63 - 125	66	54 571	200 575
101 - 150	> 125	4	8 966	32 906
		190	76 433	280 809



190 trees on the Karlovac Promenade)



Discussion and conclusion

- Trees in the Promenade absorbed more than 280 t of CO₂ and contain over 76 t of stored carbon
- 2% of the trees are over 125 years
- Field measurements are crucial because satellites cannot capture all surfaces on Earth

age	Promenade (190 trees)
to 62.5 years	64%
63 - 125 years	34%
more than 125 years	2%



- Karlovac promenade is a place for urban gatherings and events
- maintaining and caring for avenues is of great importance for the city



Thank you for your attention !

