O zrównoważonym użytkowaniu i inteligentnym zarządzaniu lasami: Pierwsze analizy wyników pozyskanych z sensorów w ramach Polsko-Tureckiego projektu Silva Nympha

Kazimierz Bęcek, Krzysztof Stereńczak, Andrzej Talarczyk, Adam Konieczny, Longina Sobolewska, Miosz Mielczarek, Wiktor Pietryga

Wrocław University of Science and Technology

TAXUS IT

IBL FOREST RESEARCH INSTITUTE

NCBR National Centre for Research and Development

TÜBİTAK

Cel i zadania projektu Silva Nympha

- Wykorzystanie technologii geoprzestrzennych dla monitorowania i predykcji wpływu czynników biotycznych i abiotycznych na lasy.
-

  Zadania:

  - Stworzenie „obserwatorium leśnego” opartego na technologii IoT i innych technikach geoprzestrzennych;
  - Harmonizacja danych teledetekcyjnych ze strumieniem danych *in situ*
  - Analizy wyników pomiarów
  - Opracowanie strategii łagodzenia skutków zakłóceń a- i biotycznych opartych na sztucznej inteligencji z przeznaczeniem dla leśników.

  - **Zakres**: Pola badawcze w Turcji i Polsce

SILVA NYMPHA

NOVEL & HOLISTIC SOLUTION TO ESTIMATE FOREST FIRES/BURNED AREAS AND BURN SEVERITY DEGREES/EARLY DETECTION AND SUSTAINABLE MONITORING OF FOREST DROUGHT AND EFFECTS OF MELOLONTHA MELOLONTHA, PITYOKTEINES CURVIDENS & IPS ACUMINATUS

GLOBAL LEVEL

SATELLITE DATA
AI-BASED
PROCESSING

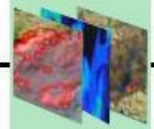
REGIONAL LEVEL

MULTISPECTRAL UAV
COMPUTER VISION
AI-BASED
PROCESSING

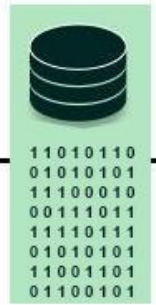
LOCAL LEVEL

IOT SYSTEMS/ SENSORS
MULTISPECTRAL CAMERA
MOBILE LIDAR
AI-BASED PROCESSING

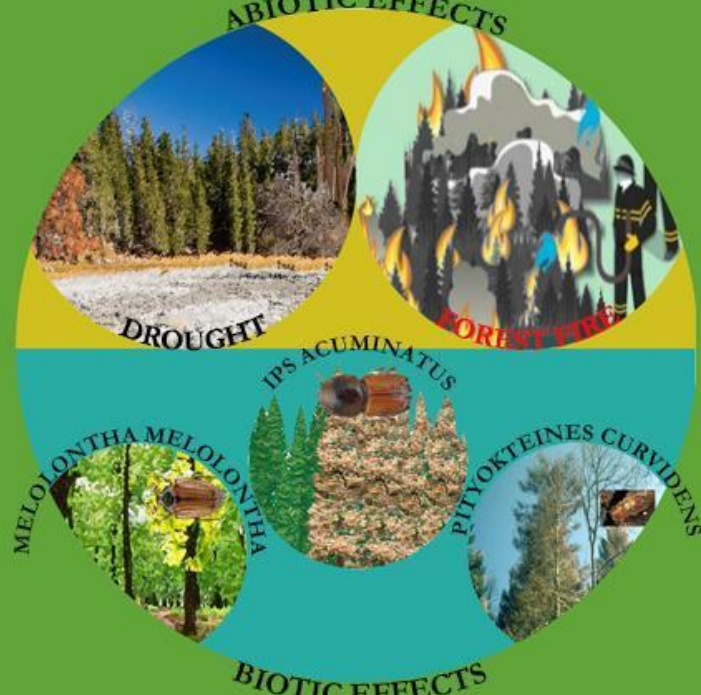
EXISTING DATA
Historical information



Red,
Green,
Blue,
Red-edge
NIR,
Thermal



11010110
01010101
11100010
00111011
11110111
01010101
11001101
01100101



ENSEMLE AI-BASED EARLY DETECTION
AND MONITORING OF BIOTIC & ABIOTIC EFFECTS

NOVEL SENSOR FUSION/INTEGRATION
AND COMMUNICATION SOLUTION

EFFICIENT INTEROPERABLE PLATFORM

SILVA NYMPHA AI-BASED MULTI-SCALE DATA ANALYSIS

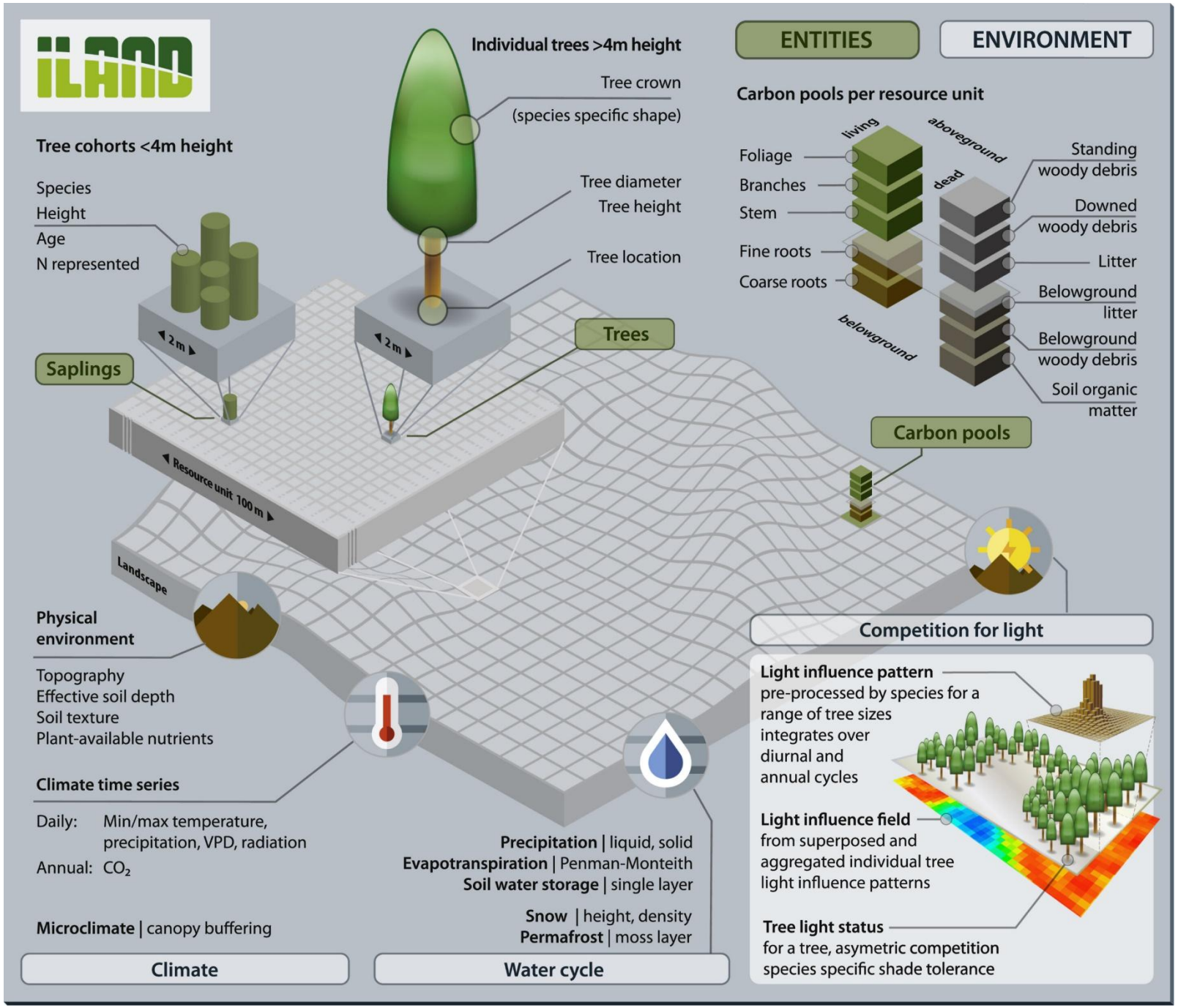
SENSOR FUSION/INTEGRATION
COMMUNICATION AND
DATA TRANSMISSION

SUSTAINABLE MONITORING
AND EARLY DETECTION OF
BIOTIC ABIOTIC EFFECTS

SECURE AND
INTEROPERABLE
DATA SERVER

AI-BASED ANALYSIS

DECISION MAKING PLATFORM

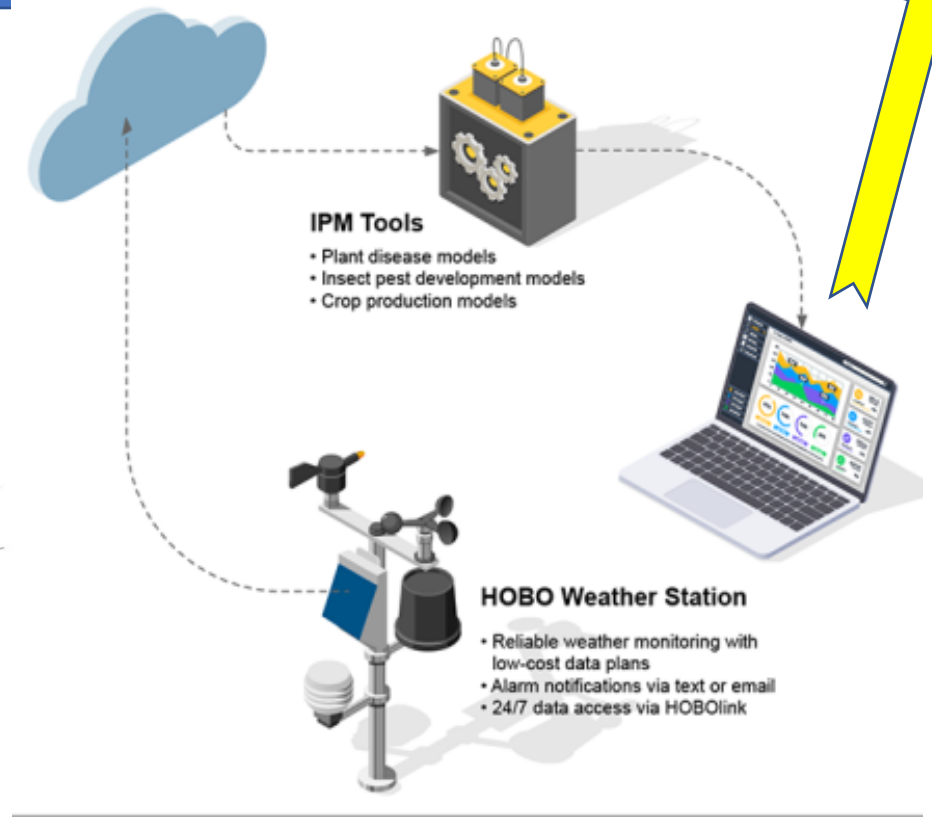


Cyfrowy model bliźniaka umożliwia precyzyjną symulację lasu, przedstawiając las jak będzie wyglądał za 100 lat

Jak to działa?

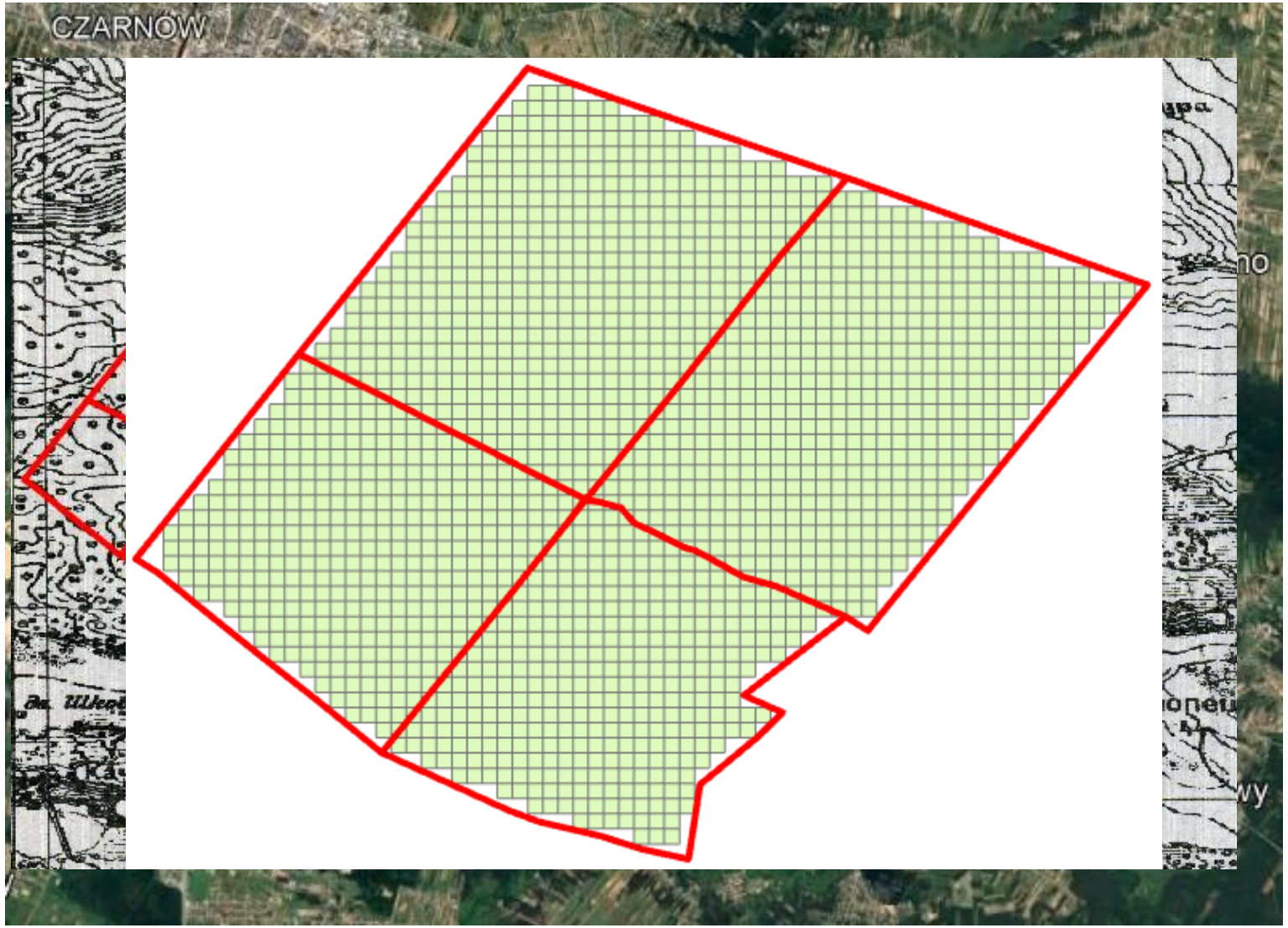
Dane teledetekcyjne:
UAV, lotnicze i satelity

Relacyjna baza danych
PostgreSQL

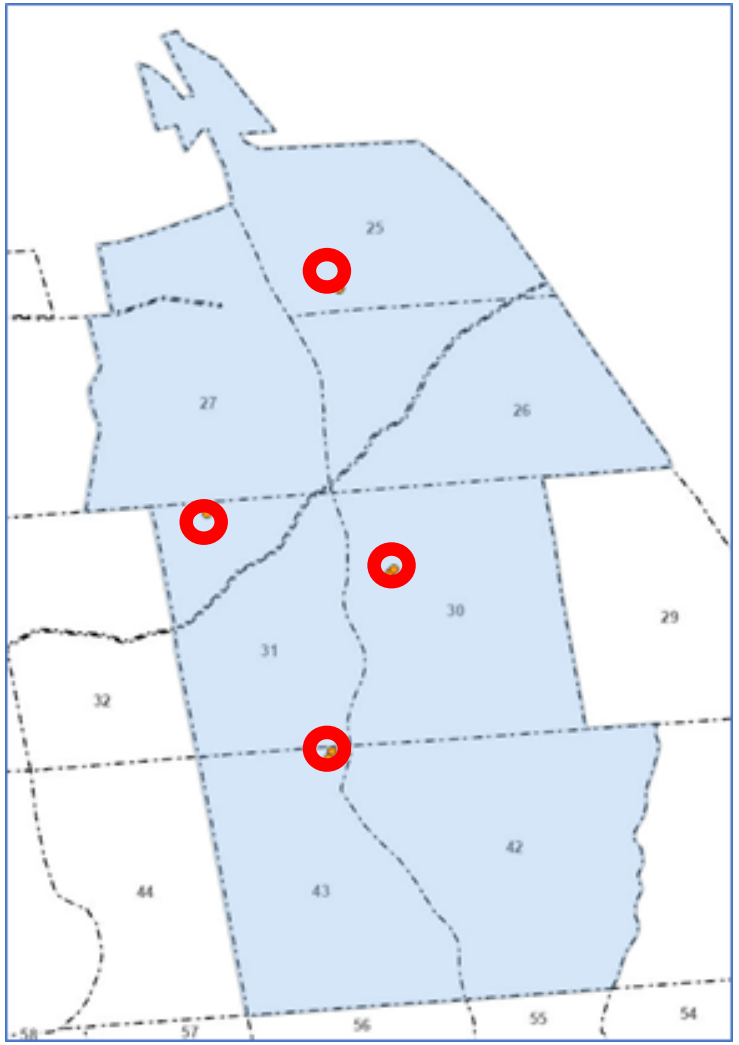


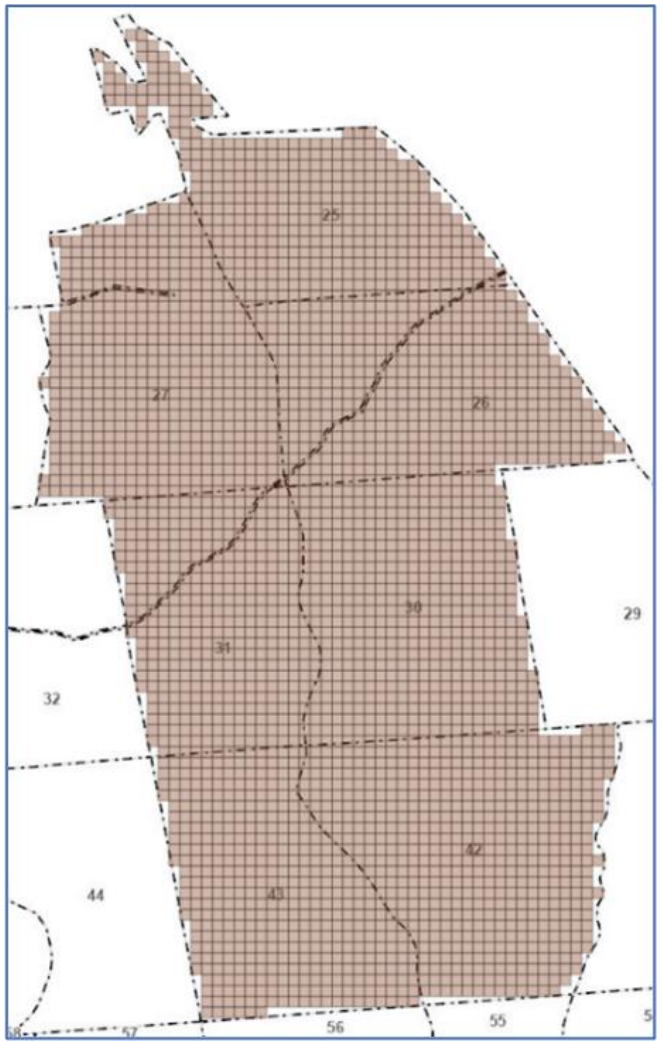
SILVA NYMPHA

Pole badawcze Daleszyce



Pole badawcze Gościęcice

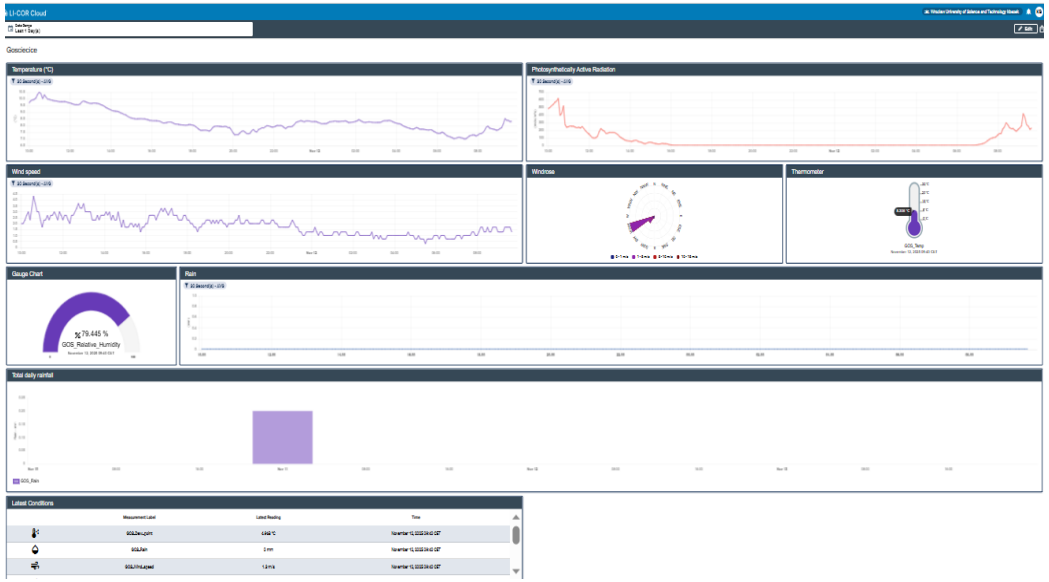


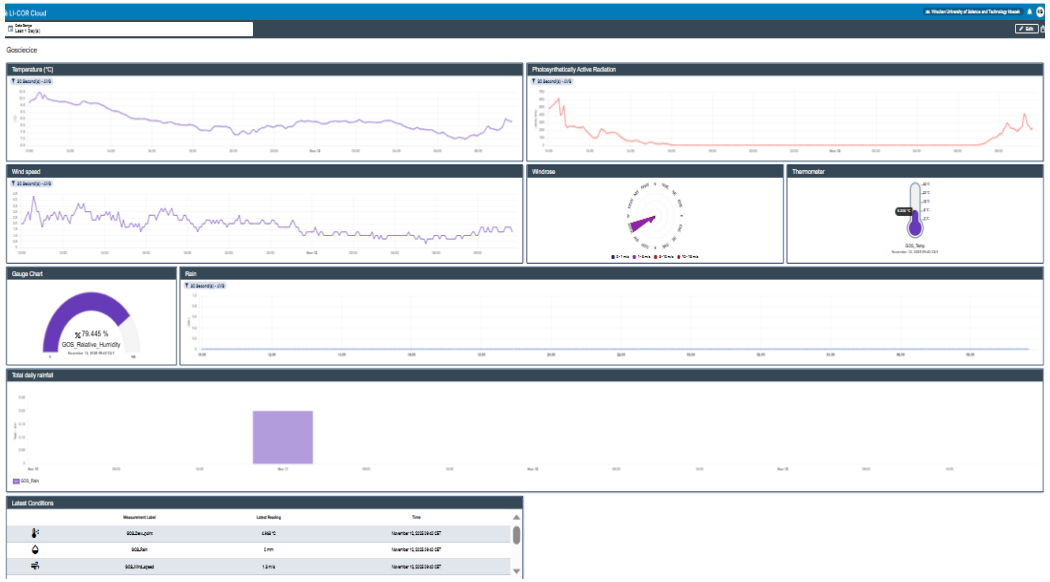


Dendrometr

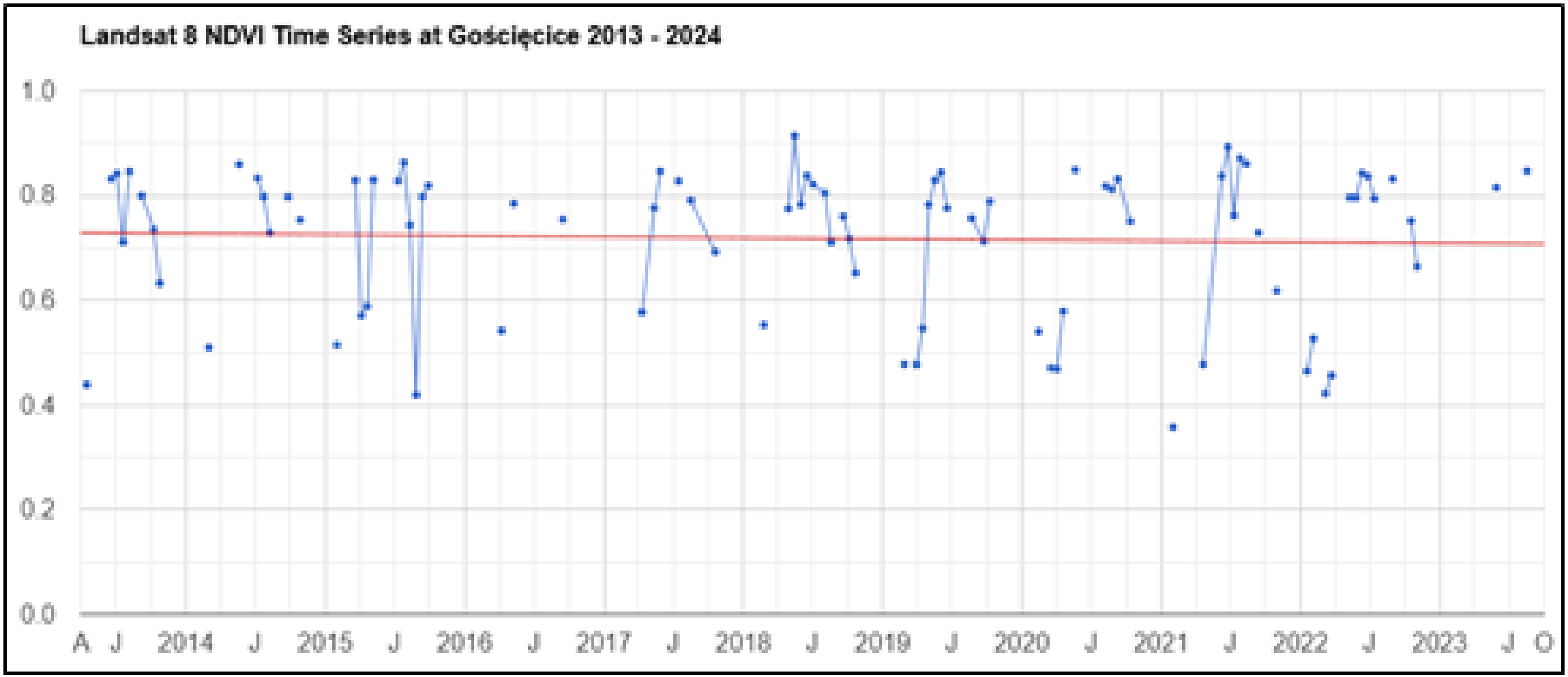
Pluwiometr

Deska rozdzielcza danych w chmurze Gościęcice i Daleszyce

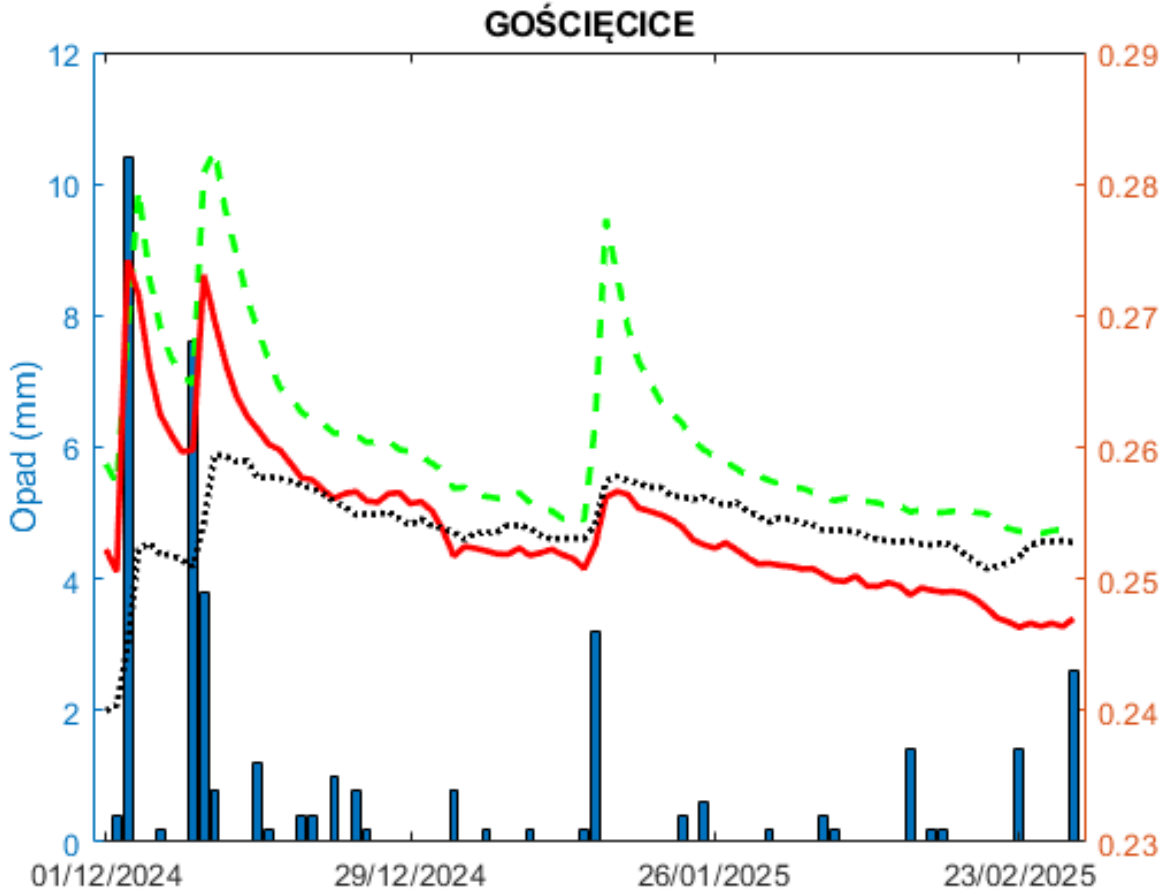


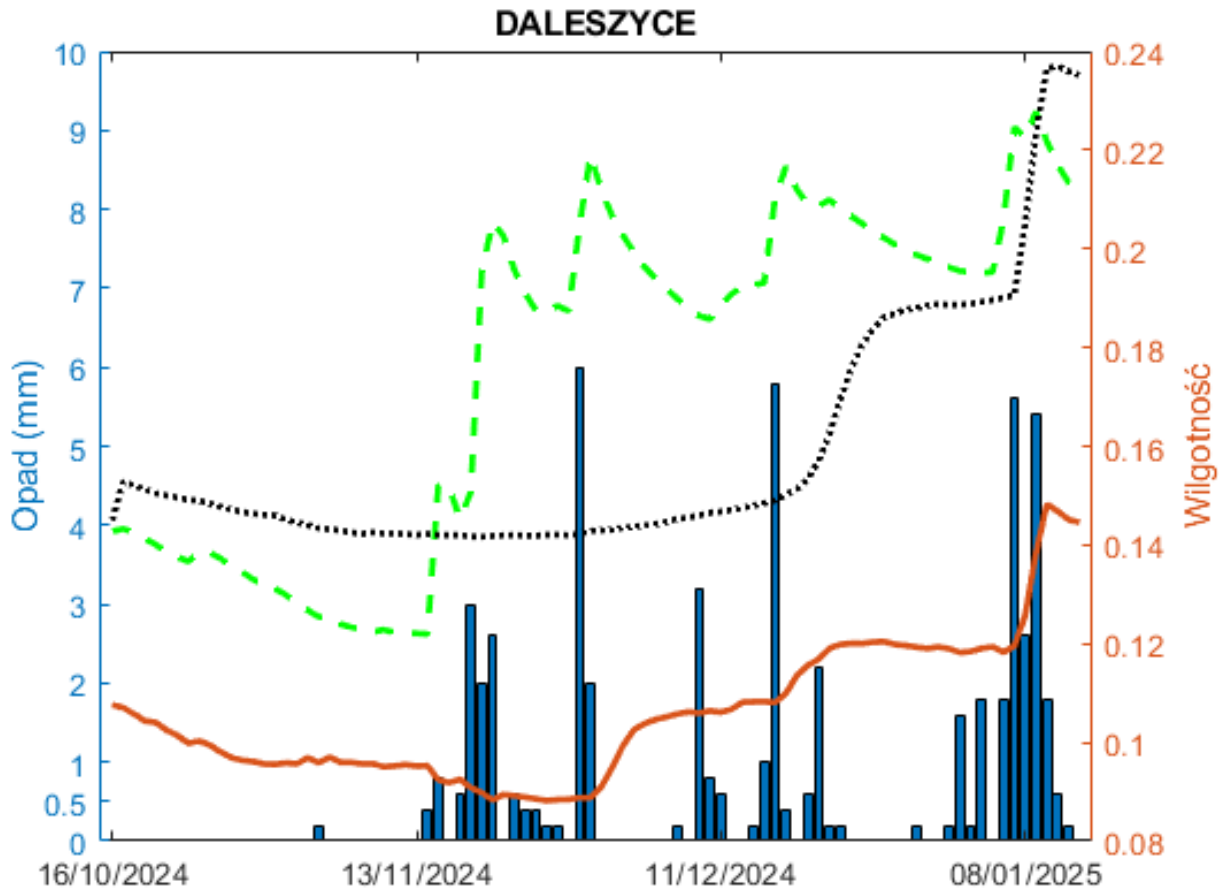


Szereg czasowy NDVI (2013 – 2024) dla Gościęcic

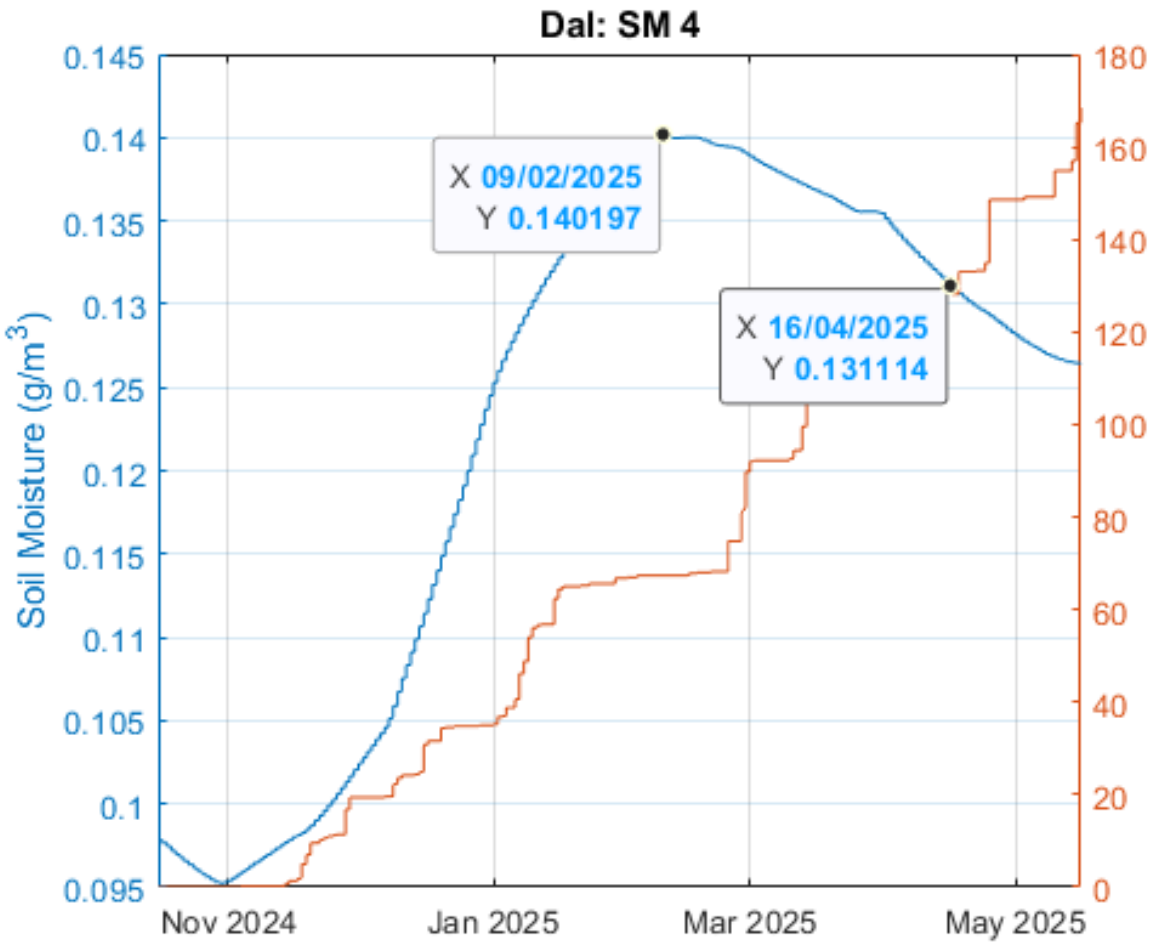


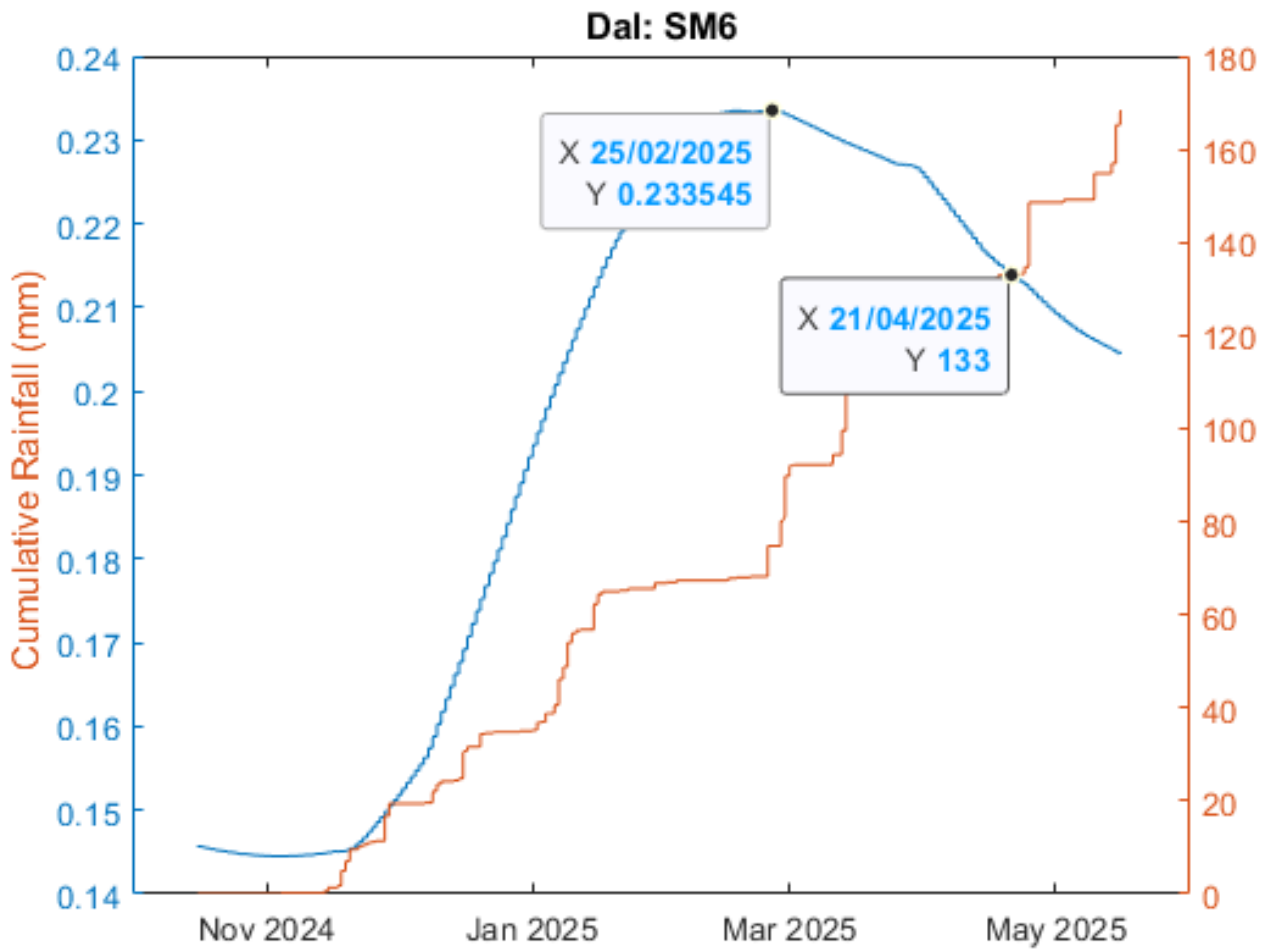
Opady a wilgotność gleby



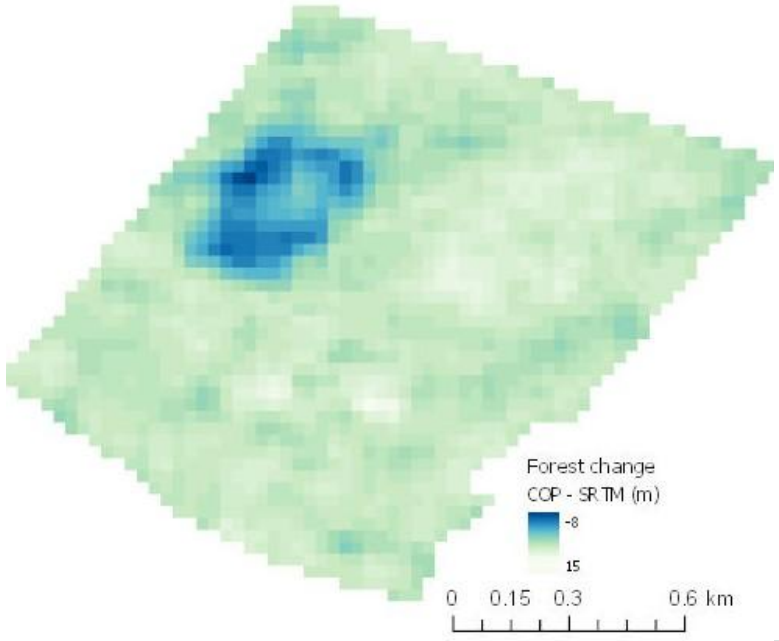


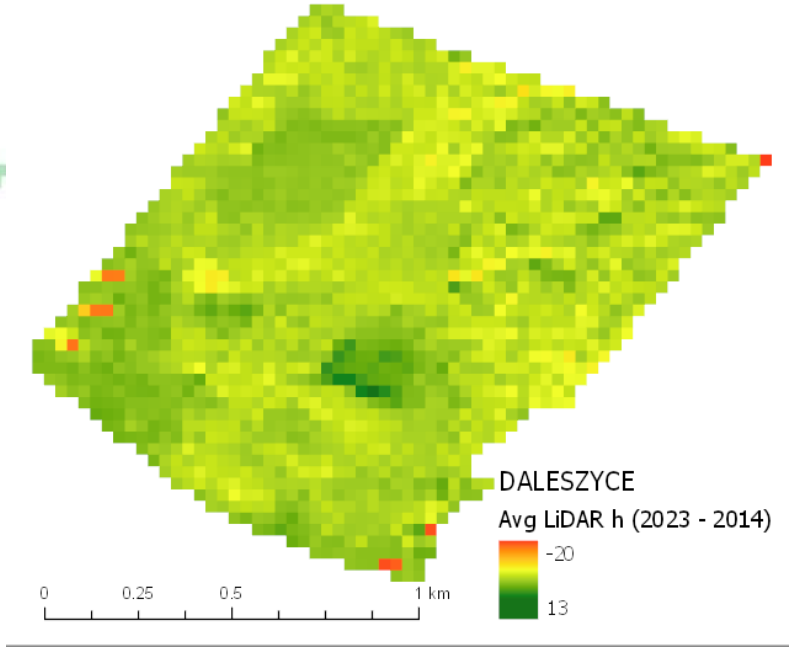
Kumulacja opadów a wilgotność gleby

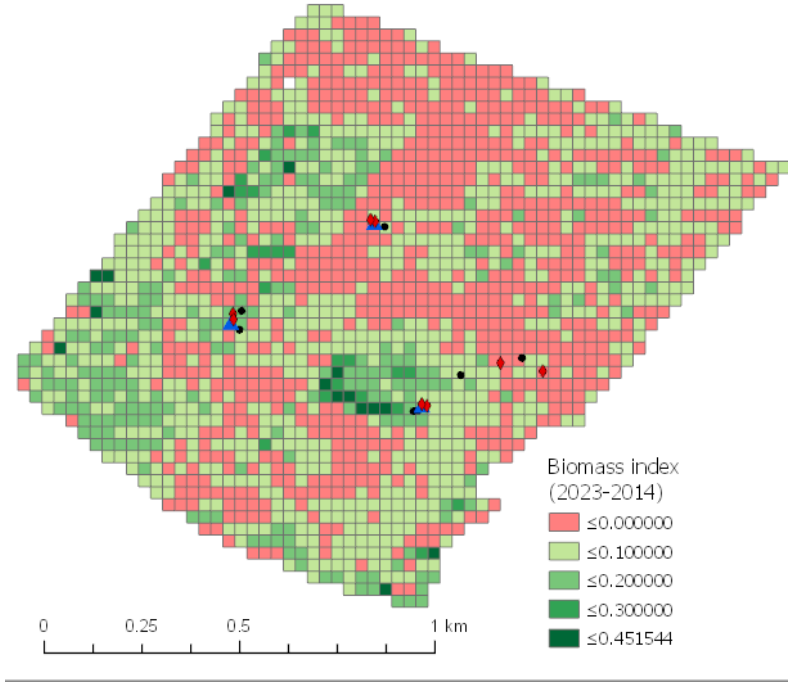




DSM dla oceny zmian lasu





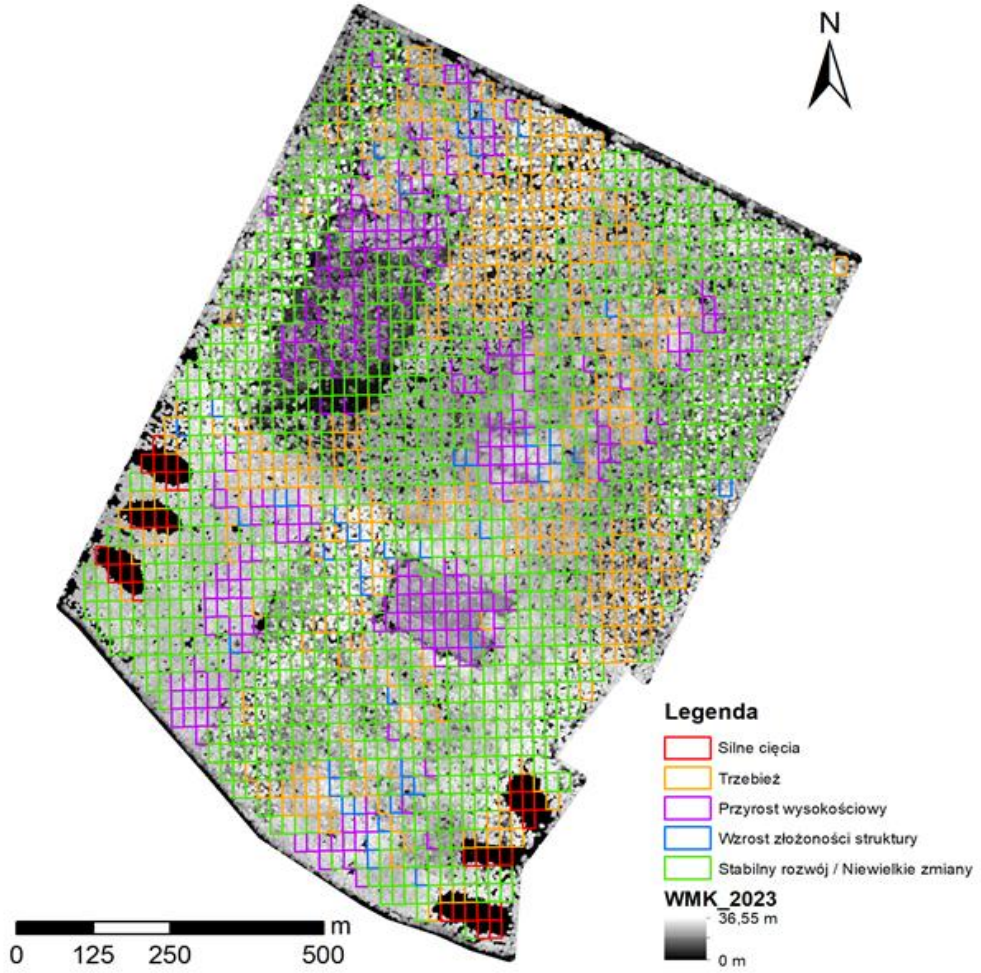


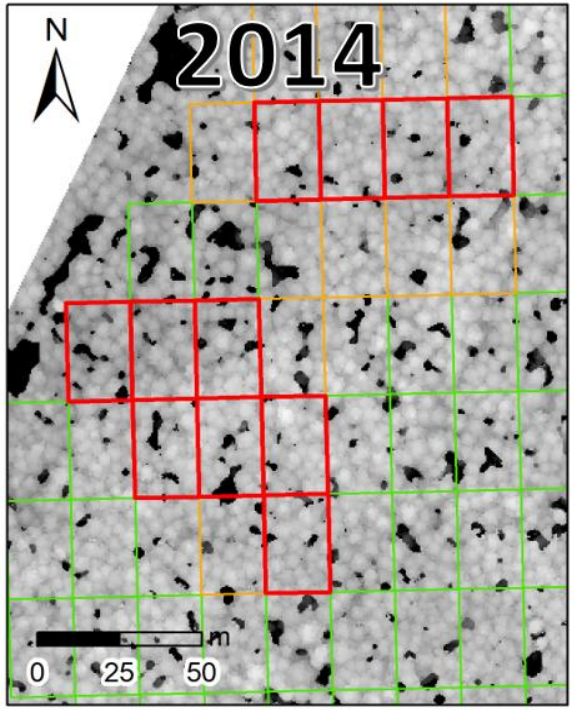
InSAR DSM

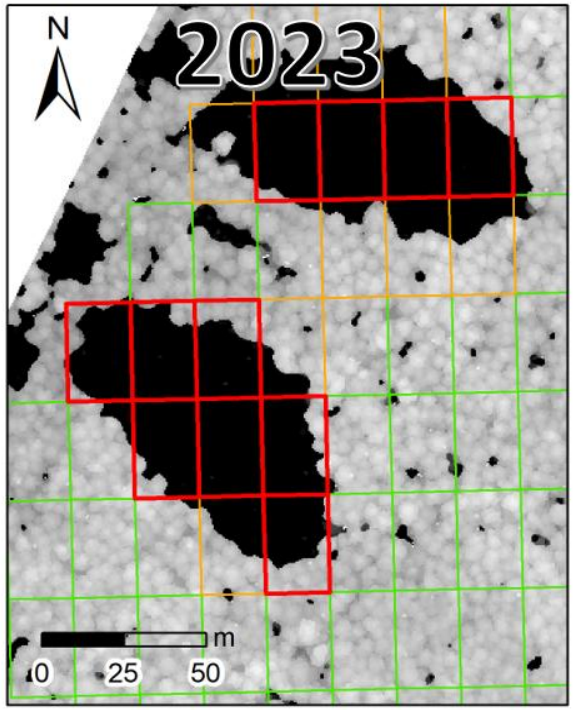
LiDAR DSM

LiDAR Biomass Index

Zmian w strukturze lasu w polu badawczym Daleszyce (2014–2023) w oparciu o chmurę punktów LiDAR

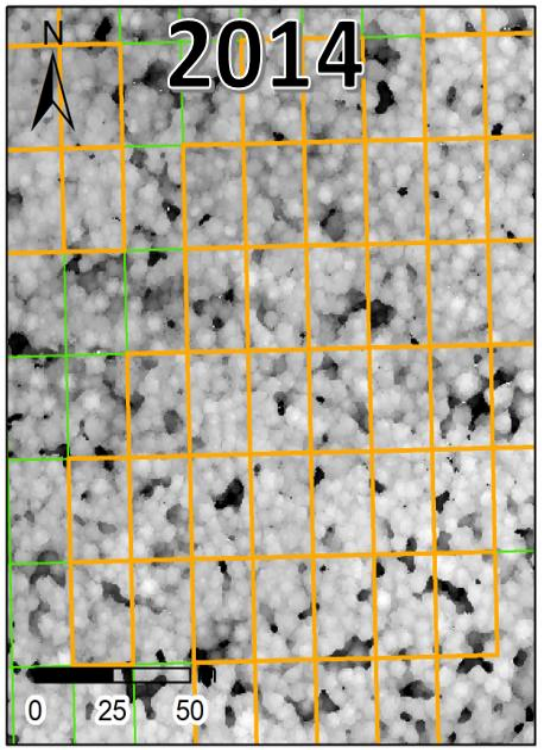


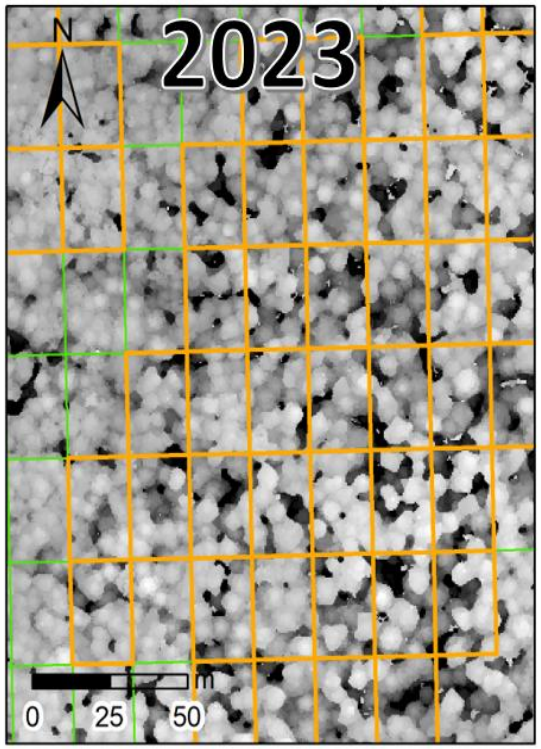




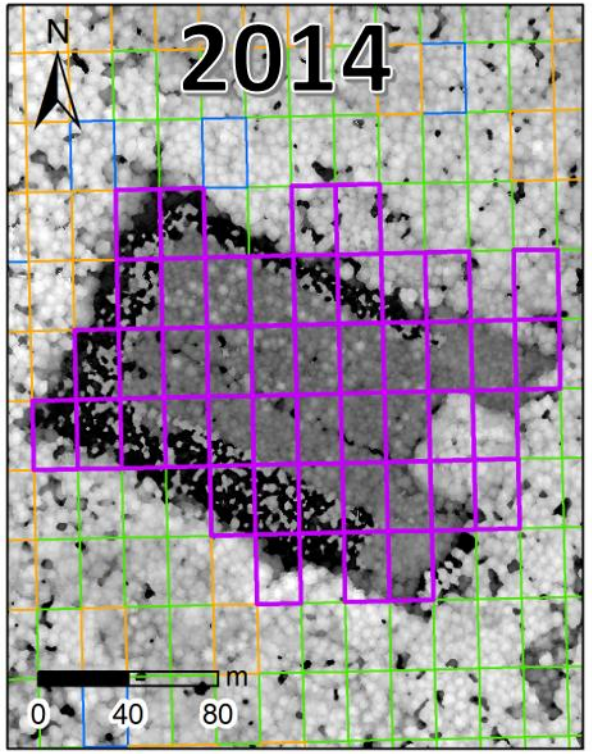
IBL
FOREST
RESEARCH
INSTITUTE

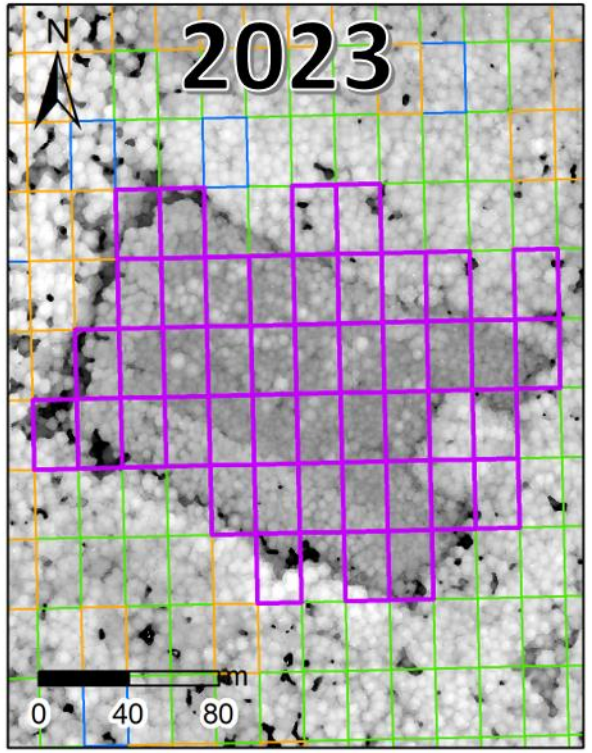
Przykłady wykrywania zmian w lesie na podstawie analiz chmury punktów LiDAR





Fragment lasu, w którym algorytm wykrył trzebieże





Obszar, w którym wystąpił znaczący przyrost wysokości drzewostanu

IBL
FOREST
RESEARCH
INSTITUTE