



Benefits of EO/Copernicus for Highways Management

An experience from Turkey

Paulo Barreto
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IMAGINE
CREATE
ACHIEVE
a sustainable future





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01

Egis Group

Key numbers

2023 TURNOVER

€1,9bi



81%

Architecture, engineering & consulting

19%

Operations



RAIL
29%



BUILDINGS
27%



ROAD
25%



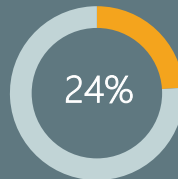
ENERGY, WATER & OTHERS
19%

France



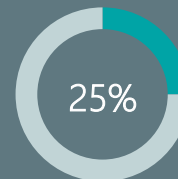
30%

Europe. Africa



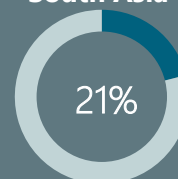
24%

Americas. Pacific



25%

Middle East.
South Asia



21%

28

ROAD OPERATING
COMPANIES

20

AIRPORTS

21

URBAN PARKING
CONTRACTS IN
EUROPE

20^a ENR



Engineering News Record
Global Ranking*

1st

FRENCH ENGINEERING
COMPANY

11th

TRANSPORTATION
MARKET*

*ENR TOP 225 2023

2023



€44 M

NET PROFIT

€221M

EBITDA



19.500

EMPLOYEES
WORLDWIDE

77% Architecture, engineering & consulting

23% Operations



02

Application in Turkey

Description of the project

Otoyol-5 (Turkey)

- Route: Gebze – Izmir
- Extension: 503 km
- 2,682 suspension bridge (Osman Gazi Bridge)

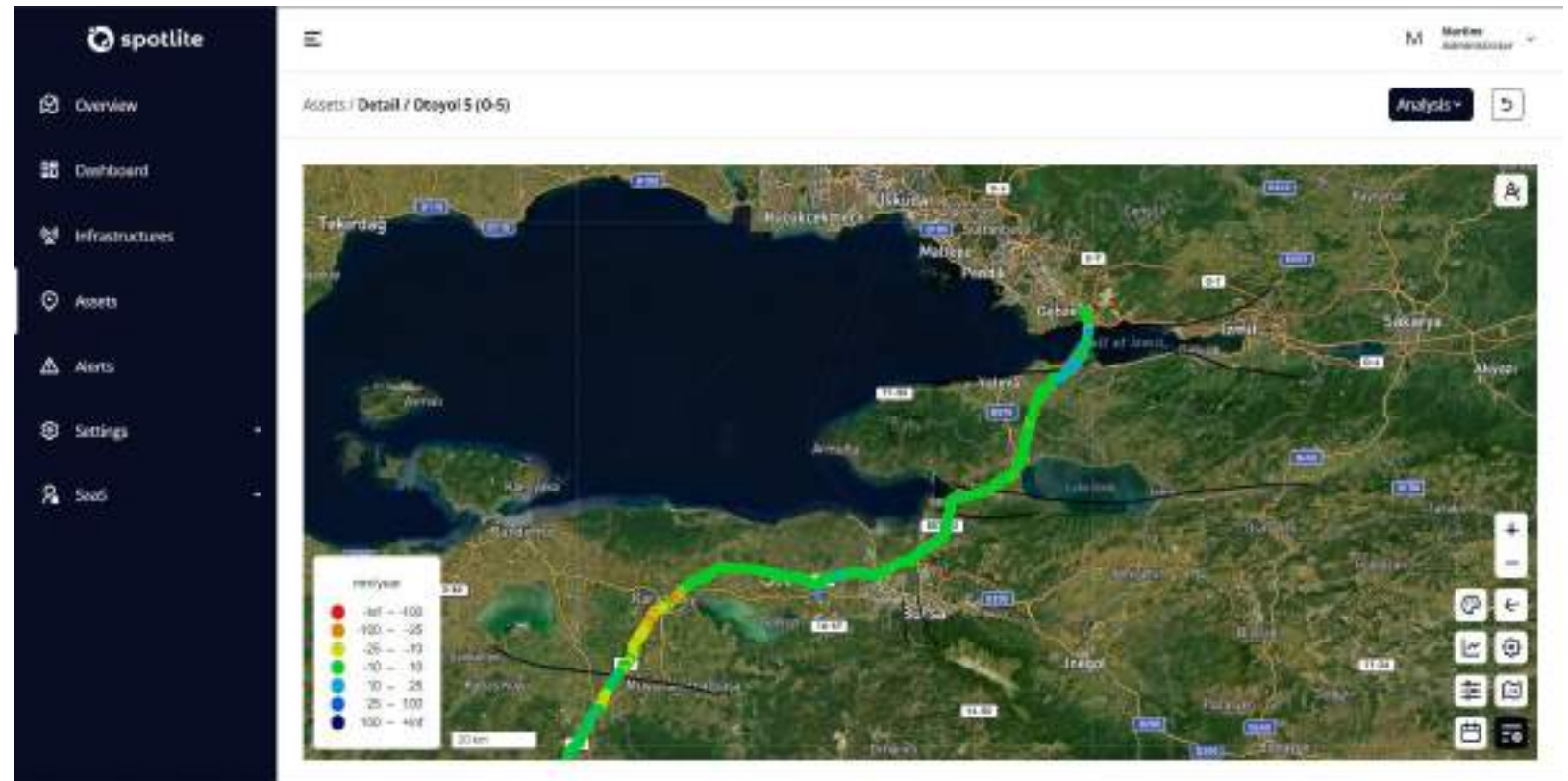


Overview

- **2-year historical inSAR analysis** using archive data (Sentinel-1) of the entire motorway and additional InSAR analysis of a specific section
- **Early-warning system configuration** with customized thresholds defined by the users, with two distinct levels of severity
- Integration of the entire **asset inventory** (slopes and pavement) in vectorial format
- Creation of **3 digital twins**: Osman Gazi Bridge, 2 motorway sections (O-5/16 002 and 0-5/16 002) and IoT sensor data integration in the Osman Gazi Bridge
- DInSAR analysis of **February 2023 earthquake impacts** on the structural integrity of the O-5 motorway
- Development of multi-factor **Landslide Susceptibility Maps (LSMs)** for selected sections of the motorway

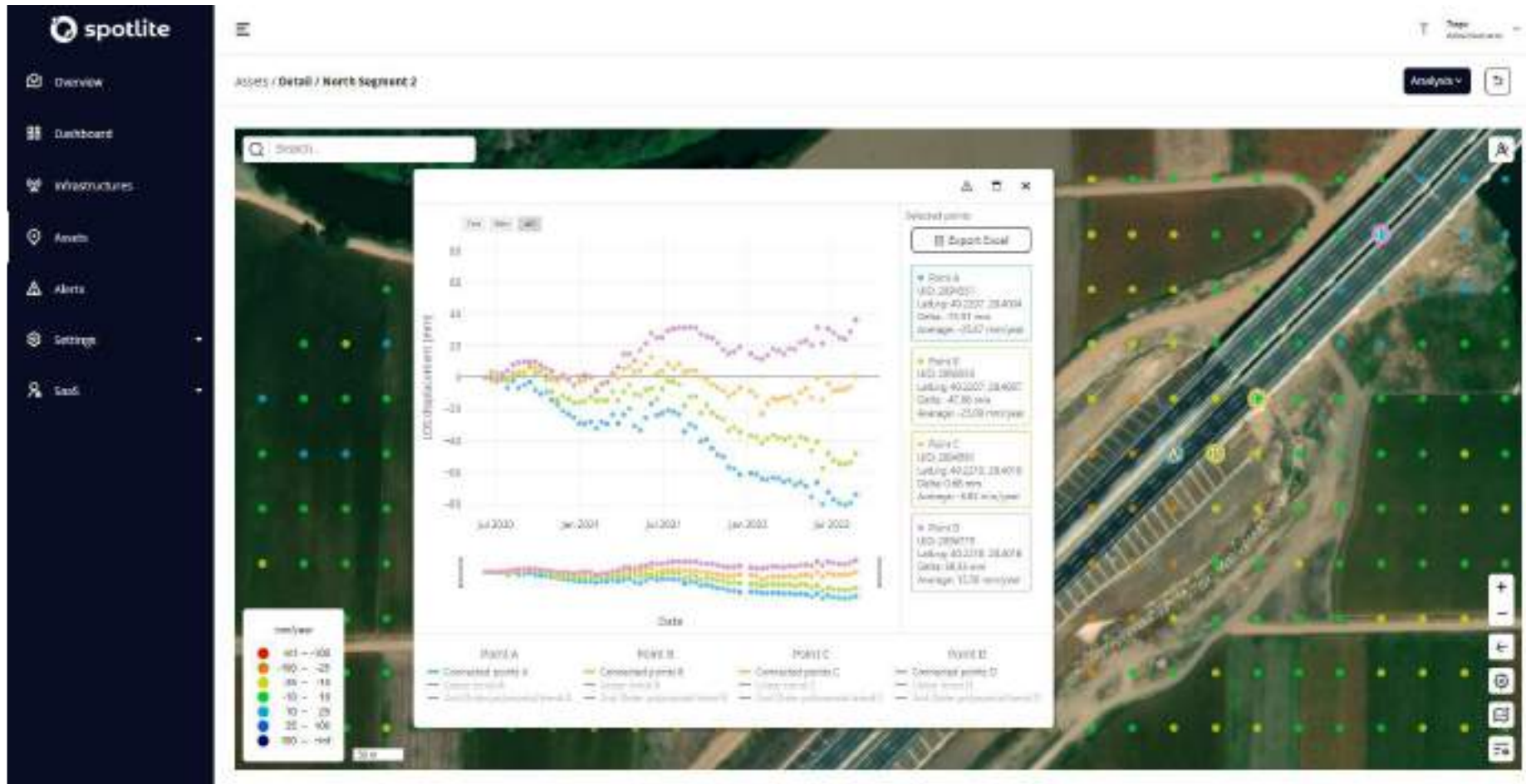
InSAR historical analysis

- InSAR historical analysis of ground motion evolution over the **last 2 years** using archive SAR data
- LOS movements (Asc. & Desc.)
- Vertical and horizontal movements
- Geological faults mapping



InSAR historical analysis

- InSAR time series visualizer



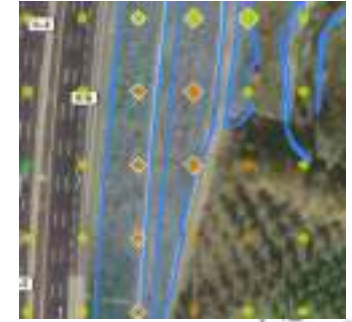
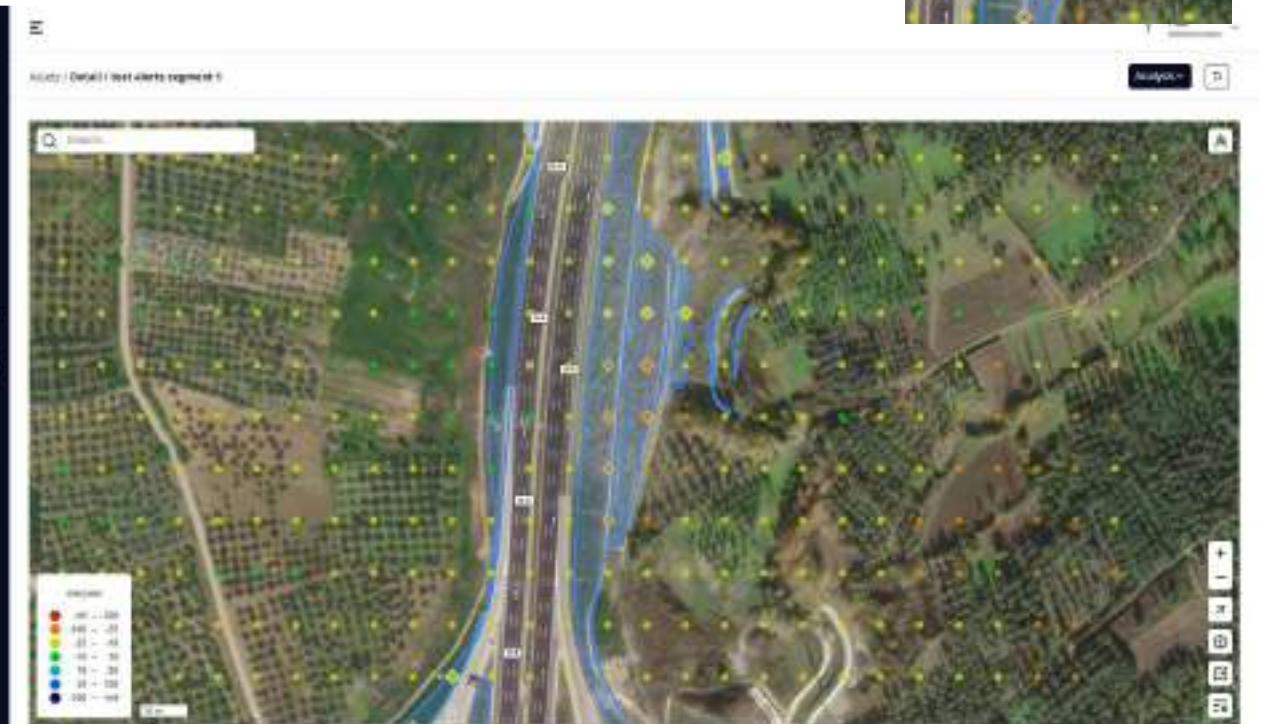
InSAR historical analysis

- Color scale customization



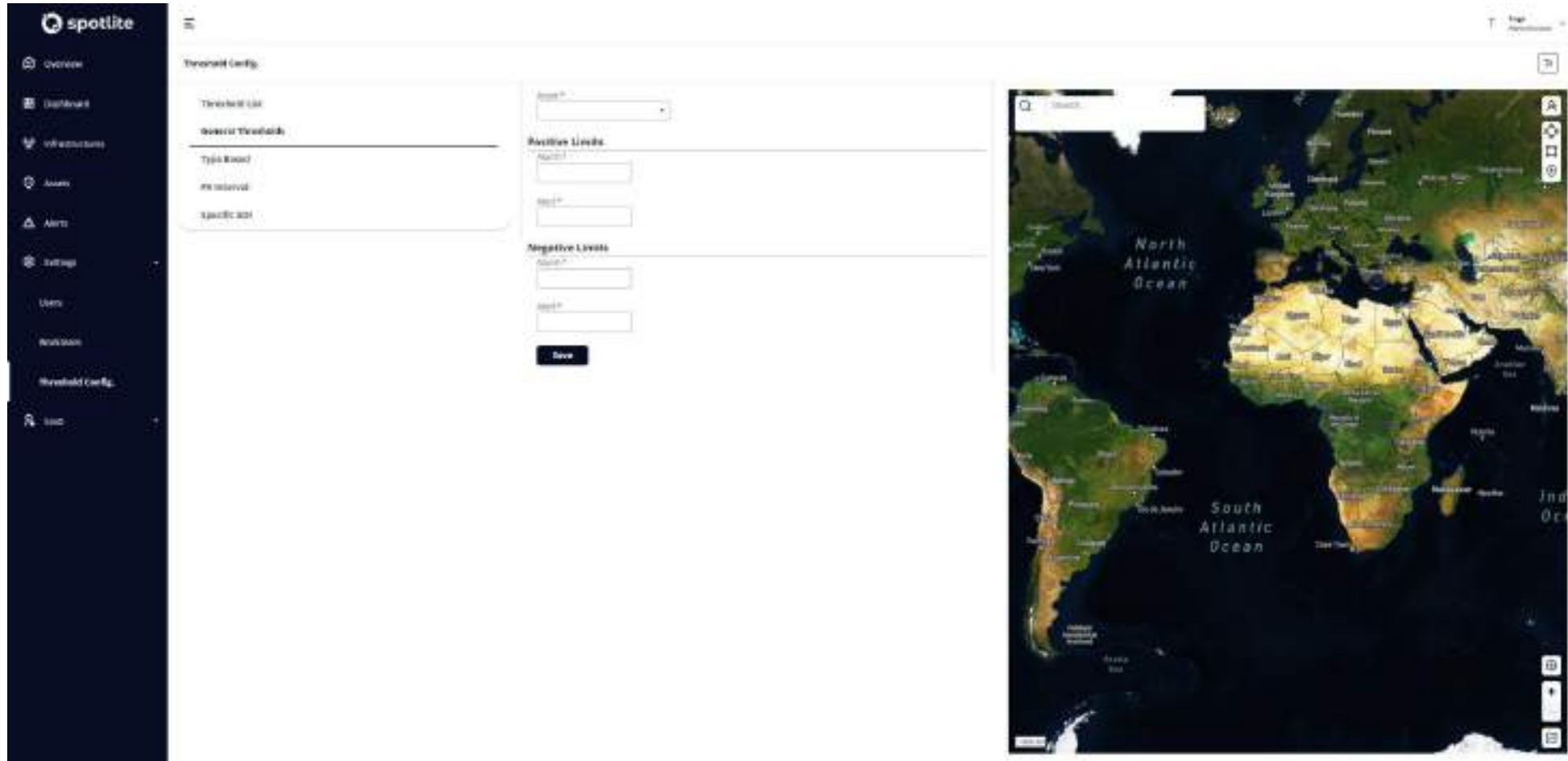
Early-warning system

- Alerts visible in the WebGIS visualiser (diamond shape)
- Alerts listed in the alert dashboard
- Alerts visible in the 360° viewer



Early-warning system

— Safety thresholds configuration



Asset inventory

- Integration of the **asset inventory** in vectorial format (slopes and pavements)



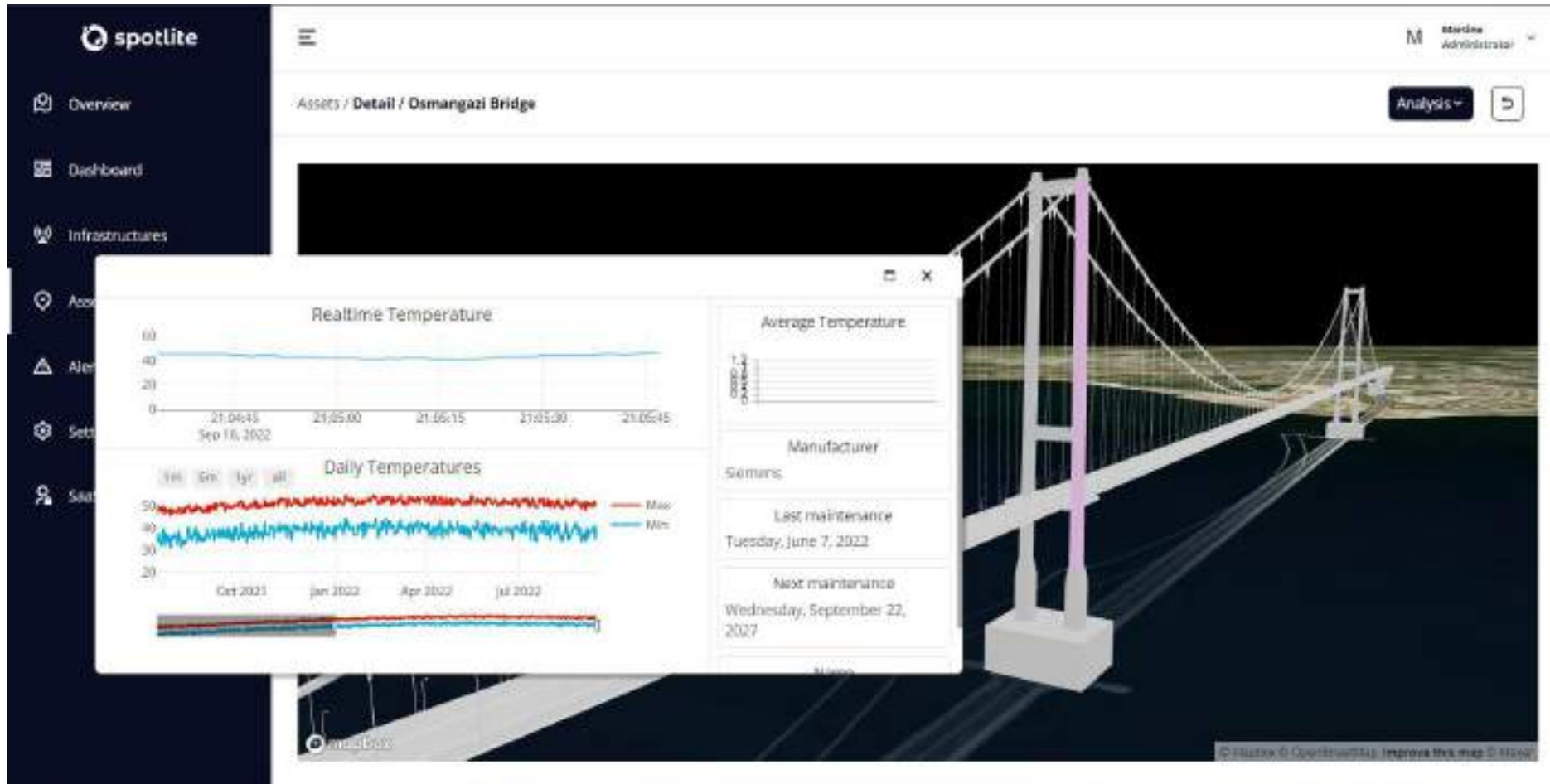
Digital Twins

- Osman Gazi Bridge
- O-5/16 022
- O-5/16 002



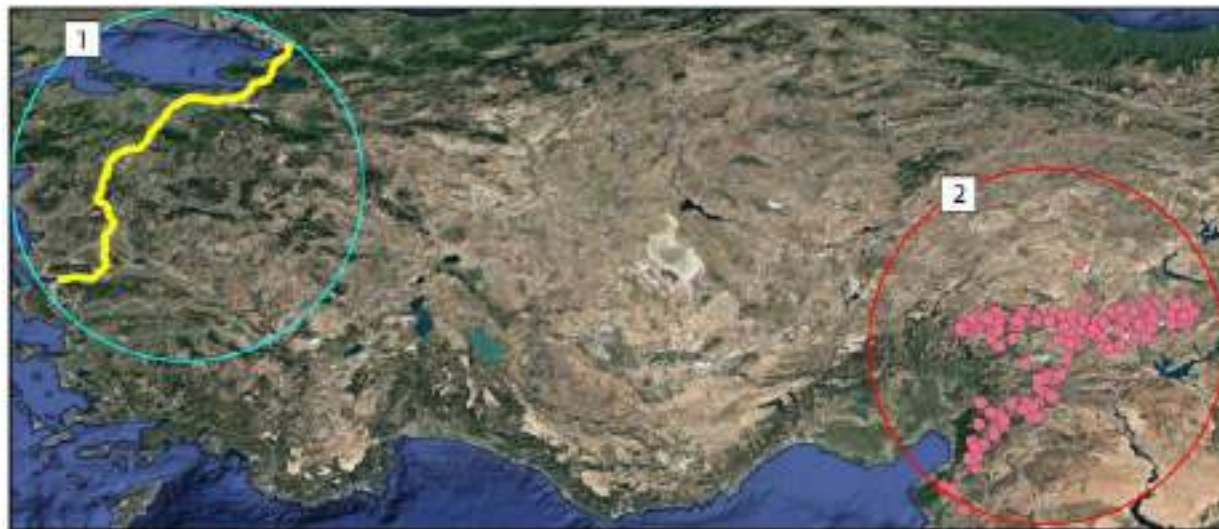
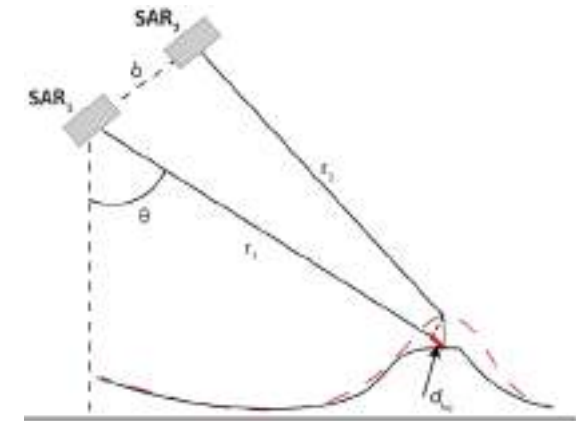
Digital Twins

IoT sensor data integration



Earthquake impacts (DInSAR) – February 2023 (Turkey)

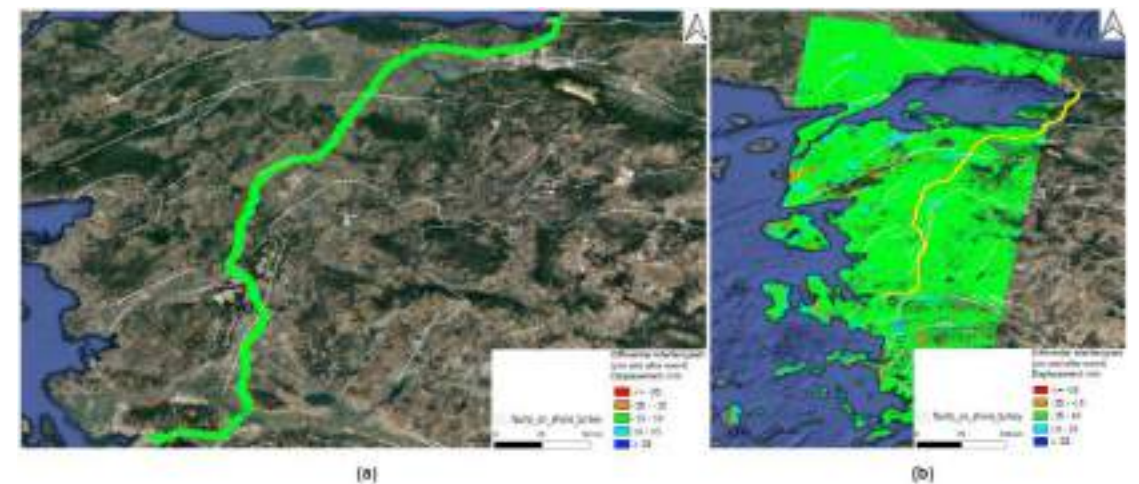
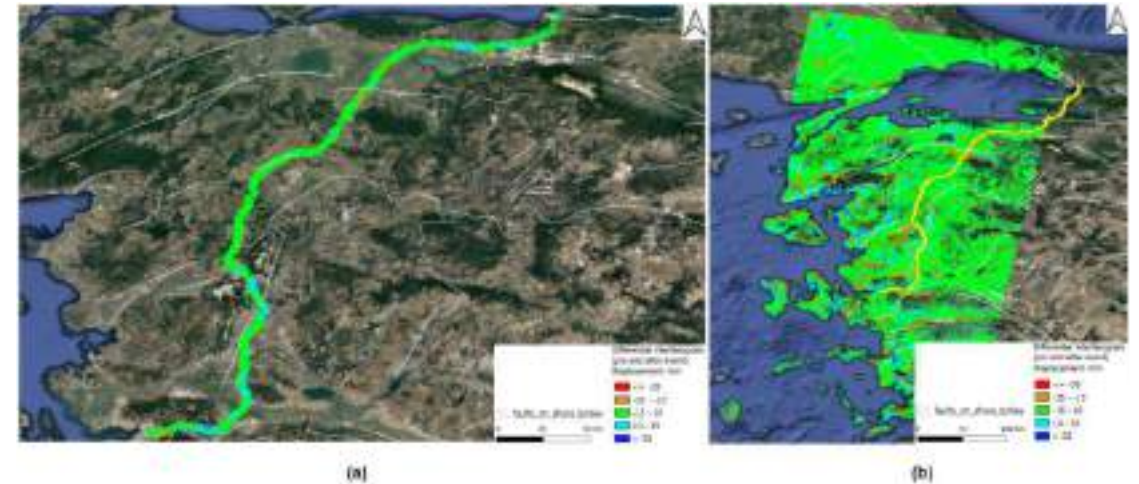
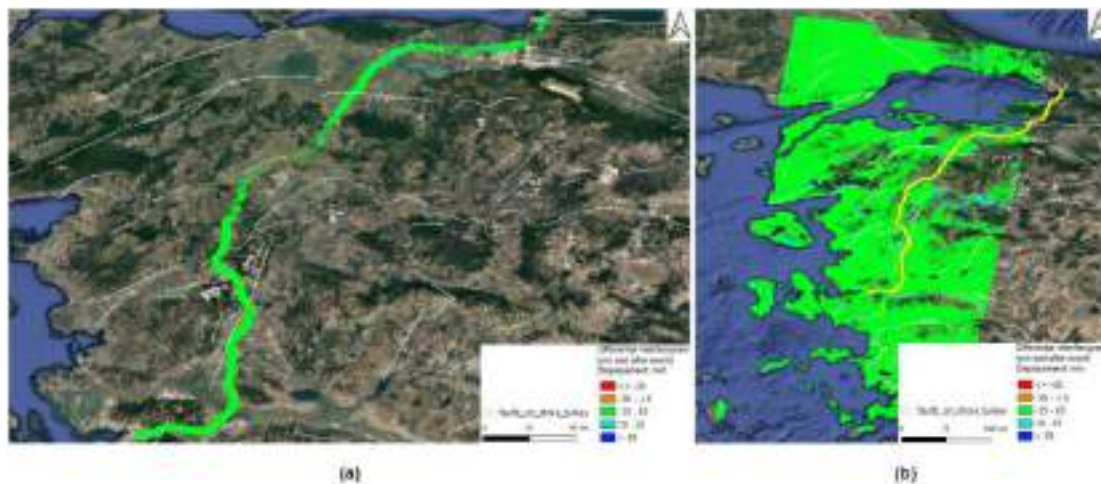
- Analysis of potential impacts using DInSAR analysis
- Epicenter: Gaziantep
- Maximum intensity: **XII (Mercalli)**
- Distance to the O-5 motorway: around **730 km**



- 1 Otoyol-5 Motorway
- 2 Earthquakes (6-10 february 2023)

Earthquake impacts (DInSAR) – February 2023 (Turkey)

- Displacement classes < -35 mm and > 35 mm show **minimal or no occurrence**, suggesting little impact from the earthquake. However, coherence loss in two DInSAR date pairs indicate abrupt movements and loss of correlation



Landslide Susceptibility Maps

- **Topographic conditions** (slope angle, aspect or elevation)
- **Geology** and **soil type**
- **Precipitation** and **soil moisture**
- **Land cover**
- **Surface temperature**
- Copernicus Climate Change Service (**C3S**)
- Copernicus Land (**CLMS**)





03

Other applications by Egis

Other applications by Egis

A24 Motorway (Portugal)

- 157 km, 2x2 lanes (mountainous motorway)
- 26 interchanges (3 for service areas)
- 70 viaducts / bridges
- 4 tunnels
- 145 retaining walls
- 86 reinforced slopes
- 1069 slopes

■ A24 MOTORWAY LOCATION



Other applications by Egis

A24 Motorway (Portugal)

- GEOTECHNICAL STRUCTURES MANAGEMENT (measurement of ground motion with InSAR)



Other applications by Egis

A24 Motorway (Portugal)



— VEGETATION MANAGEMENT

- **Normalized Difference Vegetation Index-NDVI**

Quantify the **amount of chlorophyll**, which is the element responsible for the green of the vegetation

- **Tree detection with AI**

High accuracy definition of polygons encircling the trees

- **Dead Tree detection**

The **correlation** between **NDVI** and **tree detection** makes it possible to detect dead trees

- **Tree Height & Fall Radius + Vitality**

Detecting tree height from shadow using AI and trigonometry formulas

- **Vegetation intensity per KP**

Identify the primary vegetation type adjacent to the road at each kilometer





Egis

15 avenue du Centre
CS 20538 Guyancourt
Saint Quentin-en-Yvelines
France

paulo.barreto@egis-group.com

www.egis-group.com

