NCMA S.A.

The new Basemap "LSO25":
project information and quality assurance

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The New Basemap: LSO25

- Large Scale Orthophotos (LSO25)

  Nationwide 25- cm- GSD orthophotos

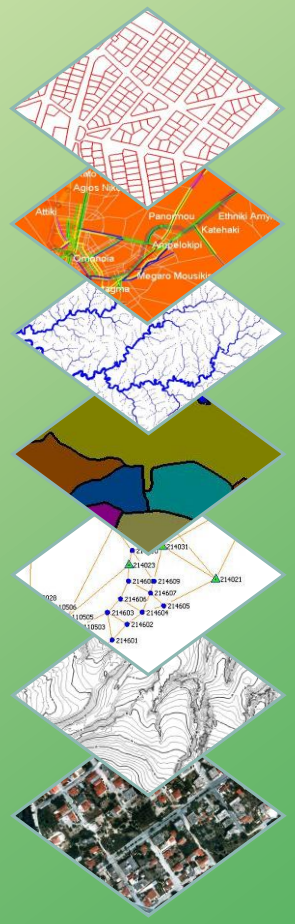
- Update for

  * VLSO (20 cm GSD, major cities, True Ortho, 2007)

  * LSO (50 cm GSD, national coverage, 2008)

- Uniform accuracy basemap for property registration in cities, smaller settlements, rural & uninhabited areas

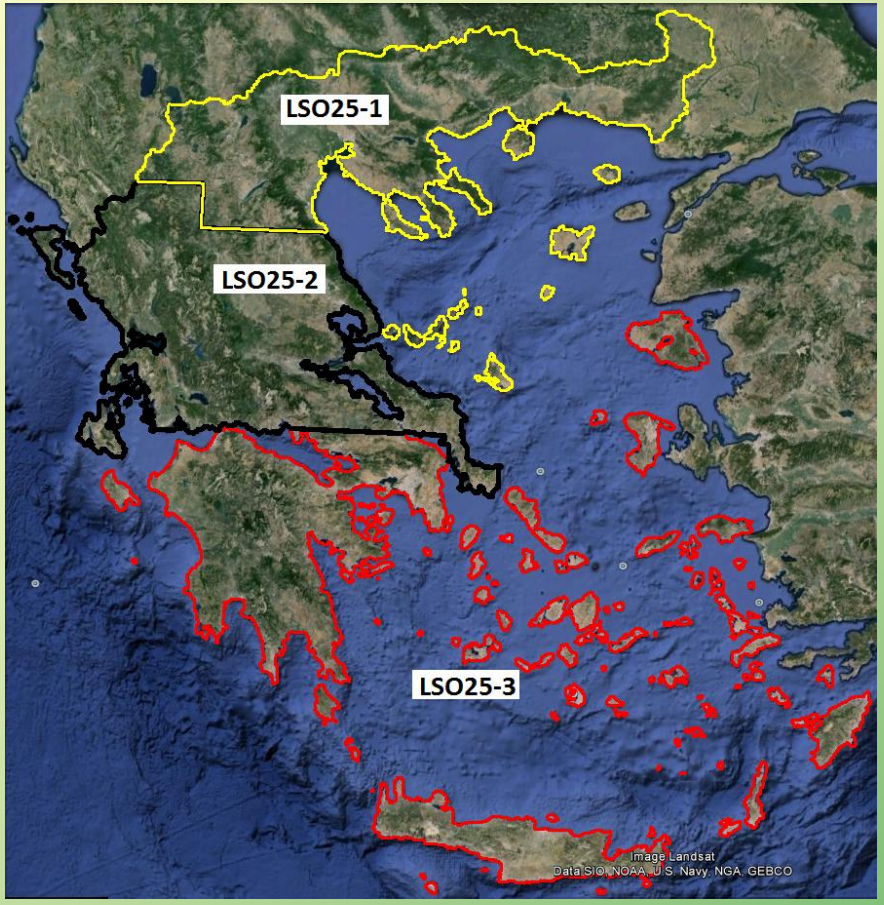
- Engineering, Education, Land Use, Real Estate



LSO25 – basic features

Large Scale Orthophotos (LSO25)

3 contracts ~**132.000 km²** / November 2014 – July 2016 (expected)



Orthophotos	
Pixel size (GSD)	0.25 m
Radiometric resolution	True Color (24 bit), NIR
Image type	JPEG2000 + .j2w
Image dimensions	2000 m X 1500 m
Number of images	49182

Digital Elevation Model (Orthometric Heights)	
Pixel size (GSD)	2.00 m
Perimetric Cover	300 m
Image type	GeoTiff Floating Point Grid
Image dimensions	2300 m X 1800 m
Number of images	49182

LSO25 – project information (1)

Large Scale Orthophotos (LSO25)

3 contracts ~**132.000 km²** / Nov 2014 – July 2016 (expected)

- National Strategic Framework 2007-2013 * Operational Component of "Digital Convergence" (EU-funded project)
- ~3.1 M €
- 3 contracts, Greek/EU contractors & sub-contractors
- Strict timetable (EU-funding deadlines, urgent availability for cadastral projects)

LSO25 – project information (2)

Large Scale Orthophotos (LSO25)

3 contracts ~**132.000 km²** / Nov 2014 – July 2016 (expected)

- Initial timetable reduction
- Critical operational delays in Q2 2015
- Delays due to slow processing at Min Of Defense
- Capital Controls ---*RISK MANAGEMENT?*

Date	Temperature (C)			Td Avg (C)	Hr. Avg (%)	Wind (km/h)			Pres. s.lev (Hp)	Prec. (mm)	Tot Cl Oct	low Cl Oct	Sun D-1 (h)	Vis Km	Daily weather summary
	Max	Min	Avg			Dir.	Int.	Gust							
06/09	27.2	15.6	21.2	13.5	62.6	SSW	10.0	33.4	1013.5	Tr	5.9	3.2	1.5	10.0	
06/10	27.6	16.2	22.2	15.1	66.8	WNW	10.2	44.5	1014.1	2.0	4.4	2.0	6.3	10.0	
06/11	29.4	21.0	24.7	14.0	52.3	NW	12.3	35.2	1014.9	Tr	5.2	3.0	10.9	10.0	
06/12	31.3	17.2	24.4	14.5	57.7	SW	10.2	31.5	1017.3	0.0	1.8	1.6	12.4	10.0	
06/13	32.0	19.0	24.7	12.9	49.5	S	12.5	31.5	1016.6	0.0	2.1	1.4	13.8	10.0	
06/14	33.3	17.8	24.7	14.0	53.3	SW	8.3	27.8	1014.1	0.0	2.2	1.4	12.9	10.0	

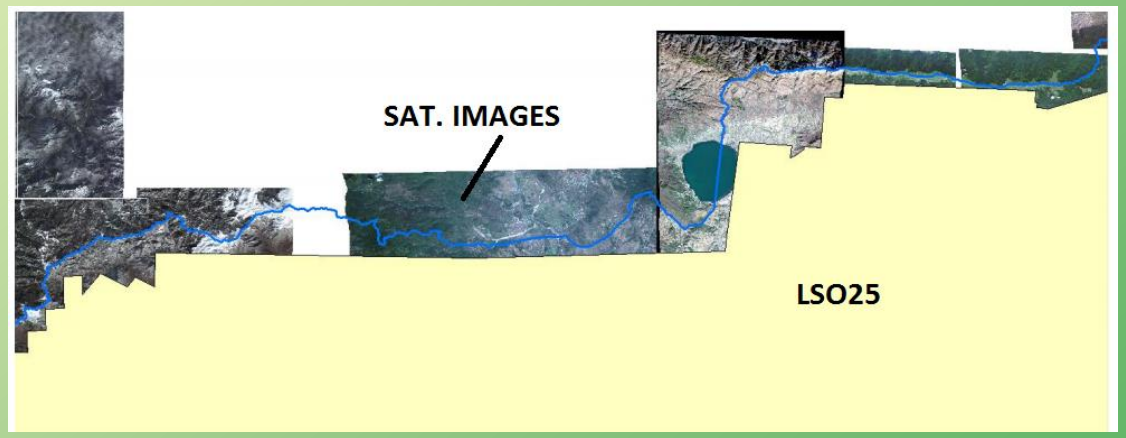
- Late submissions
- Timetable rearrangement, new deadlines, in-house funding for 2016
- EU-funds: ~ 60-65 %

LSO25 – project information (3)

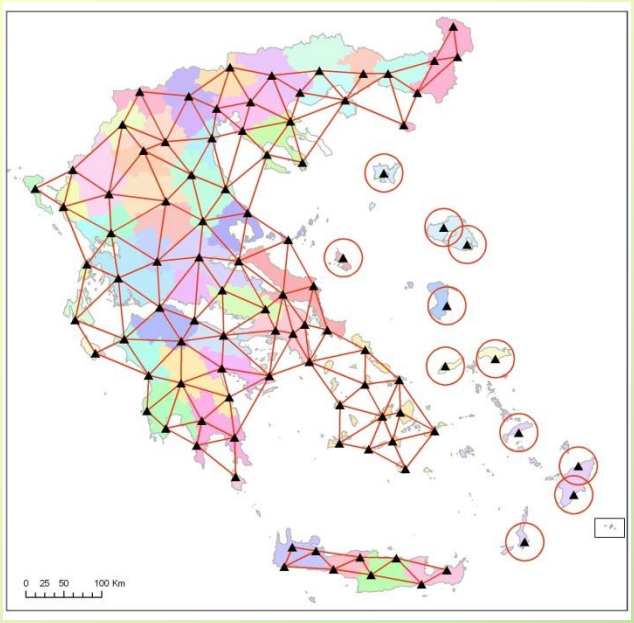
LSO25(QC_LSO25)

Current Project Status

- Flights completed in Nov 2015
- ORTHO/DEM Production Completed in Feb 2016 (LSO25-3 in Nov 2015)
- Border areas: Satellite Imagery (World View II, 50 cm at nadir)



Reference system & Projection

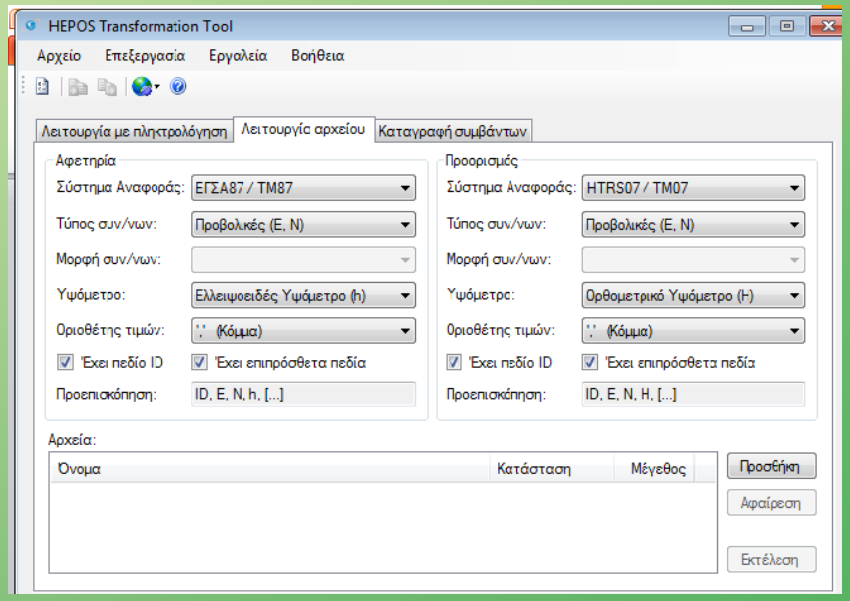


HEPOS
Ελληνικό Σύστημα Εντοπισμού

ΕΡΓΟ ΣΥΓΧΡΗΜΑΤΟΔΟΤΟΥΜΕΝΟ ΑΠΟ ΤΗΝ ΕΥΡΩΠΑΪΚΗ ΕΝΩΣΗ
ΣΤΟ ΠΛΑΙΣΙΟ ΤΟΥ ΕΠΙΧΕΙΡΗΣΙΑΚΟΥ ΠΡΟΓΡΑΜΜΑΤΟΣ «ΚΟΙΝΩΝΙΑ ΤΗΣ ΠΛΗΡΟΦΟΡΙΑΣ»

- Active GPS Network
- 98 stations
- HTRS07- ETRF89
- HTRS07→ GGRS87 (TM)

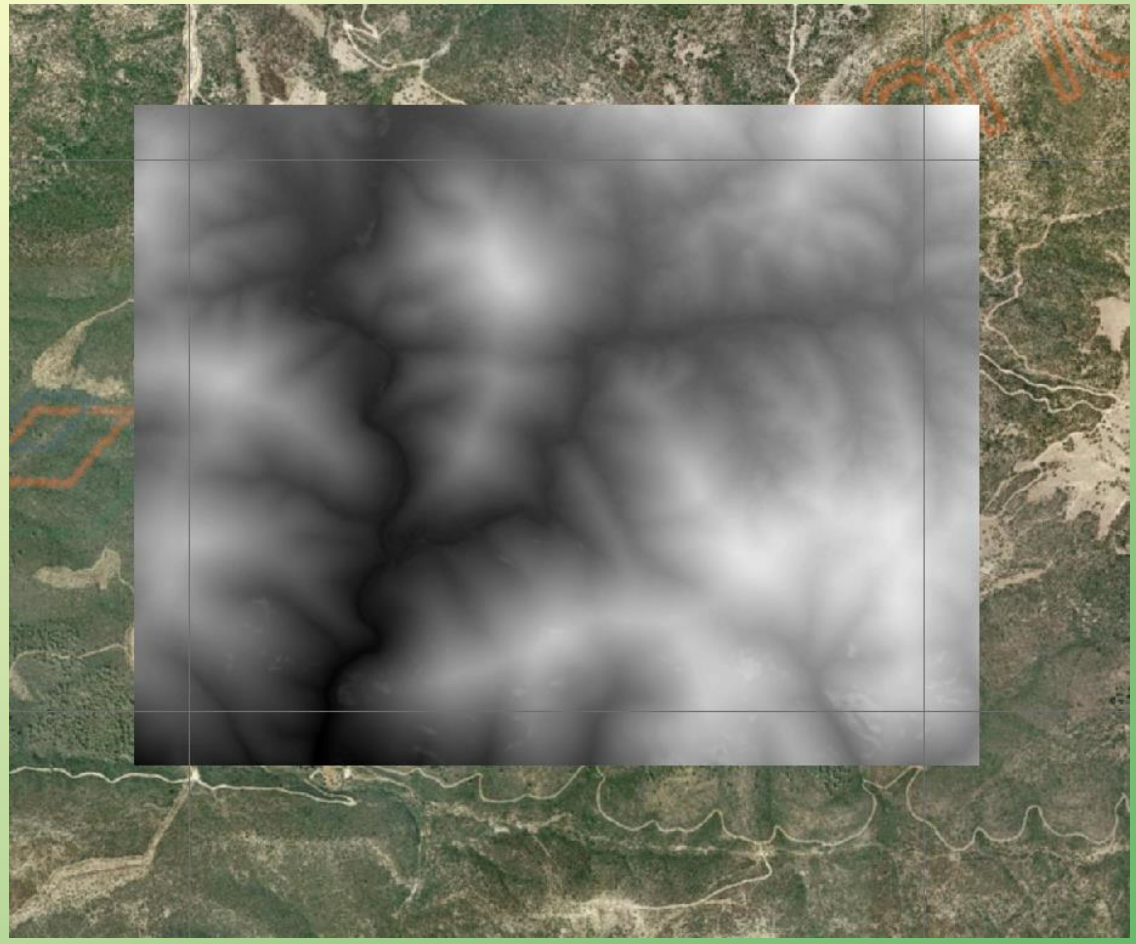
HTRS07→ GGRS87



LSO25– orthos (sample)

LSO25 vs. previous LSO basemap (0.50m)

LSO25 – DEM (sample)



LSO25 Quality Assurance

Quality Control for LSO25(QC_LSO25)

Jan 2016 – June 2016 (expected)

FGDC National Standard for Spatial Data Accuracy

- Outsourced QC: "**QC_LSO25"**
- ~170 k €
- Project to be completed within 6,5 months

Two groups with separate tasks:

Spatial Accuracy QC

- Horizontal Accuracy
- Heights (DEM)

Image & DEM QC

Radiometry

Image Quality (Features)

In-house

✓ **Completeness of deliverables**

(Fully automated procedure)

✓ **Check of contractors' QAR's**

(manual procedure)

✓ **Part of Spatial Accuracy QC**

LSO25 Quality Assurance

Quality Control for LSO25(QC_LSO25)

Jan 2016 – June 2016 (expected)

"QC_LSO25"

Key-challenges:

- tight time schedule- rearrangement of initial project team
- extensive field work in winter
- QC of QC-LSO25 (!)
- fast evaluation and feedback to LSO25
- quick correction, reporting and re-submission planning

Positional accuracy – LSO25

✓ **Orthophoto Positional accuracy**

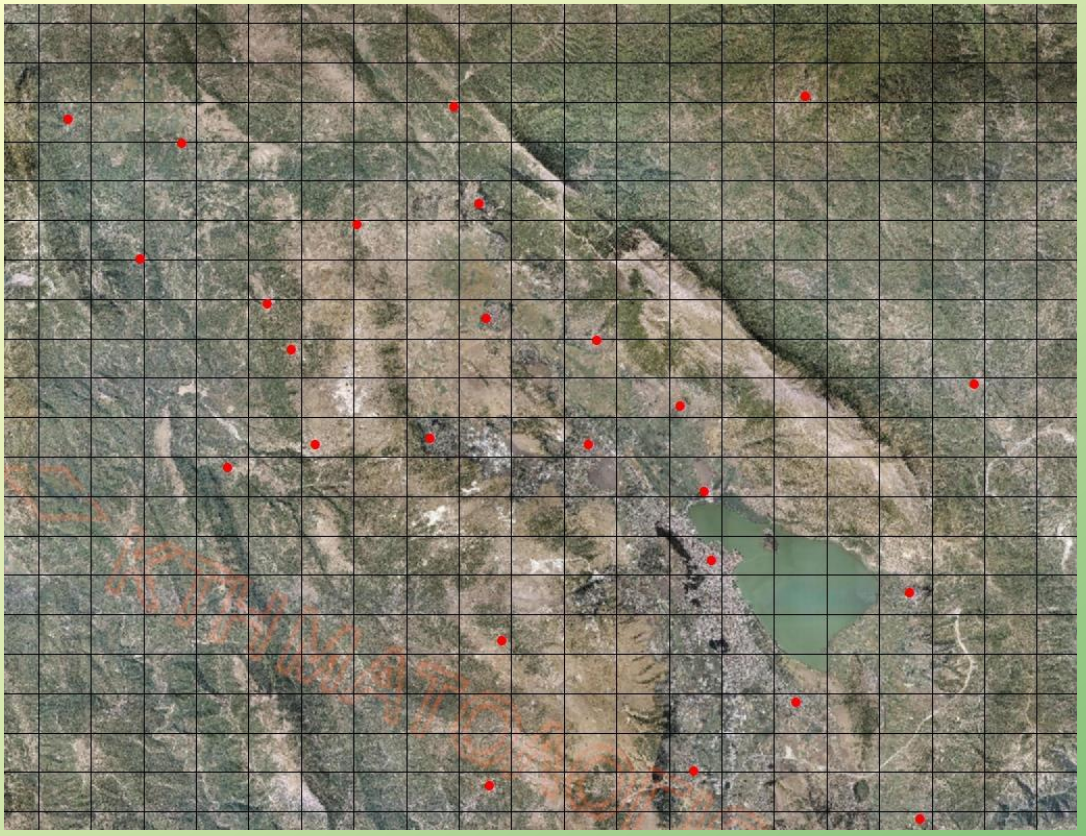
(Fully manual qc procedure)

1. *QC_LSO25: 2500 check points*
2. *In-house: ~2200 check points*

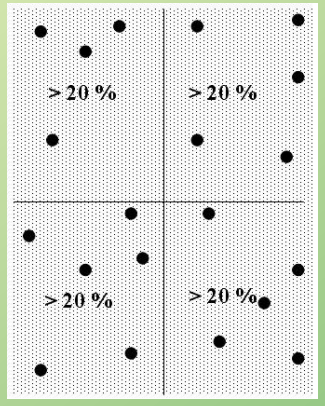
1. **QC-LSO25:**

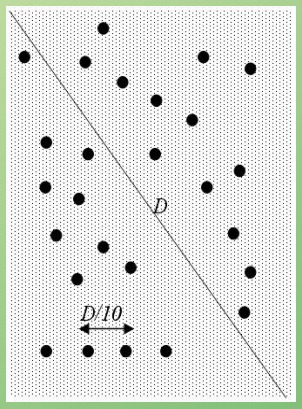
- planning and data preparation
- urban settlements/ constructed features
- road networks
- choice of approximate positions on orthos
- static & RTK (RS, VRS) positioning

Positional accuracy – sampling



Optimal Sampling distribution





- Point density: 2-3 km
- 200 m buffer zone

Positional accuracy – LSO25

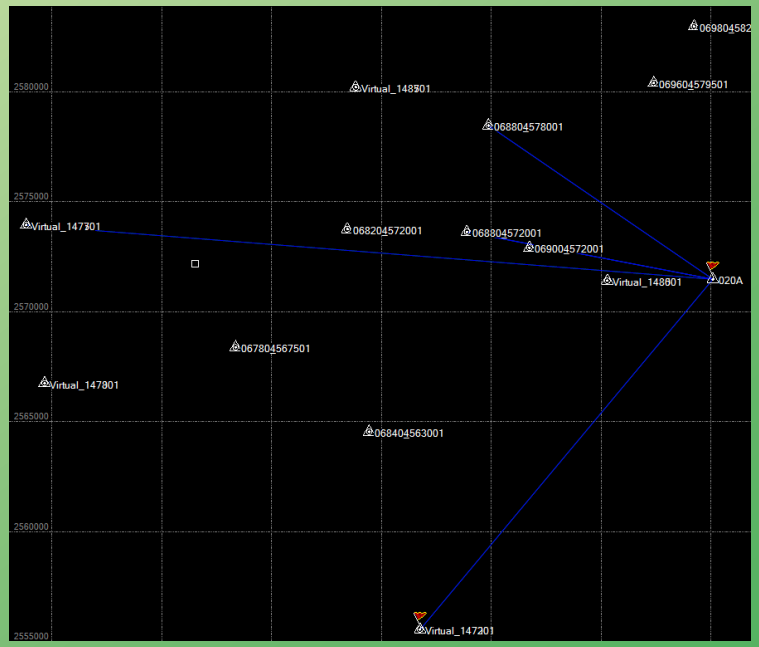
✓ **Orthophoto Positional accuracy**

(Fully manual qc procedure)

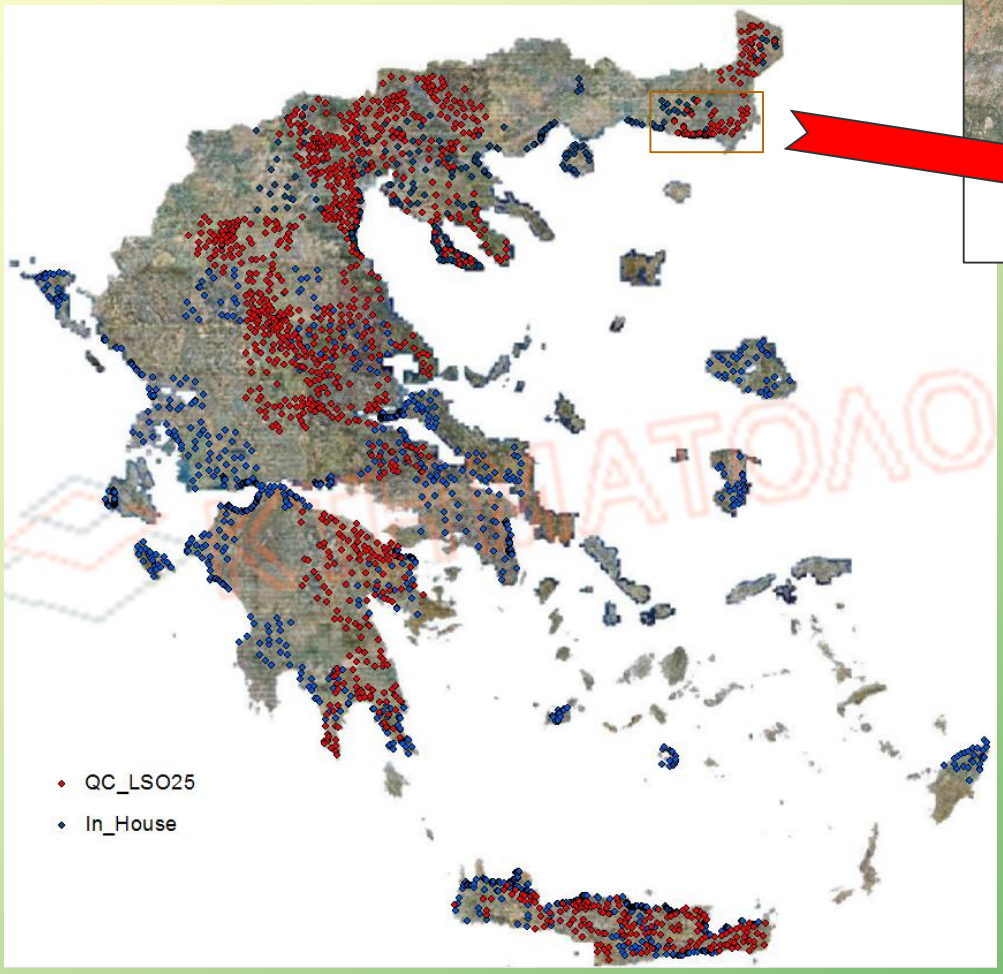
In-house: ~2200 check points

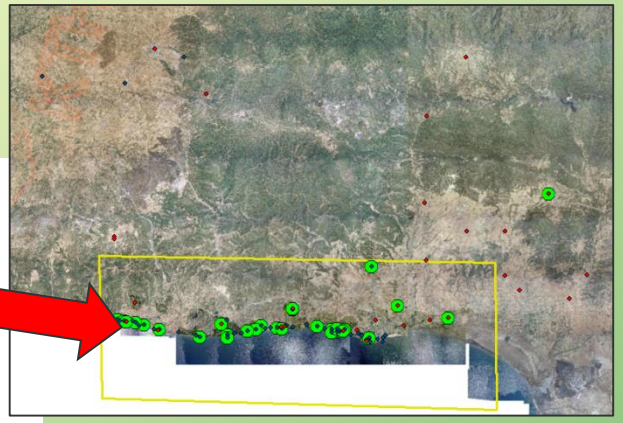
2. In-House:

- Control Points of past projects
- HTRS07 or other ITRF realizations
- recalculation of reference points using stored HEPOS rinex data (2008-2009)
- ~85% traced and utilized in LSO25 images
- Trimble Business Center v.2.0, ArcMap v.10.0



Positional accuracy – LSO25





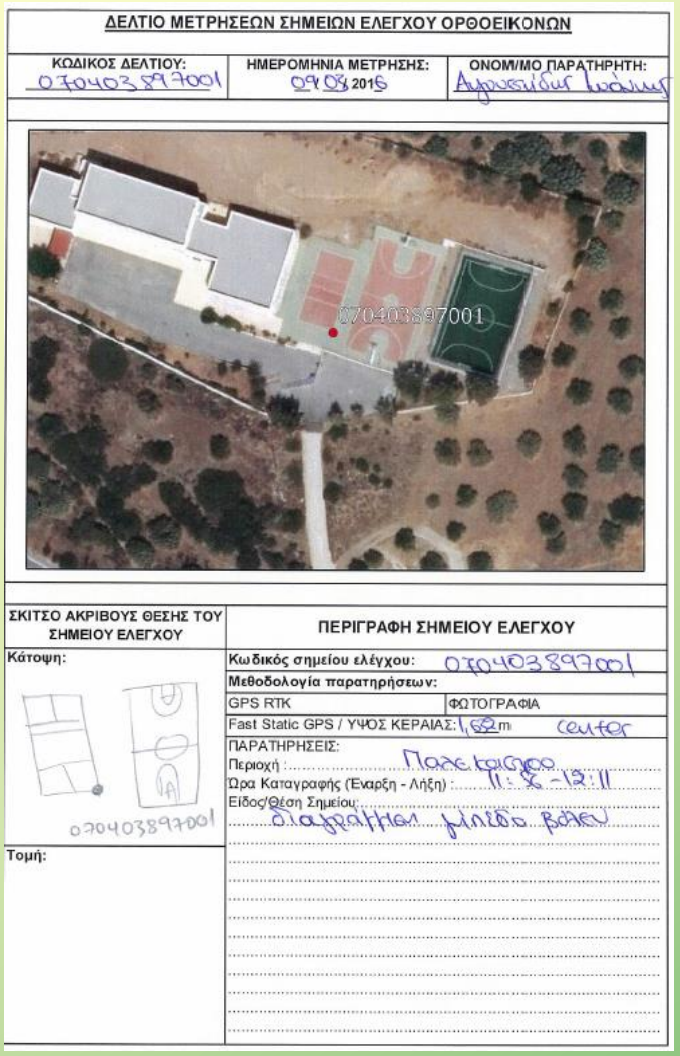
identification of systematic errors (aero triangulation, nr. of GCP)

RMSEx, RMSEy <= 0.25 m

RMSExy <= 0.35 m

Abs. Accuracy <= RMSExy*1.73m = 0.60m (2σ)

Positional accuracy – documentation & results

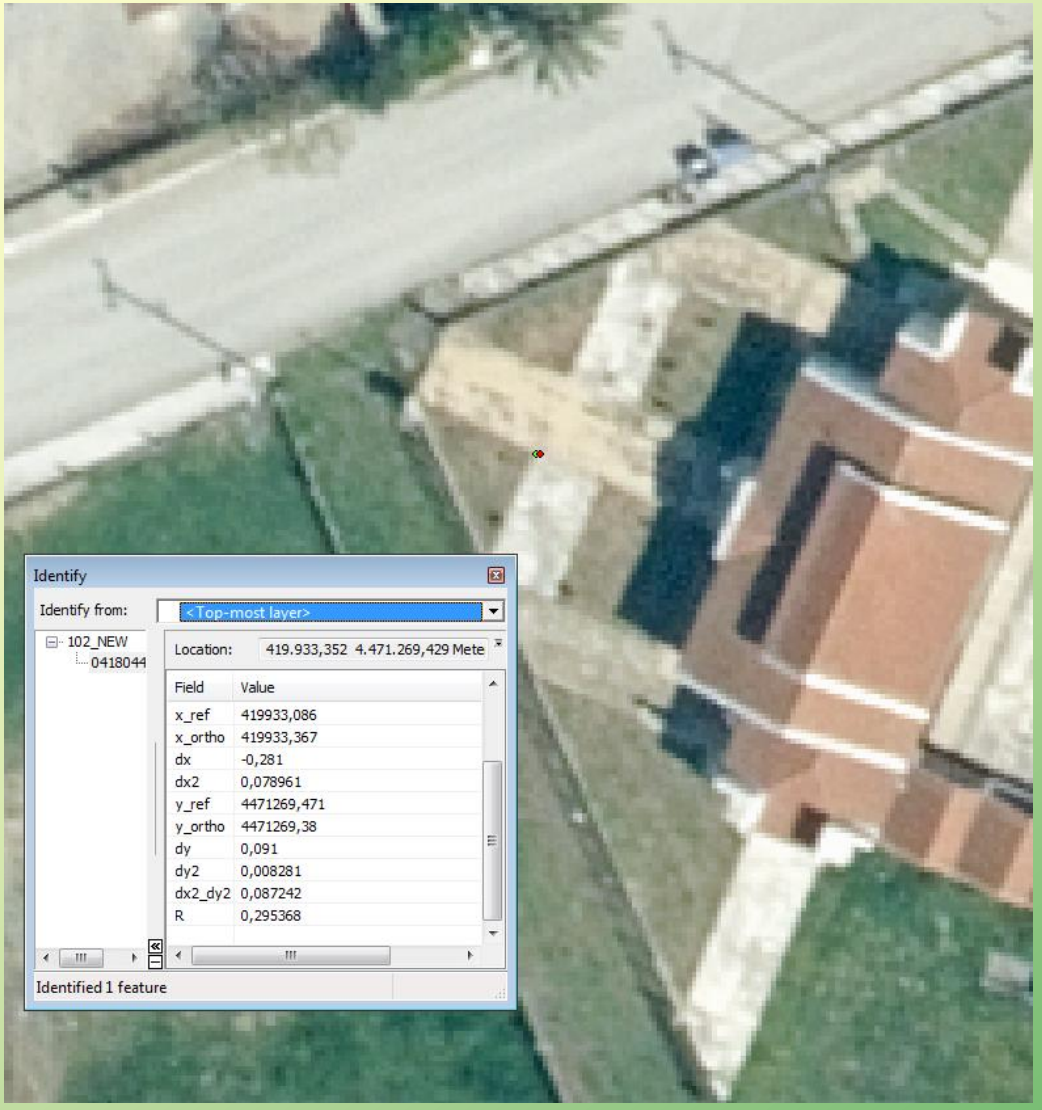


ΔΕΛΤΙΟ ΜΕΤΡΗΣΕΩΝ ΣΗΜΕΙΩΝ ΕΛΕΓΧΟΥ ΟΡΘΟΕΙΚΟΝΩΝ

ΚΩΔΙΚΟΣ ΔΕΛΤΙΟΥ:	ΗΜΕΡΟΜΗΝΙΑ ΜΕΤΡΗΣΗΣ:	ΟΝΟΜ/ΜΟ ΠΑΡΑΤΗΡΗΤΗ:
07040389700 1	09/08/2016	Αμβροσιάδης Ιωάννης

ΣΚΙΤΣΟ ΑΚΡΙΒΟΥΣ ΘΕΣΗΣ ΤΟΥ ΣΗΜΕΙΟΥ ΕΛΕΓΧΟΥ	ΠΕΡΙΓΡΑΦΗ ΣΗΜΕΙΟΥ ΕΛΕΓΧΟΥ
Κάτοψη:	Κωδικός σημείου ελέγχου: 07040389700 1
	Μεθοδολογία παρατηρήσεων:
	GPS RTK / ΦΩΤΟΓΡΑΦΙΑ
	Fast Static GPS / ΥΨΟΣ ΚΕΡΑΙΑΣ: 1,62 m center
	ΠΑΡΑΤΗΡΗΣΕΙΣ:
	Περιοχή: Παλαιόκαστρο
	Ώρα Καταγραφής (Έναρξη - Λήξη): 11:8 - 12:11
	Είδος/Θέση Σημείου: διαγράμμιση μπάσκετ βόρεια
Τομή:	

Positional accuracy – documentation & results



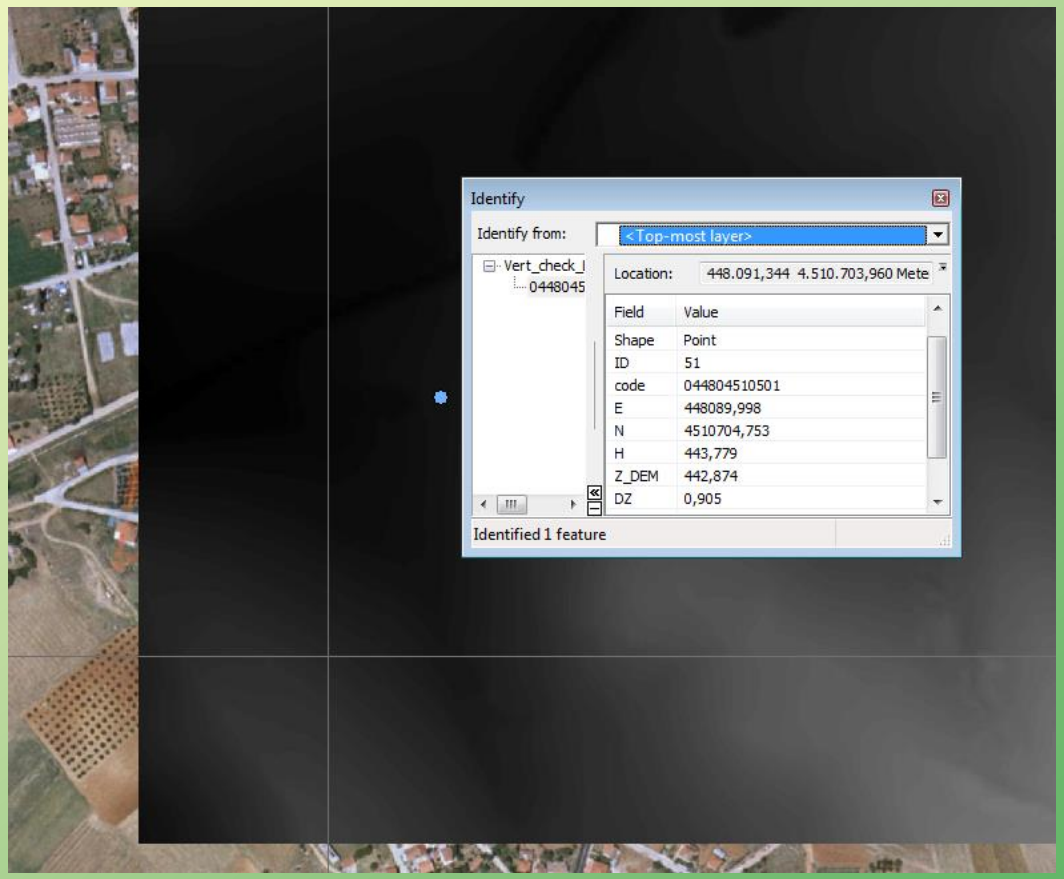
ΠΙΝΑΚΑΣ ΟΡΙΖΟΝΤΙΟΓΡΑΦΙΚΟΥ ΕΛΕΓΧΟΥ ΠΑΡΑΔΟΤΕΩΝ

A	B	C	D	E	F	G	H	I	J	K
Αριθμός σημείου	Περιγραφή Σημείου	X Ανεξάρτητο	X Υπόβαθρου	ΔX	ΔX²	Y Ανεξάρτητο	Y Υπόβαθρου	ΔY	ΔY²	ΔX²+ΔY²
1	066603874501	667294,118	667294,050	0,07	0,00462	3875672,845	3875672,967	-0,12	0,014884	0,01951
2	066803879001	668204,805	668204,735	0,07	0,0049	3880073,784	3880073,729	0,06	0,003025	0,00793
3	067003879001	671819,824	671819,751	0,07	0,00533	3880494,860	3880494,890	-0,03	0,0009	0,00623
4	067403879001	674209,688	674209,612	0,08	0,00578	3880293,073	3880293,404	-0,33	0,109561	0,11534
5	067603877501	677765,047	677764,967	0,08	0,0064	3878030,060	3878030,121	-0,06	0,003721	0,01012
6	067603882001	676950,262	676950,410	-0,15	0,0219	3883294,486	3883294,502	-0,02	0,000256	0,02216
7	067803882001	679648,432	679648,435	0,00	9E-06	3882181,730	3882181,949	-0,22	0,047961	0,04797
8	068603882001	686368,826	686368,930	-0,10	0,01082	3883002,393	3883002,675	-0,28	0,079524	0,09034
9	068603885001	687547,144	687547,144	0,00	0	3886348,601	3886348,470	0,13	0,017161	0,01716
10	068003877501	681863,248	681863,258	-0,01	0,0001	3878960,010	3878960,194	-0,18	0,033856	0,03396
11	056003912001	560837,537	560837,470	0,07	0,00449	3912921,567	3912921,615	-0,05	0,002304	0,00679
12	056003915001	561489,222	561489,184	0,04	0,00144	3915359,546	3915359,627	-0,08	0,006561	0,008
13	056203910501	562486,955	562486,978	-0,02	0,00053	3911098,768	3911098,928	-0,16	0,0256	0,02613
14	056203913501	563869,751	563869,734	0,02	0,00029	3914059,707	3914059,505	0,20	0,040804	0,04109
15	056603910501	566131,114	566130,958	0,16	0,02434	3910819,980	3910820,011	-0,03	0,000961	0,0253
16	052003892501	521637,085	521636,989	0,10	0,00922	3893066,860	3893067,037	-0,18	0,031329	0,04055
17	052803894001	528399,676	528399,686	-0,01	0,0001	3895241,670	3895241,737	-0,07	0,004489	0,00459
18	053003898501	531033,949	531033,921	0,03	0,00078	3899336,643	3899336,675	-0,03	0,001024	0,00181
19	053203904501	533007,674	533007,589	0,08	0,00722	3905768,719	3905768,759	-0,04	0,0016	0,00882
20	053403898501	534611,228	534611,236	-0,01	6,4E-05	3898966,803	3898966,715	0,09	0,007744	0,00781
21	041004084501	410357,516	410357,444	0,07	0,00518	4085678,855	4085678,970	-0,12	0,013225	0,01841
22	036004093501	360462,619	360462,487	0,13	0,01742	4094656,067	4094656,084	-0,02	0,000289	0,01771
23	036004093502	360980,067	360980,042	0,02	0,00062	4093689,232	4093689,217	0,01	0,000225	0,00085
24	036204093501	363033,415	363033,267	0,15	0,0219	4094508,657	4094508,643	0,01	0,000196	0,0221
25	036404096501	365464,876	365464,690	0,19	0,0346	4097346,725	4097346,920	-0,19	0,038025	0,07262
26	036404098001	364256,799	364256,839	-0,04	0,0016	4099318,781	4099318,637	0,14	0,020736	0,02234
27	037404108501	374427,892	374427,755	0,14	0,01877	4109790,251	4109790,498	-0,25	0,061009	0,07978
28	037604098001	377246,007	377246,020	-0,01	0,00017	4098408,537	4098408,481	0,06	0,003136	0,0033
29	037804104001	379258,592	379258,587	0,01	2,5E-05	4105513,464	4105513,718	-0,25	0,064516	0,06454
30	038004113001	381421,598	381421,549	0,05	0,0024	4114390,907	4114390,819	0,09	0,007744	0,01014
31	038404111501	385678,524	385678,525	0,00	1E-06	4112914,256	4112914,253	0,00	9E-06	1E-05
			Μέσος Όρος ΔX	0,04			Μέσος Όρος ΔY	-0,06		
			RMSEx	0,200644			RMSEy	0,24841		
									Άθροισμα	0,85341
									Μέσος Όρος	0,02753
									RMSExy	0,16592
									Ακρίβεια	0,28717

- 15/4/2016: ~ 1200 points in 4 months

Vertical accuracy – DEM

- Orthometric heights of control points vs. DEM pixel values
- Level locations, not buildings



RMSEz<= 0.70 m

Abs. Accuracy <= RMSEz*1.73m = 1.47m (2σ)

QC – image visual quality

Evaluation method**: Full Inspection**

✓ **Orthophoto visual checks –QC_LSO25**

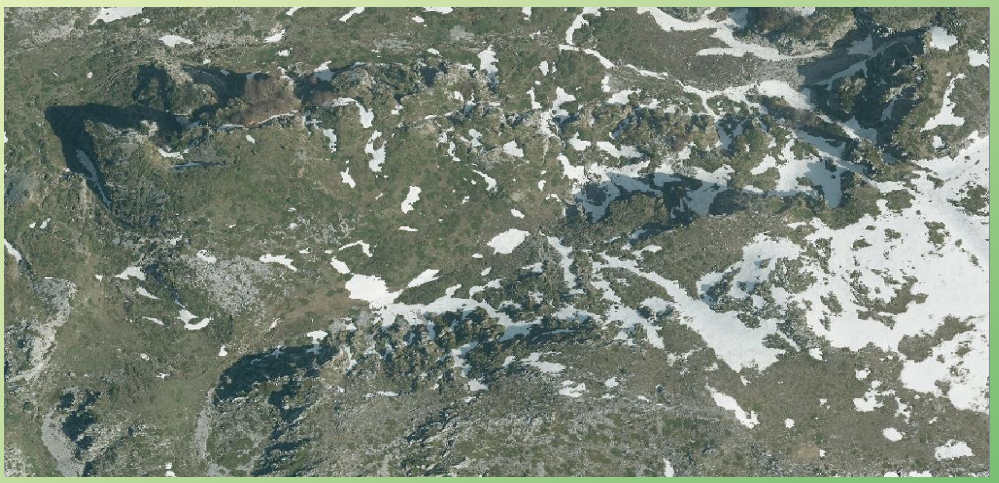
(complete manual inspection of LSO25 dataset)

- Artifacts, shades/clouds, snow, smoke,…)
- Orthorectification issues (smears, wavy features, …)
- Radiometric issues (blur, hue, saturation…)
- Image connection/continuation problems (geometric & radiometric)
- Block connection problems (geometric & radiometric)

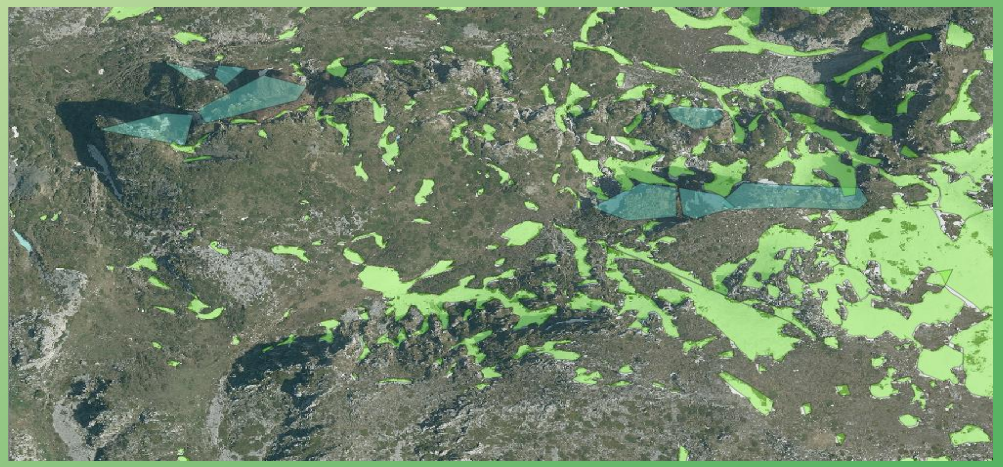
also

- Land coverage (different flight epochs)
- Connection between contracts (LSO25)

+ quality in processing of classified areas



Snow & wavy features



QC – image visual quality (2)

discontinuity

Smoke, cloud shadow

Different contractors- radiometry

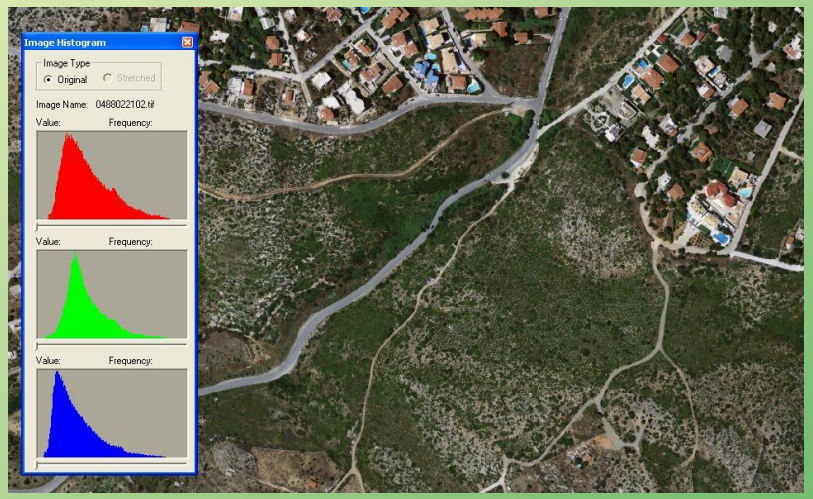
QC – radiometry check

✓ **Orthophoto Radiometry checks**

(Fully automated procedure)

Checking for

- Nr of bands
- Nr of lines
- Nr of samples per line
- Mean histogram value
- Standard deviation
- Saturation (values 0 & 255)
- Values width >=230

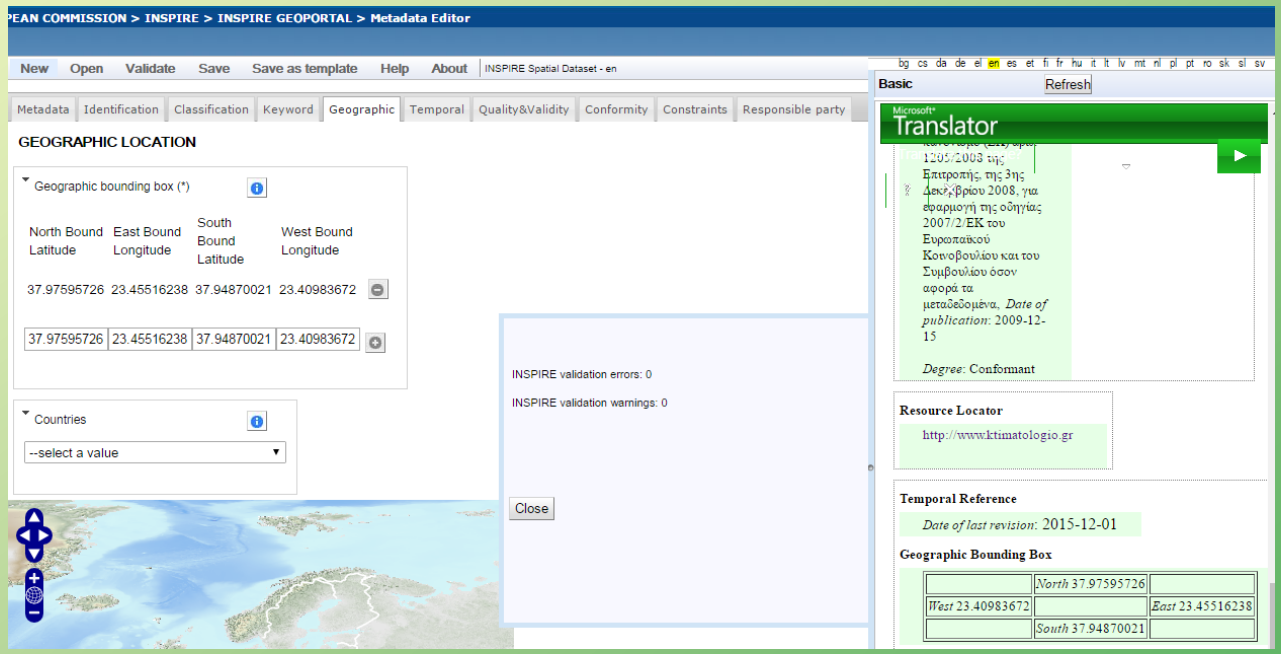


QC-LSO25: customized SW

Evaluation method**: Full Inspection**

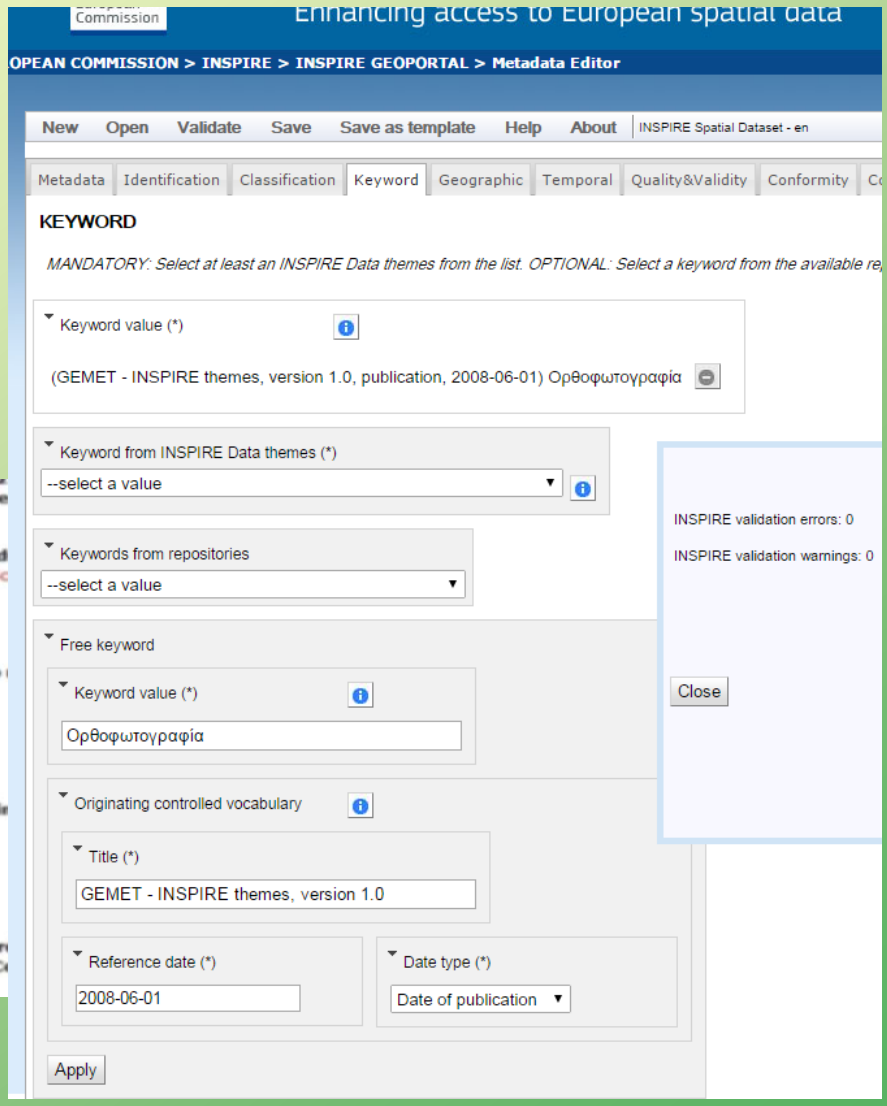
Metadata

- Open Data/NSF/ Inspire requirements
- Generation of Metadata for Orthos, DEM, aerial photos
- Vector data: UML diagrams, GML generation
- Contractor->NCMA SA communicational schema
- Validation using Inspire Metadata Editor



Metadata

- Validation using Inspire Metadata Editor
- Aerial Photos-no keyword / not valid
- Reference system definition- external
- Necessity of a fully open, functional tool



Thank you!

Any questions or comments?

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