HELLENIC REPUBLIC
Ministry of Digital Governance

Hellenic Cadastre

Quality control procedures for high definition aerial LiDAR data in Greece

Panos Lolonis
Rural and Surveying Engineer-Geographer, Ph.D.
Head of the Geospatial Information Department

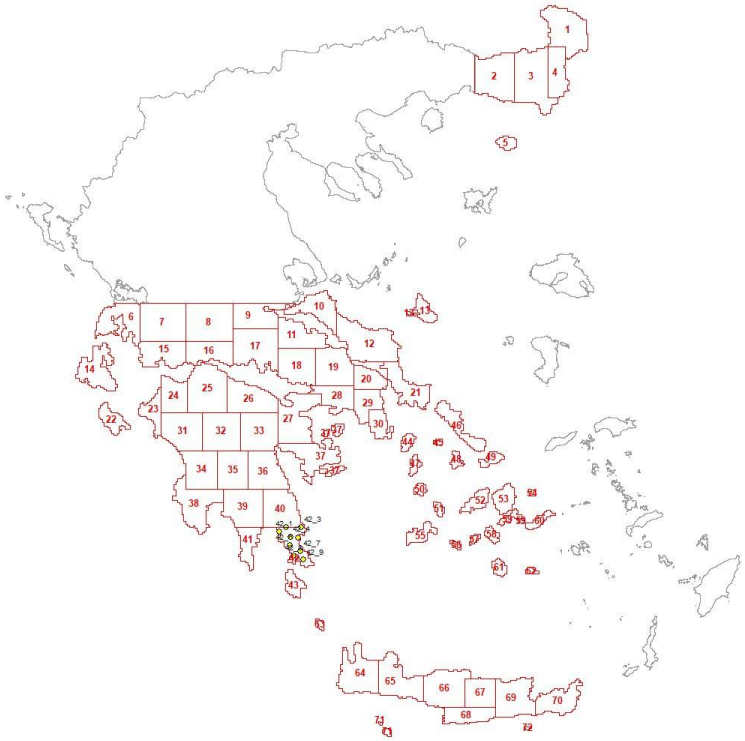
HELLENIC CADASTRE

288 Mesogion Ave.
155 62 Cholargos – Athens
Tel. +30 (210) 6505-636

e-mail: plolonis@ktimatologio.gr

High Definition Digital Elevation Base Map

(On-going project in Greece)



Area covered by the High Definition DEM basemap project

Purpose of the project:

To develop a high definition digital elevation model and a color orthophotomap of Greece that would be used to cover the cartographic needs of the country

Time table

Start: August 27, 2024

Finish: December 31, 2025

Area covered:

61.500 Km^2 (~47% of the country)

Area covered:

Co-financed by the Recovery and Resiliance Fund (RRF)

Ελλάδα 2.0 ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης NextGenerationEU

High Definition Digital Elevation Base Map

(On-going project in Greece)

Venue of the 5th International Workshop on Spatial Data Quality in Athens. Image collected

Deliverables:

- A Digital Terrain Model (DEM) with grid size 1m and vertical accuracy RMSEz ≤ 0,30m
- A Digital Surface Model (DSM) with grid size 1m and vertical accuracy RMSEz ≤ 0,30m
- Point cloud dataset with density>= 5 returns/m2 and vertical accuracy RMSEz ≤ 0,30m
- Color orthophotomap with GSD 25cm
- The aerial photos used to compile the Orthophotomap
- A classification of the Earth's surface in 10 main categories

Ελλάδα 2.0 ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης NextGenerationEU

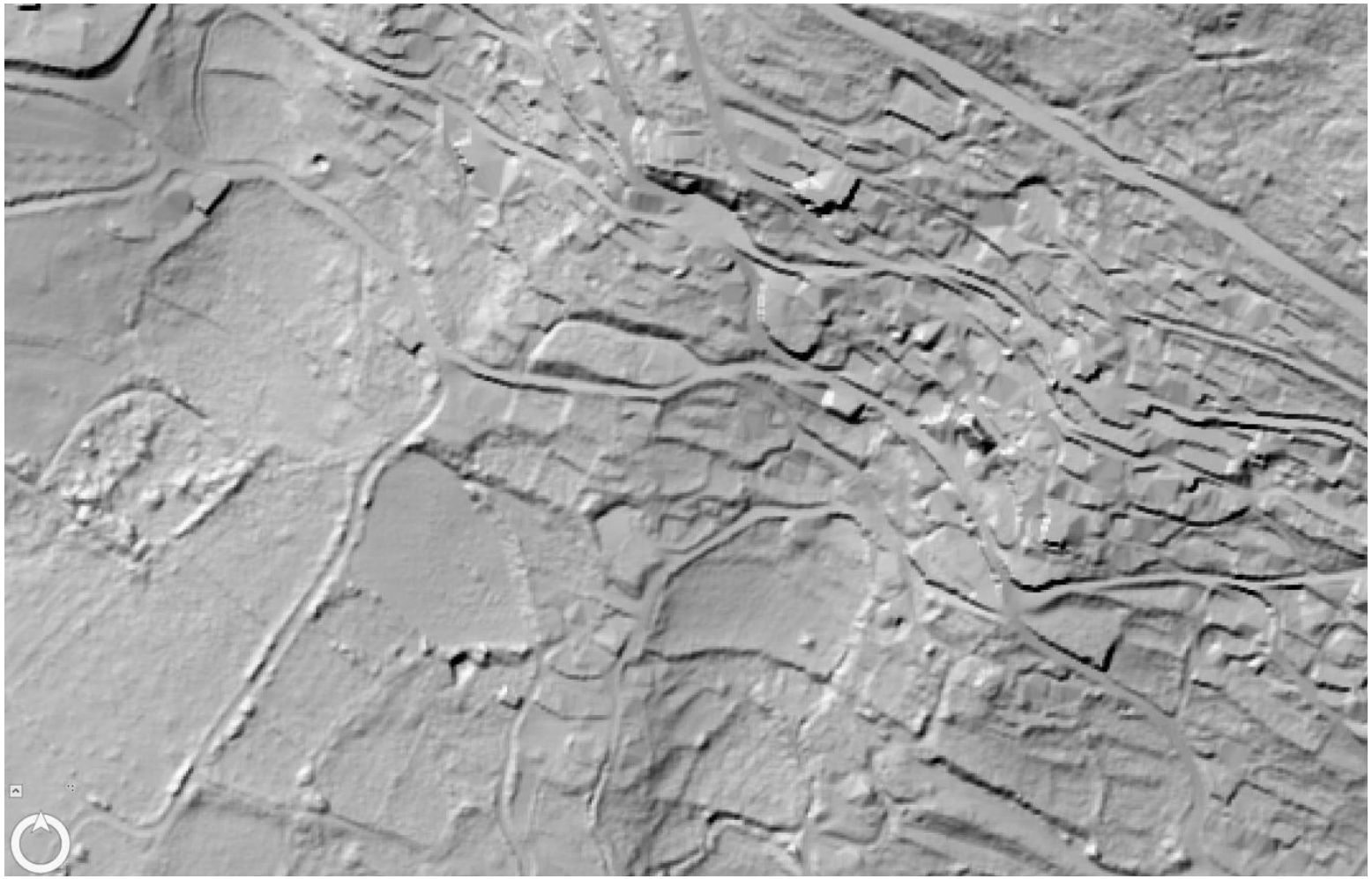
High Definition Digital Elevation Base Map

Parthenon, Acropolis, Orthophotomap
(RRF Project: High Definition Elevation Base Map DEM_HD – Lidar)

High Definition Digital Elevation Base Map

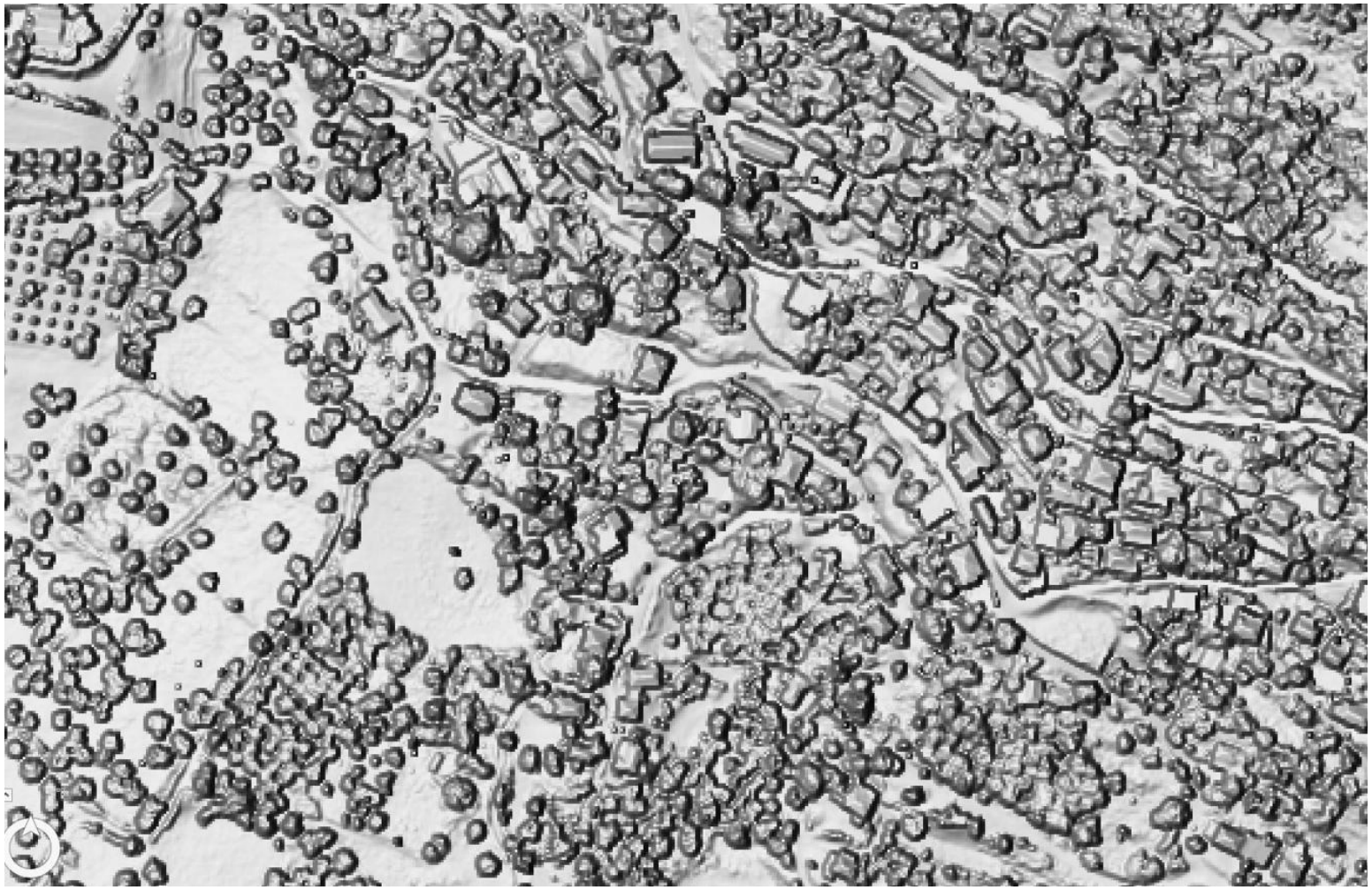
Acropolis, Orthophotomap
(RRF Project: High Definition Elevation Base Map DEM_HD – Lidar)

High Definition Digital Elevation Base Map



Digital terrain model in an island in Greece (Amorgos)

High Definition Digital Elevation Base Map



Digital surface model in an island in Greece (Amorgos)

High Definition Digital Elevation Base Map

Orthophtomap of an island in Greece (Amorgos)

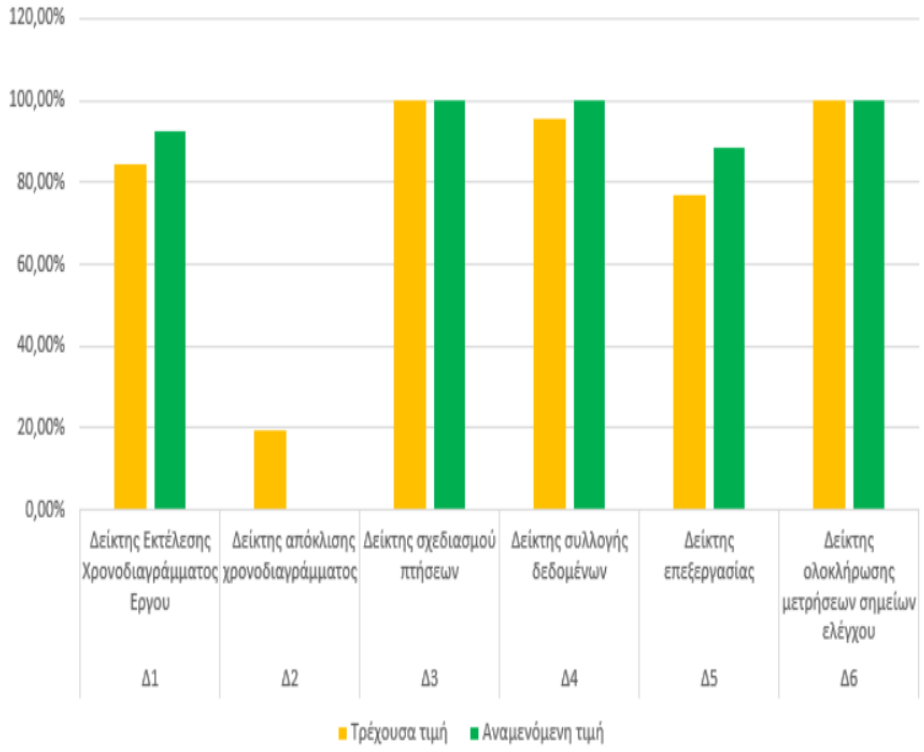
Ελλάδα 2.0 ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης NextGenerationEU

High Definition Digital Elevation Base Map

A composite of the orthophotomap and the digital surface model in an island in Greece (Amorgos)

Ελλάδα 2.0 ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης NextGenerationEU

Progress of the implementation of the Project



Progress of the implementation of to project (orange bars) in comparison with the planned (green)

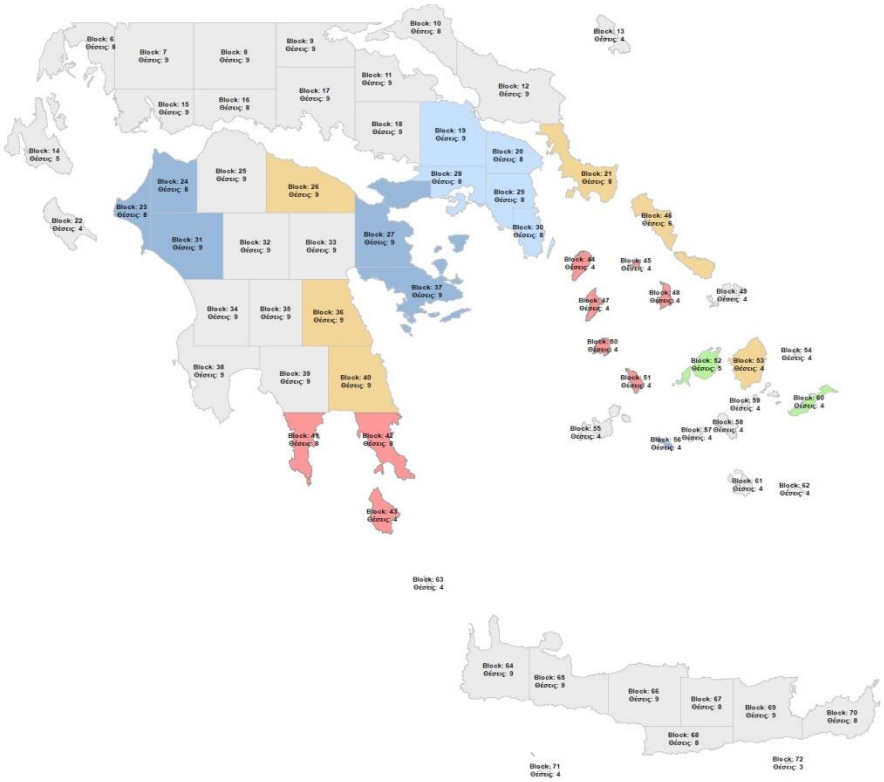
<u>Progress Indices</u>:

- Data collection progress ~95%
- Data processing progress: 75%
- Field measurement progress: 100%

Expected completion: 31/12/2025

Ελλάδα 2.0 ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης NextGenerationEU

Quality Control Checks of the Deliverables



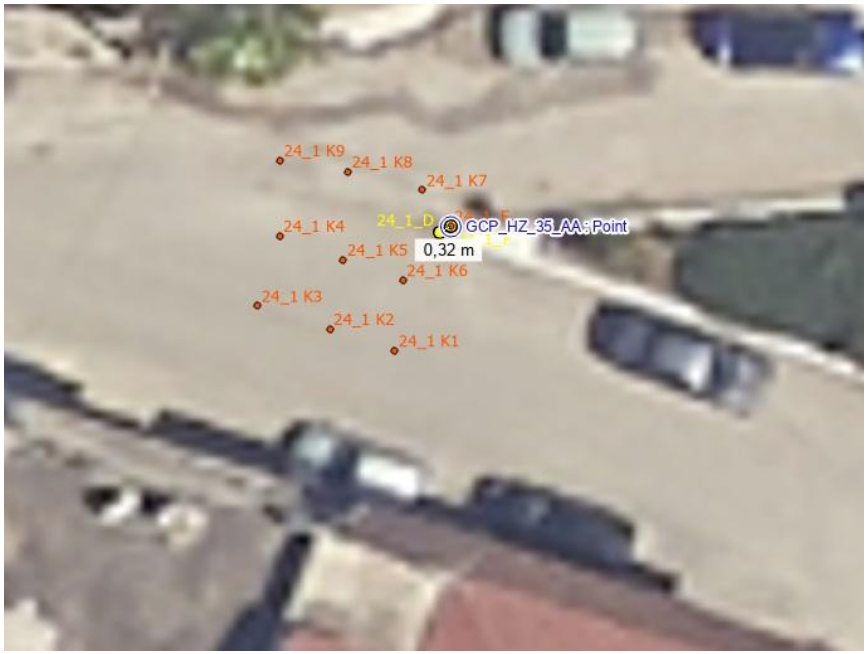
Aerial photography blocks covering part of the area of interest

The quality control checks cover:

- completeness of the deliverables
- quality of the data
- fulfillment of geometric accuracy requirements and
- correctness of the classification of the LiDAR point cloud and the generated models (DSM and DTM)

Ελλάδα 2.0 ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης NextGenerationEU

Quality Control Checks of the Deliverables



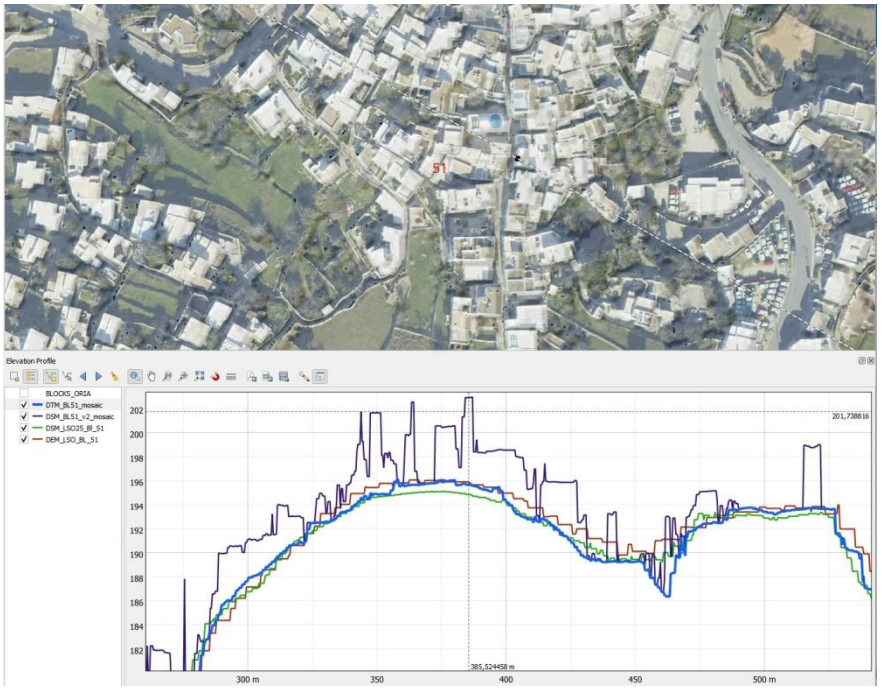
Point measurements for checking the vertical accuracy of the deliverables

Completeness and Quality Checks:

- Completeness of coverage of the Project Study Area is checked.
- Overlaps between the swaths are checked to avoid gaps (no-data values).
- Density and uniform distribution of the points of the LiDAR point cloud are verified.
- Continuity of the Digital Elevation Models (DSM and DTM) and the avoidance of gaps (except for graded areas) are checked.
- Avoidance of patterns, spikes and holes in DSM and DTM is checked

Ελλάδα 2.0
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης
NextGenerationEU

Quality Control Checks of the Deliverables



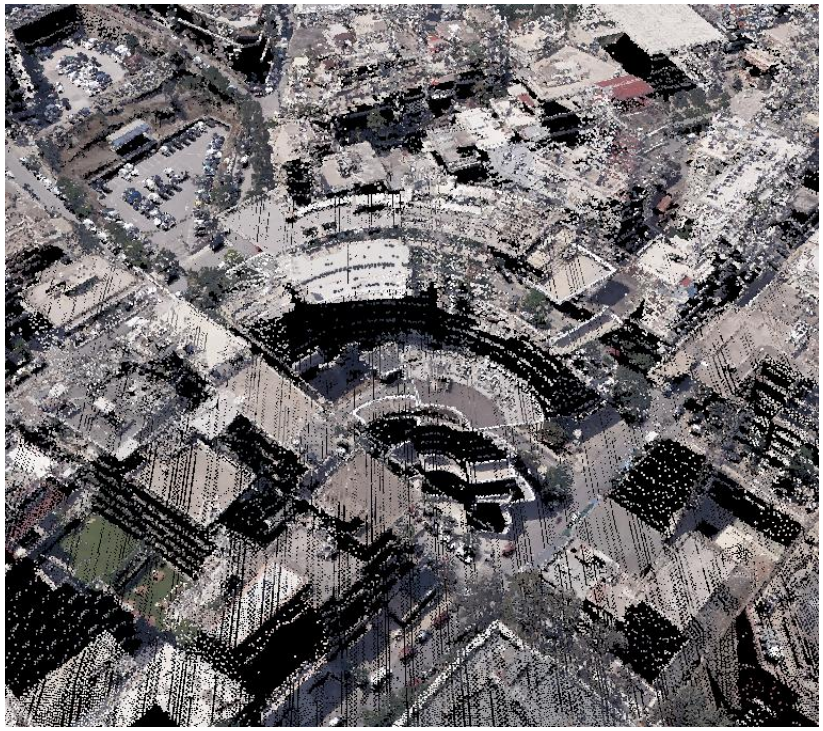
Checking vertical geometric accuracy using cross-sections

Geometric Accuracy Checks (Absolute and Relative):

- The absolute horizontal and elevation accuracy of the point data (Point Cloud) and Digital Models (DSM and DTM) is evaluated using independent check points (8-9/block).
- The required values for non-vegetated areas (NVA) and vegetated areas (VVA) are checked.
- The relative elevation accuracy (internal geometric quality) of the LiDAR points is verified (RMSExy:0,20m, RMSEz:0,15m)

Ελλάδα 2.0
ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης
NextGenerationEU

Quality Control Checks of the Deliverables



LiDAR point cloud classification

LiDAR Point Cloud Classification Checks:

- The result of the LiDAR point classification is checked, which must be consistent with the ASPRS coding categories (e.g., Ground, Buildings, Vegetation, Water).
- Sample checks are performed for the correctness of the classification on project signs.
- The maximum allowed error rate in the final classification is 1% for ground points and 10% for all other points.
- The treatment of water surfaces (lakes, rivers) as surfaces of uniform elevation is checked.

Ελλάδα 2.0
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης
NextGenerationEU

Quality Control Checks of the Deliverables

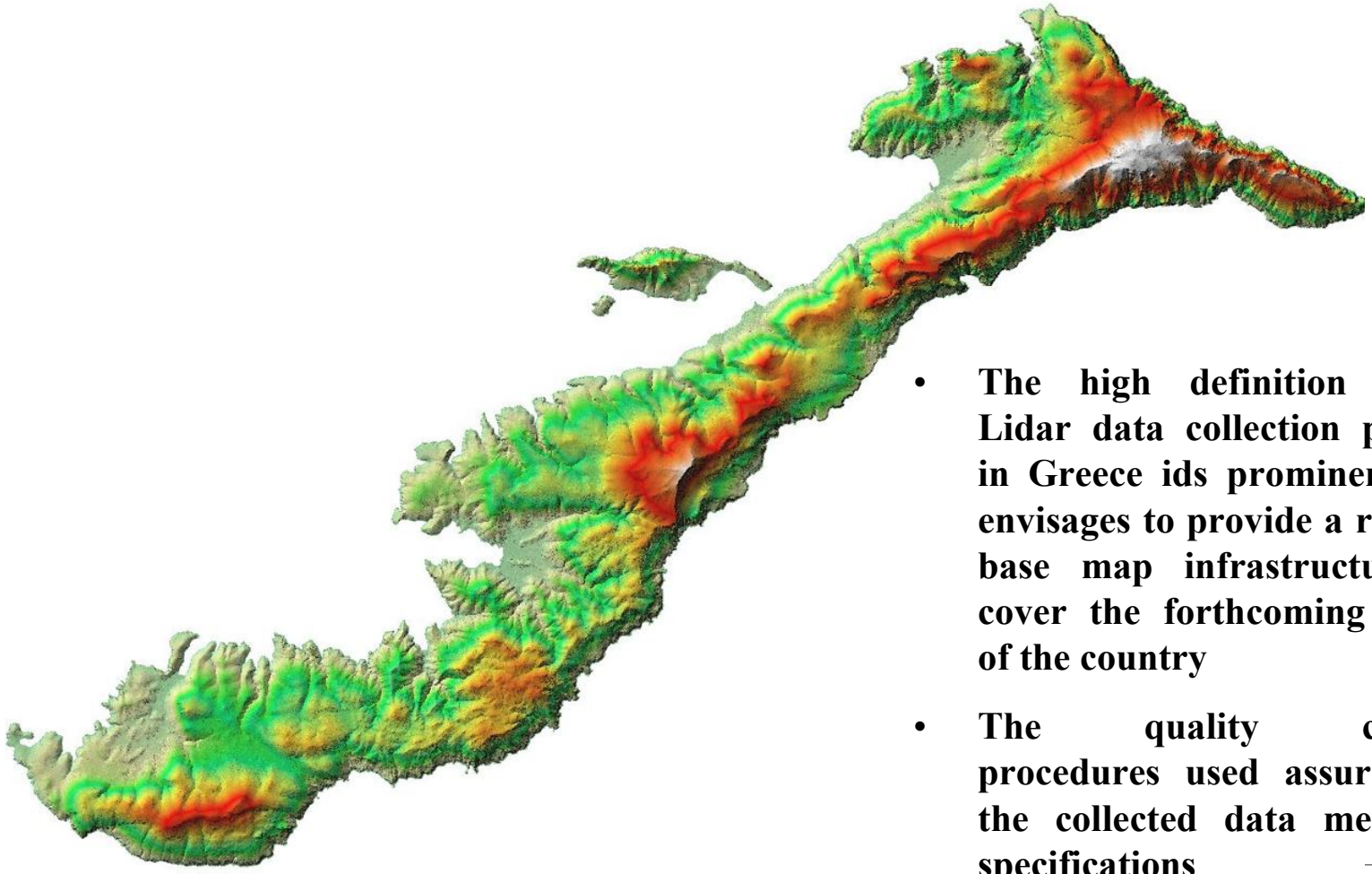
Field measurement for quality control

Checking Procedure:

- The checks are carried out by Hellenic Cadastre.
- Filed measurements were made in cooperation with the Hellenic Military Geographical Service
- The checks are carried out on a sample basis, covering 5% of the total deliverables (excluding automated checks which are exhaustive).
- If it is found that more than 5% of the inspected instances do not meet the criteria, then the entire deliverable is rejected and returned to the Contractor for correction.

Ελλάδα 2.0 ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης NextGenerationEU

Conclusions



Digital elevation model in an island in Greece (Amorgos)

- **The high definition aerial Lidar data collection project in Greece ids prominent and envisages to provide a reliable base map infrastructure to cover the forthcoming needs of the country**
- **The quality control procedures used assure that the collected data meet the specifications**

Ελλάδα 2.0 ΕΘΝΙΚΟ ΣΧΕΔΙΟ ΑΝΑΚΑΜΨΗΣ ΚΑΙ ΑΝΘΕΚΤΙΚΟΤΗΤΑΣ
Με τη χρηματοδότηση της Ευρωπαϊκής Ένωσης NextGenerationEU