Maussane campaign September 2011 orthoimages

Beata Hejmanowska

Recommendation for orthoimages validation

- Wikicap JRC

Data and methodology

Orthoimagery

- Existing in JRC: WV2, GE1 (0,5m)
- New Bing utlracamm xd (0,30 m)
- UAV (SKYMAGING) – (0,10/0,20 m)

mini/small UAVs

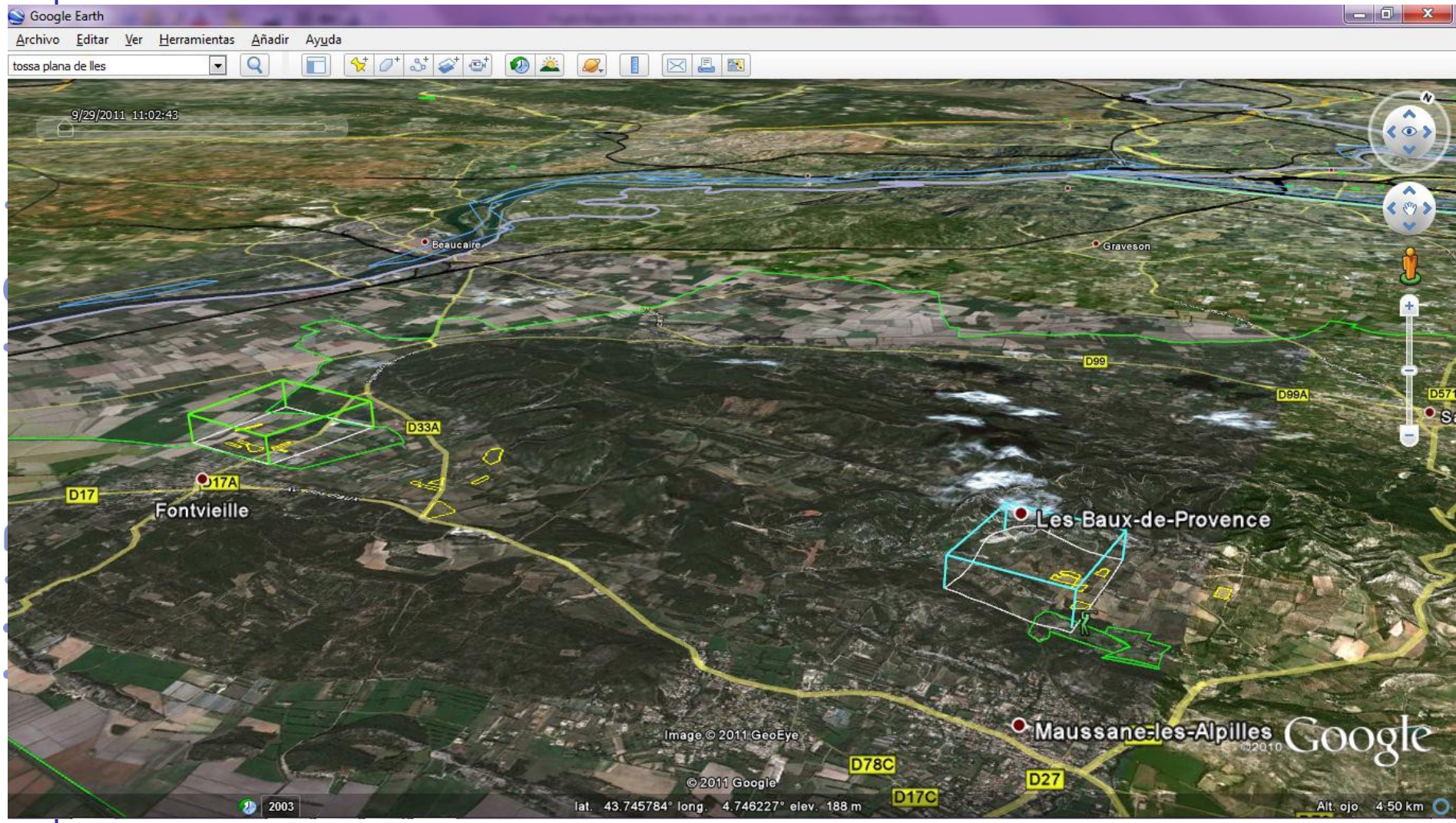
- **miniUAVs (aprox. 2 kg)**
- material sintético ligero
- autopiloto
- 500 gr. carga útil
- autonomía 1 hora (max. 1:30h)
- velocidad crucero 40 km/h, máxima 60 km/h
- lanzamiento manual. No necesita pista de aterrizaje

- **smallUAVs (6-13kg)**
- material fibra
- autopiloto
- 1.5-3 kg carga útil
- autonomía 2 hora (max. 3h)
- velocidad crucero 60 km/h, máxima 100 km/h
- lanzamiento con catapulta. No necesita pista de aterrizaje

Trabajamos con las plataformas ligeras más avanzadas del mercado, donde integramos los sensores de imagen, y la electrónica de navegación y posicionamiento.

UAU images assumtions

- **Service Requirements**
  - Perform a flight with UAV in order to acquire Very High Resolution images over an area located in the 'Maussane' test site (South of France);
  - Perform the acquisitions between the 15th of July and 15th of August 2011;
  - Acquire images over 2 zones of 1 km2;
  - For each zone, perform one acquisition with 20 cm pixel resolution;
  - Perform the ortho rectification of the 2 images;
  - Deliver the acquired images and corresponding ortho rectified images to the JRC/MARS Unit in *UTM zone 31N ellipsoid WGS84* projection (or one that can be easily re-projected to this projection).
  - Finally:
    - 2 test sites
    - Pixel size10 and 20 cm
    - Fast and standard ortho generation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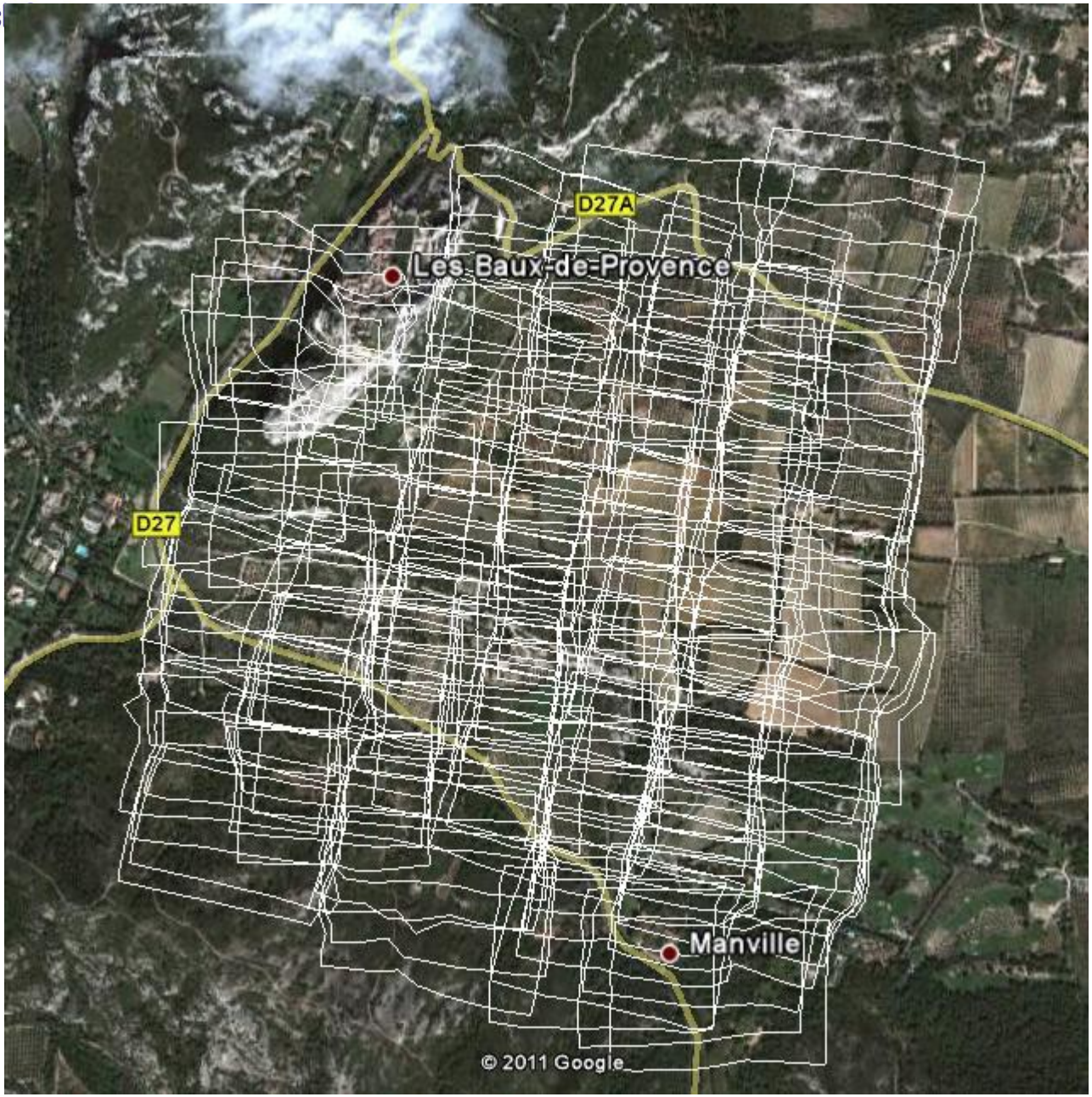
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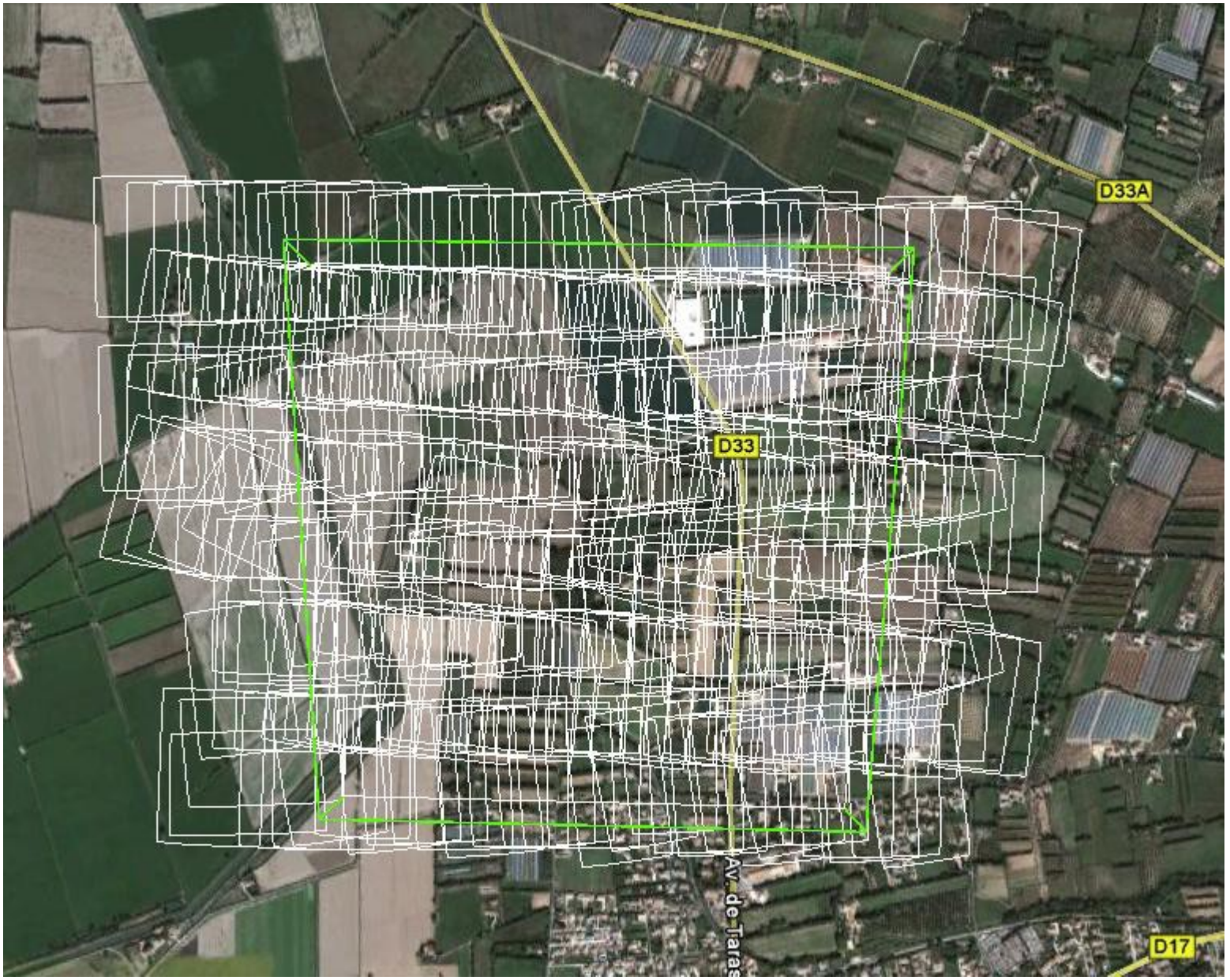
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- The flight lasted about one hour to complete and during the flight a total of 765 images where acquired, of which 546 have been used to generate the two mosaics.
- **Mosaic 1/2:**
  - Location: Maussane les Alpilles, France
  - Longitude / Anchorage: 3500 / 260 m
  - Resolution: 0.05 m/pix
  - Flight altitude: 200 m AGL.

Camera and image acquisition

- Camera model: Samsung NX100
- Optics: Voigtlander Color Skopar 20mm f/3.5 SL II Aspherical
- Image data:
  - Width / Height: 4592 x 3056 pixels
  - Image resolution: 14 Mpx
  - Image format: sRGB
  - Iris aperture: f/3.5
  - Shutter speed: 1/1250 s
  - Focal length (aprox): 30 mm
  - Sensor sensibility: ISO-200
  - Color depth: 24 bit (8 per channel)
  - Pixel size: 5.1µm

Postprocessing

- ***Level 1***
  - This level is generated using automatic mosaicking software that searches for automatic tie points and creates a mosaic without any geo-referencing. This mosaic is geo-referenced in a second stage using ground control points or points measured from an existing map or ortho-photography. The advantage of this method is that it enables a quick turnaround time at a cost of the geometric accuracy. In flat areas and with a good density of ground control points it can generates a map with a few pixels of accuracy.
  - In areas with irregular terrain it can lead into image distortions that are not removed on the geo-referencing process, requiring the proper ortho-rectification step.
- ***Level 2***
  - This level uses the exterior orientation of each image registered from the GPS+IMU systems and performs a traditional aerotriangulation process. The accurate projection centre coordinates and camera attitude is calculated for each image. At this level, ground control points measured with centimetre accuracy are used. Additionally, the terrain relief is corrected by means of a digital elevation model (DEM) that is provided by the customer or can be calculated from the AT.
  - In a first step, tie points between images are detected and ground control points (GCP) are measured. During consecutive steps an aero-triangulation is calculated by means of bundle block adjustment. When the residual of the observations is acceptable an ortho-rectification is performed on each image then an image-mosaic is created.

Delivered material

- Acquired images in JPG format. 14 Mpix resolution
- Level 1 photo-mosaic at 10 and 20 cm/pixel resolution
- Level 2 photo-mosaic at 10 and 20 cm/pixel resolution
- Approximate projection centre of the images in SHP and KMZ
- 3D Flight Track in KMZ format
- GPS coordinates of the ground control points (GCP) measured with RTK GPS

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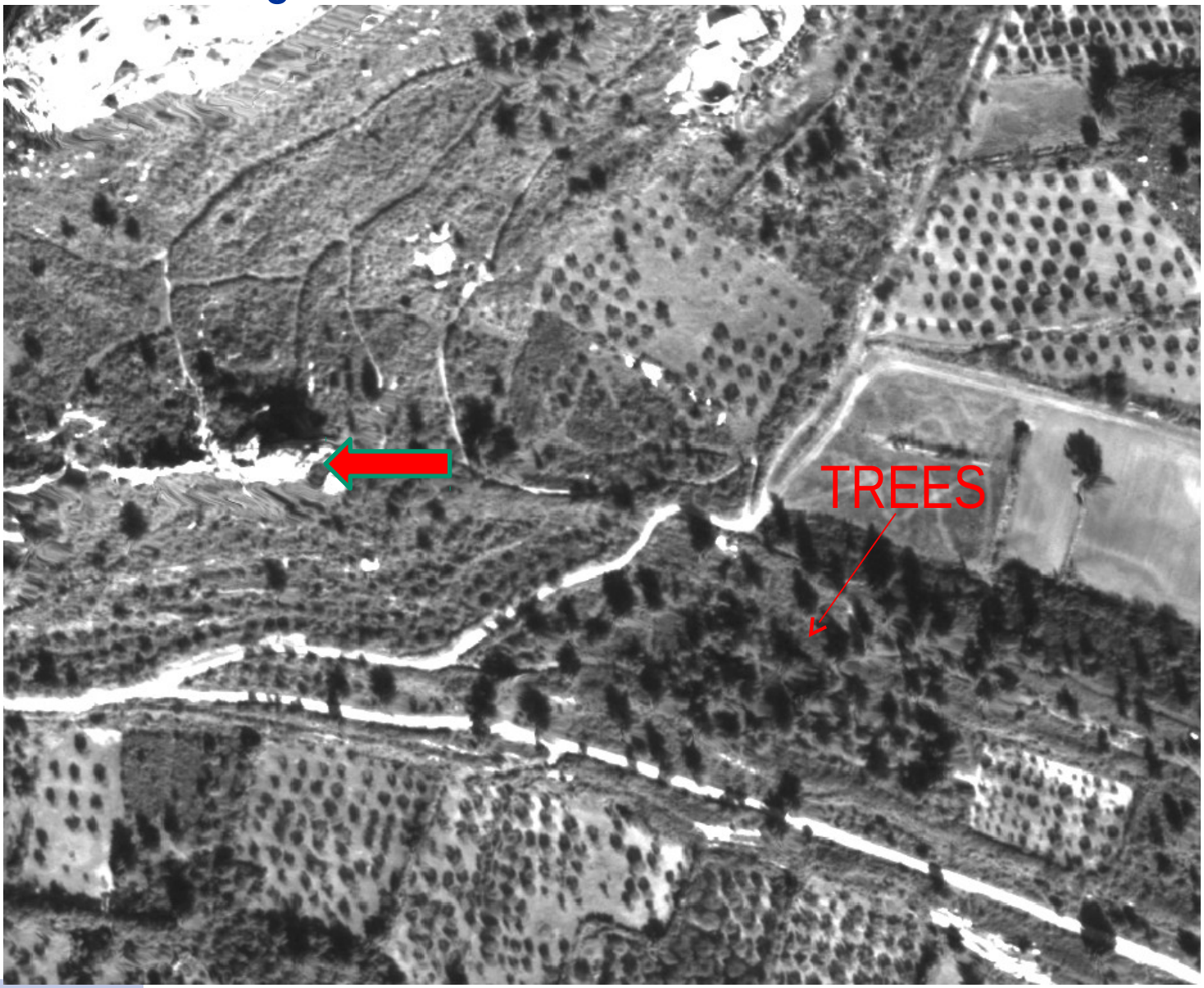
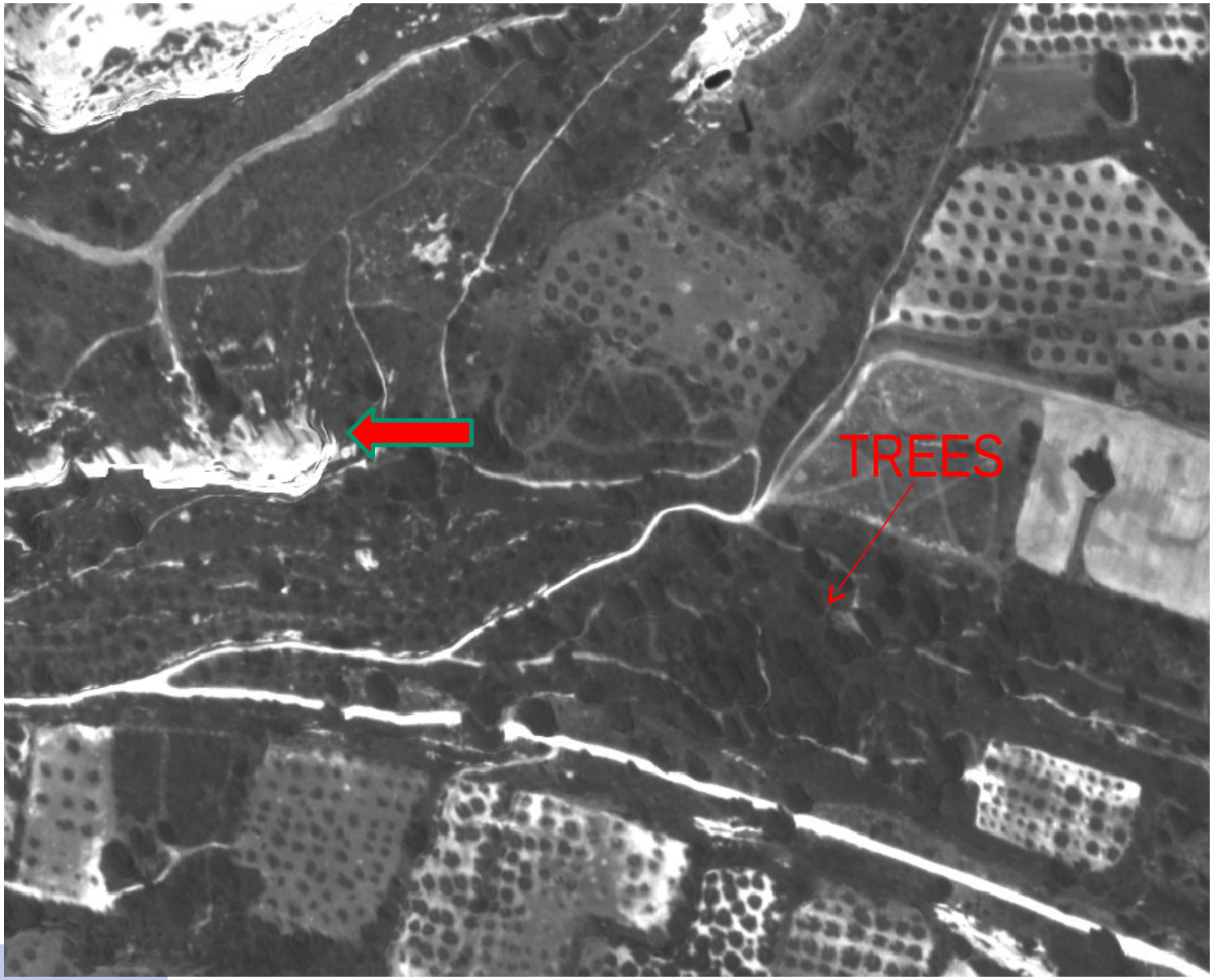
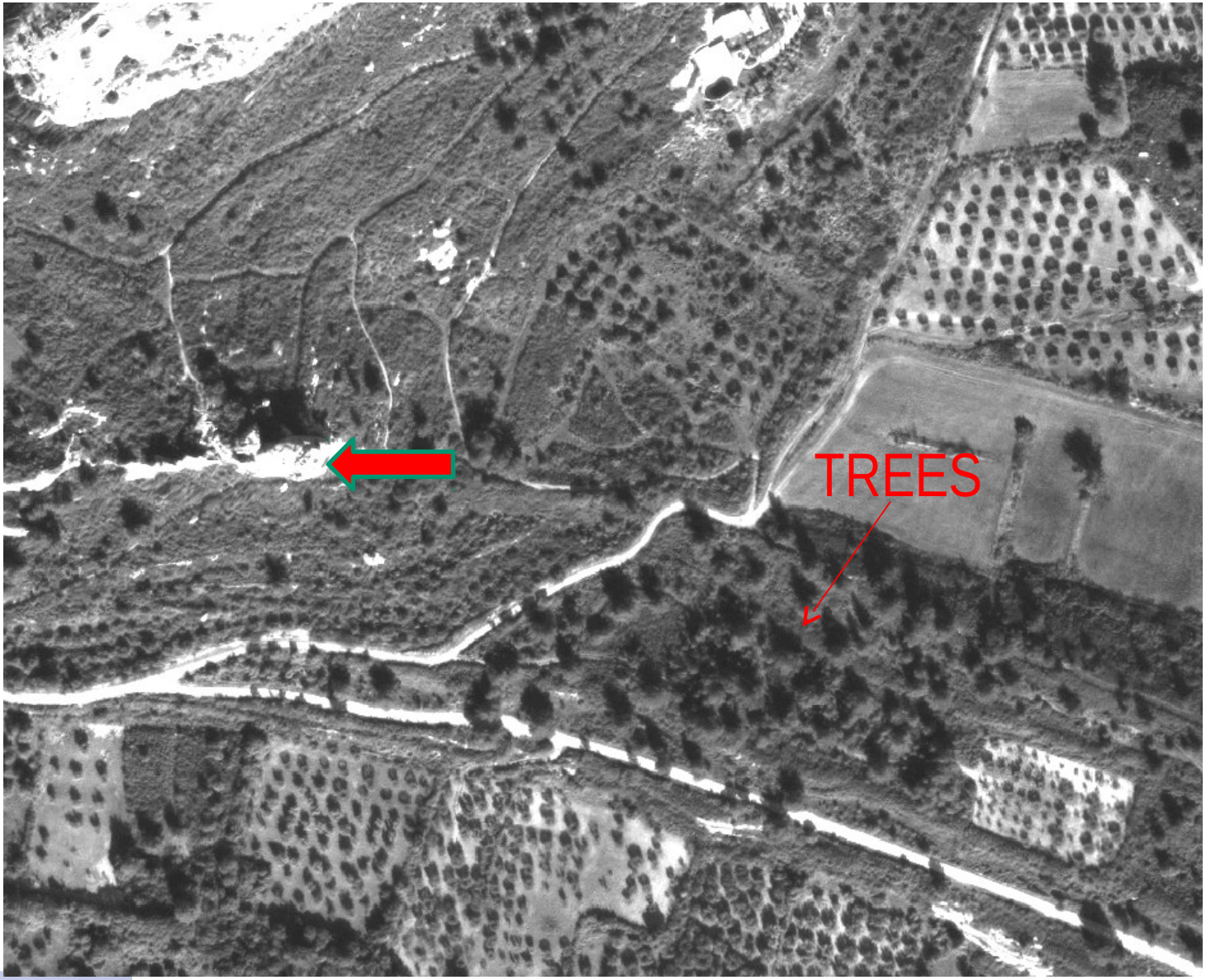
Mausanne VW2_L - zenith angle 21.8 degree, 22.01.2010



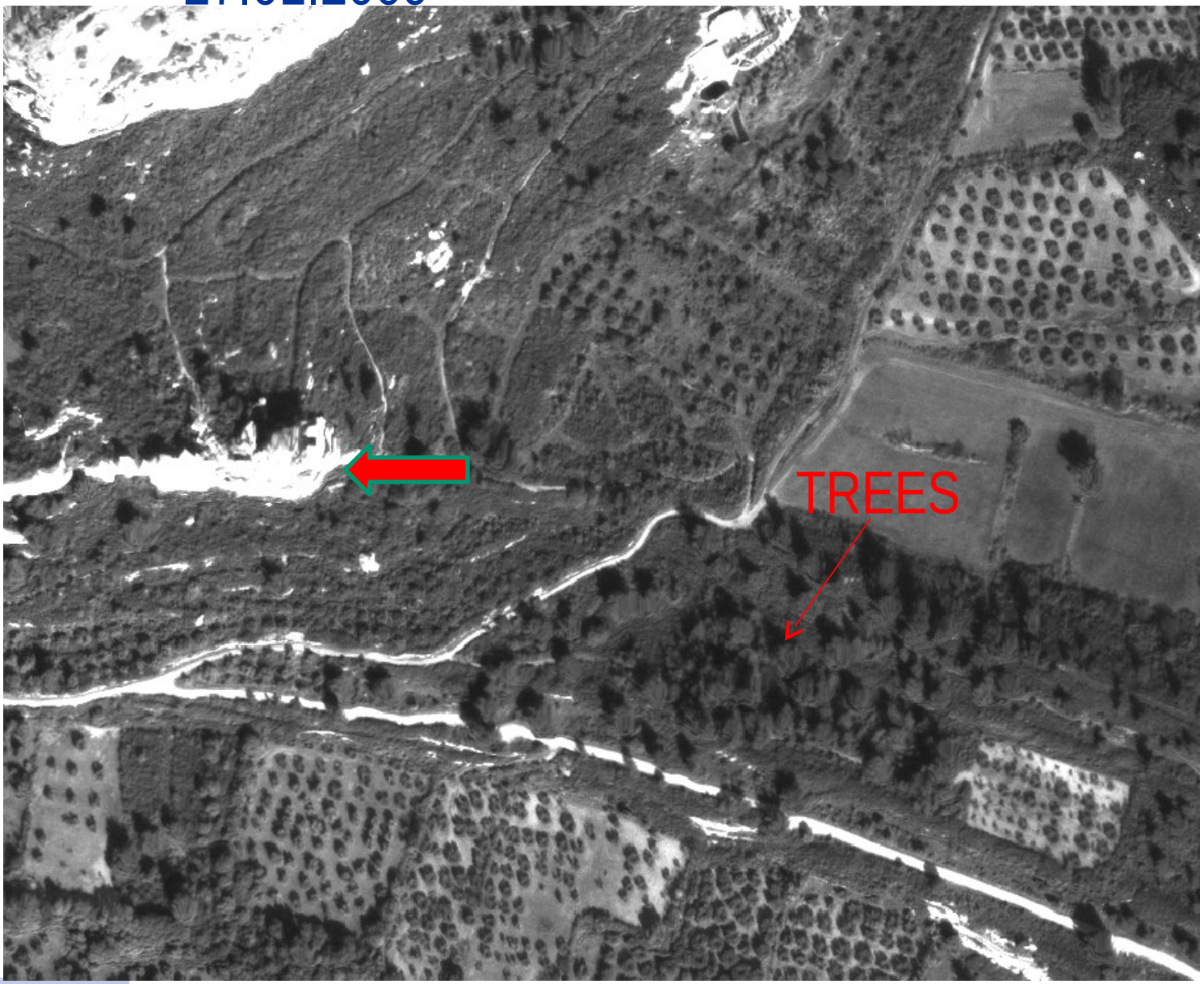
Mausanne VW2_H – zenith angle 35.7 degree, 18.04.2010



Mausanne GE1 – L - zenith angle 8.3 degree, 27.01.2009

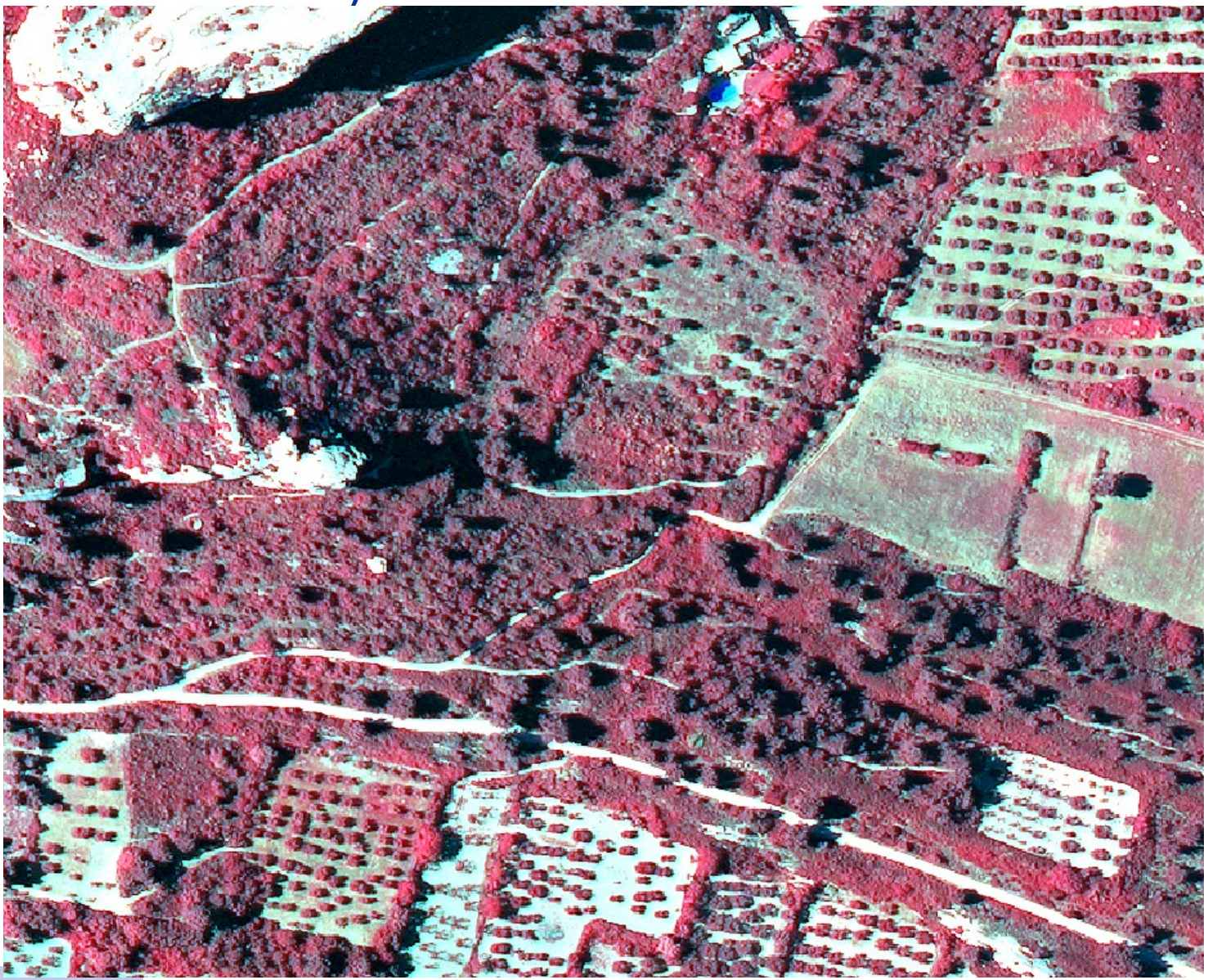


Mausanne GE1 – H - zenith angle 27.6 degree, 27.01.2009



Bing utlracamm xd data for Mausanne (GSD = 0.3 m) RGB

Bing utlracamm xd data for Mausanne (GSD = 0.6 m) CIR



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UAV for Mausanne (GSD = 0.1 m) RGB, campaign September 2011

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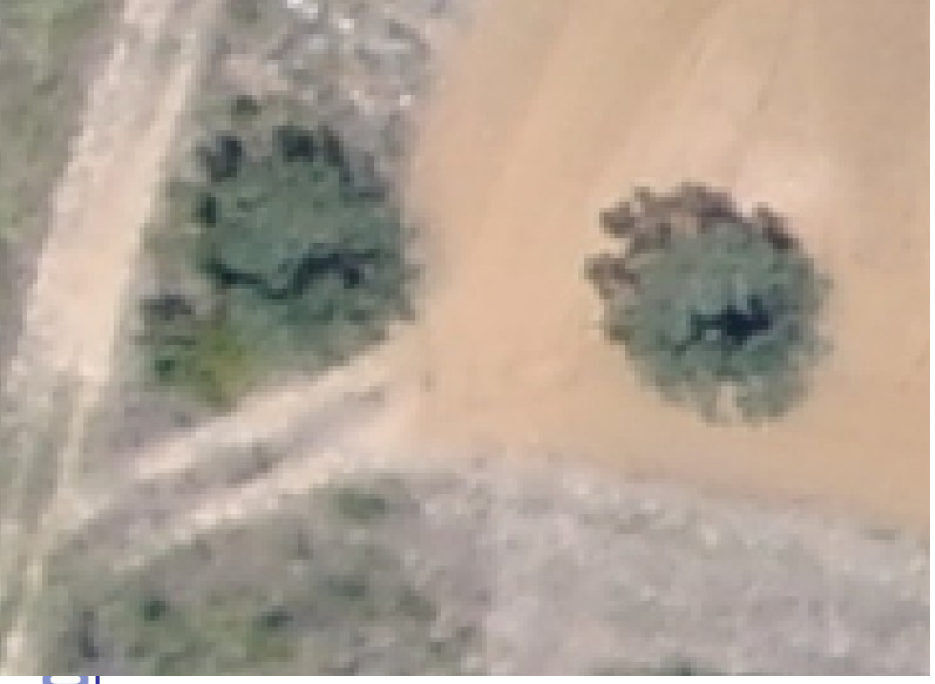
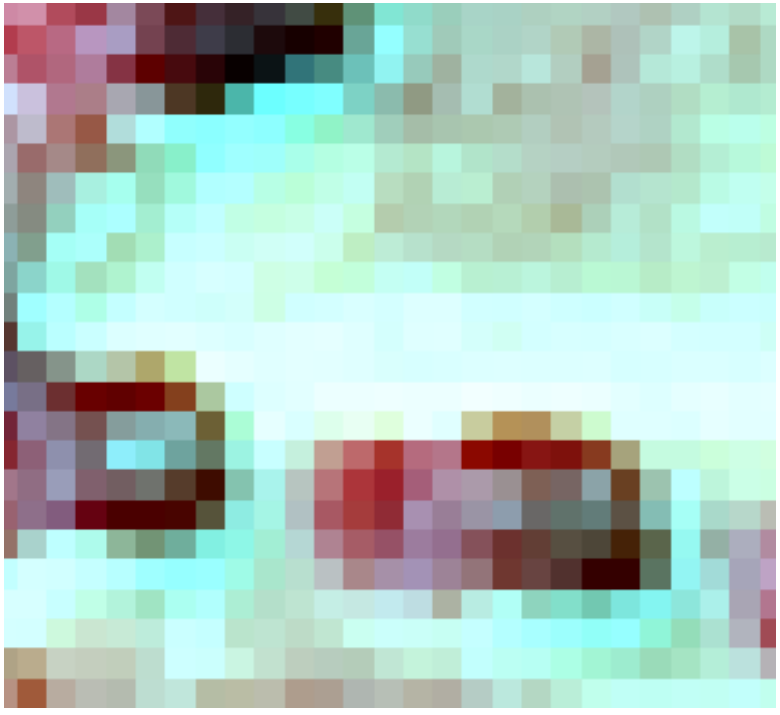
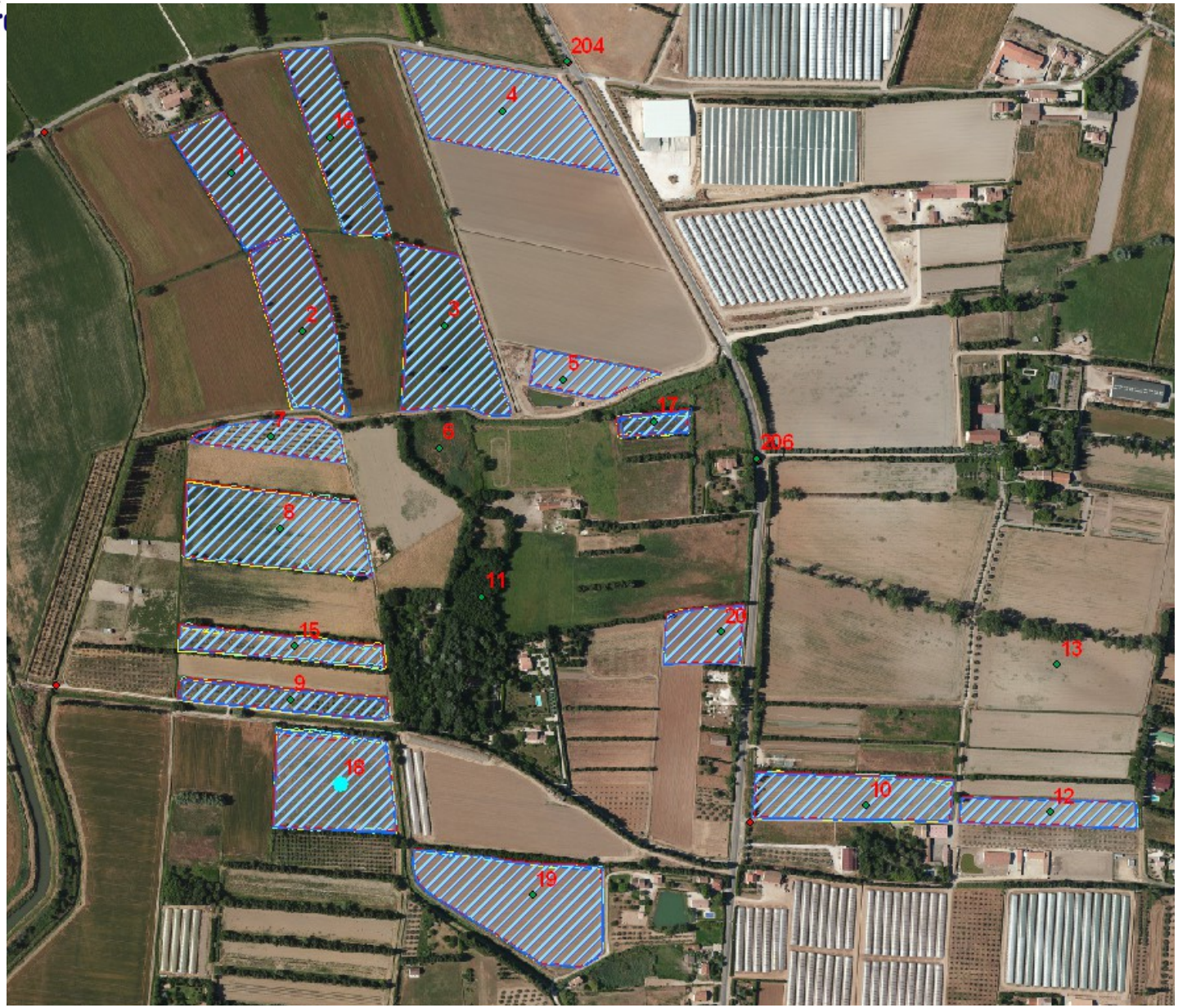
UAV for Mausanne (GSD = 0.2 m) RGB, campaign September 2011



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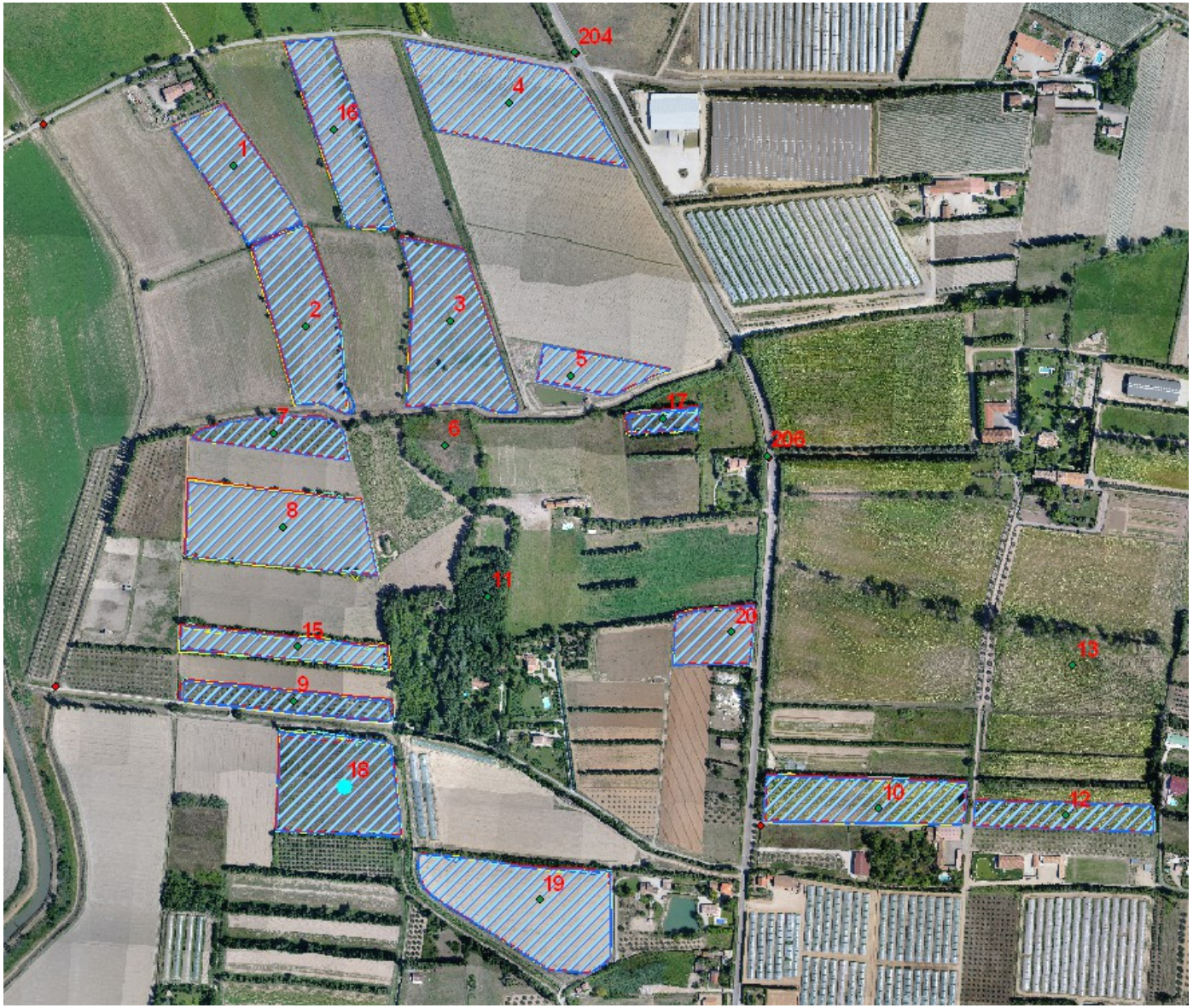
Results of proficiency tests for orthoimagery 0,30m

Id	area	perimeter	RTK area	RTK perim	diff/perim	abs(diff/perim)	diff/perim	abs(diff/perim)	
1	10721,0	455,1	11047	459	0,710	0,71	0,710	0,710	
2	14043,6	548,6	14480	548	0,796	0,80	0,796	0,796	
3	17588,6	604,5	17966	606	0,623	0,62	0,623	0,623	
4	20639,3	662,6	20434	660	-0,311	0,31	-0,311	0,311	
5	5230,0	356,7	5005	356	-0,632	0,63	-0,632	0,632	
7	5919,3	410,8	5756	406	-0,402	0,40	-0,402	0,402	
8	18293,2	602,8	18967	611	1,103	1,10	1,103	1,103	nothing special
9	5288,0	526,8	6294	541	1,860	1,86			wrong border recognition on the image
10	12029,0	572,5	12054	567	0,044	0,04	0,044	0,044	
12	6257,3	475,9	6150	475	-0,226	0,23	-0,226	0,226	
17	1771,1	203,8	2056	217	1,313	1,31			very bad border
18	15465,1	499,4	15062	493	-0,818	0,82	-0,818	0,818	
19	20285,6	618,4	20423	616	0,223	0,22	0,223	0,223	
20	5735,9	304,7	5836	310	0,323	0,32	0,323	0,323	
101	12848,4	461,4	12937	463	0,191	0,19	0,191	0,191	
102	5795,5	301,6	6031	319	0,738	0,74	0,738	0,738	
103	9158,3	407,7	8829	405	-0,813	0,81	-0,813	0,813	
104	2298,1	193,5	2297	197	-0,006	0,01	-0,006	0,006	
105	3860,4	262,6	3806	268	-0,203	0,20	-0,203	0,203	
106	5562,9	387,8	5430	390	-0,341	0,34	-0,341	0,341	
107	3673,4	264,3	3239	254	-1,710	1,71			very bad border
108	6936,2	333,7	6781	331	-0,469	0,47	-0,469	0,469	
109	3048,3	223,4	2962	226	-0,382	0,38	-0,382	0,382	
110	13344,9	574,2	13335	556	-0,018	0,02	-0,018	0,018	
111	1649,3	162,4	1675	168	0,153	0,15	0,153	0,153	
112	4673,1	317,6	4576	320	-0,303	0,30	-0,303	0,303	
				mean	**0,033**		**-0,047**		
				median	**-0,012**		**-0,018**		
				1,96*SD	**1,448**	**1,368**	**1,014**	**0,875**	**Percentile(0,95)**

Difficult parcels on orthoimagery 0,30 m

Difficult parcels on orthoimagery 0,30 m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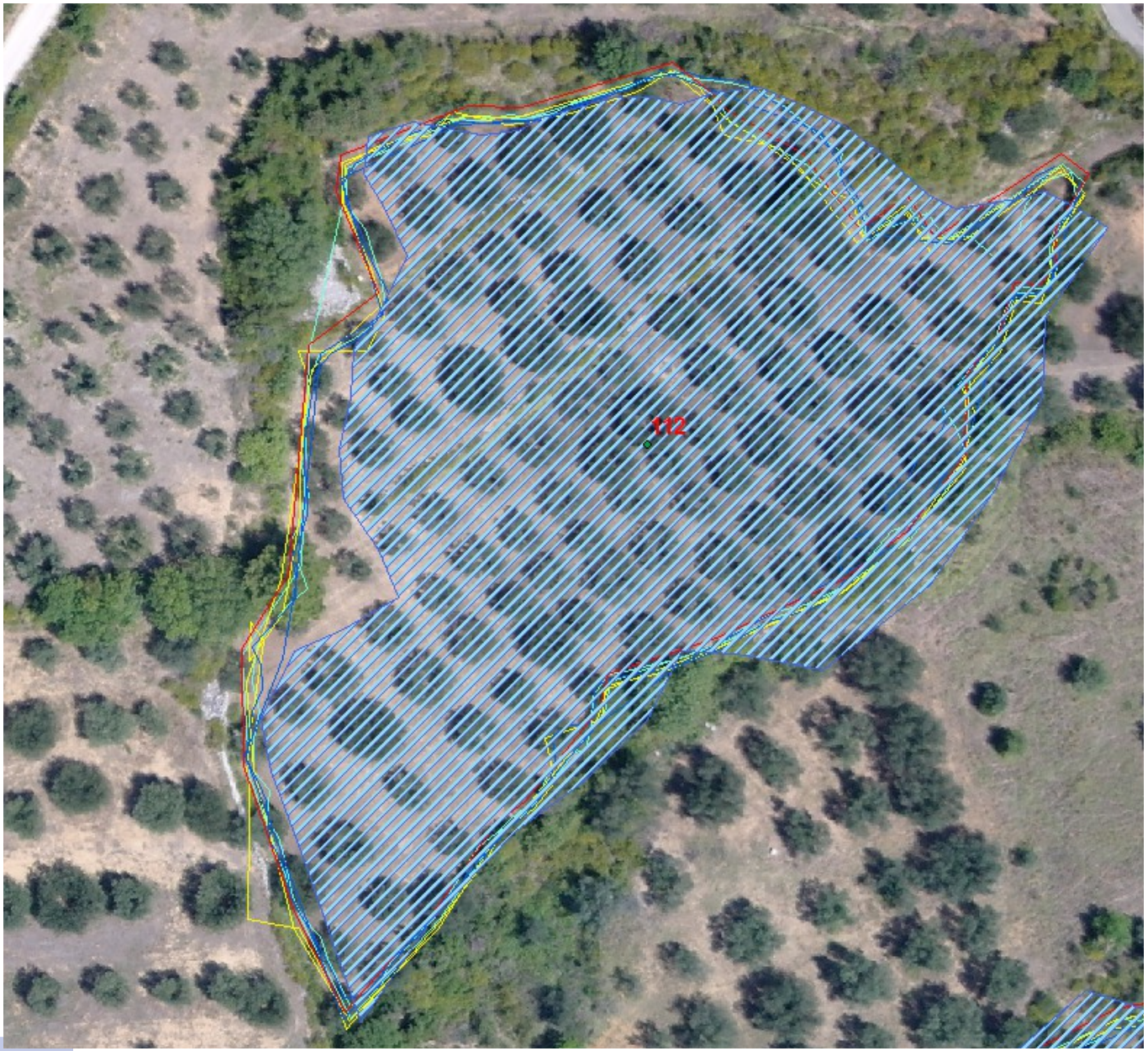
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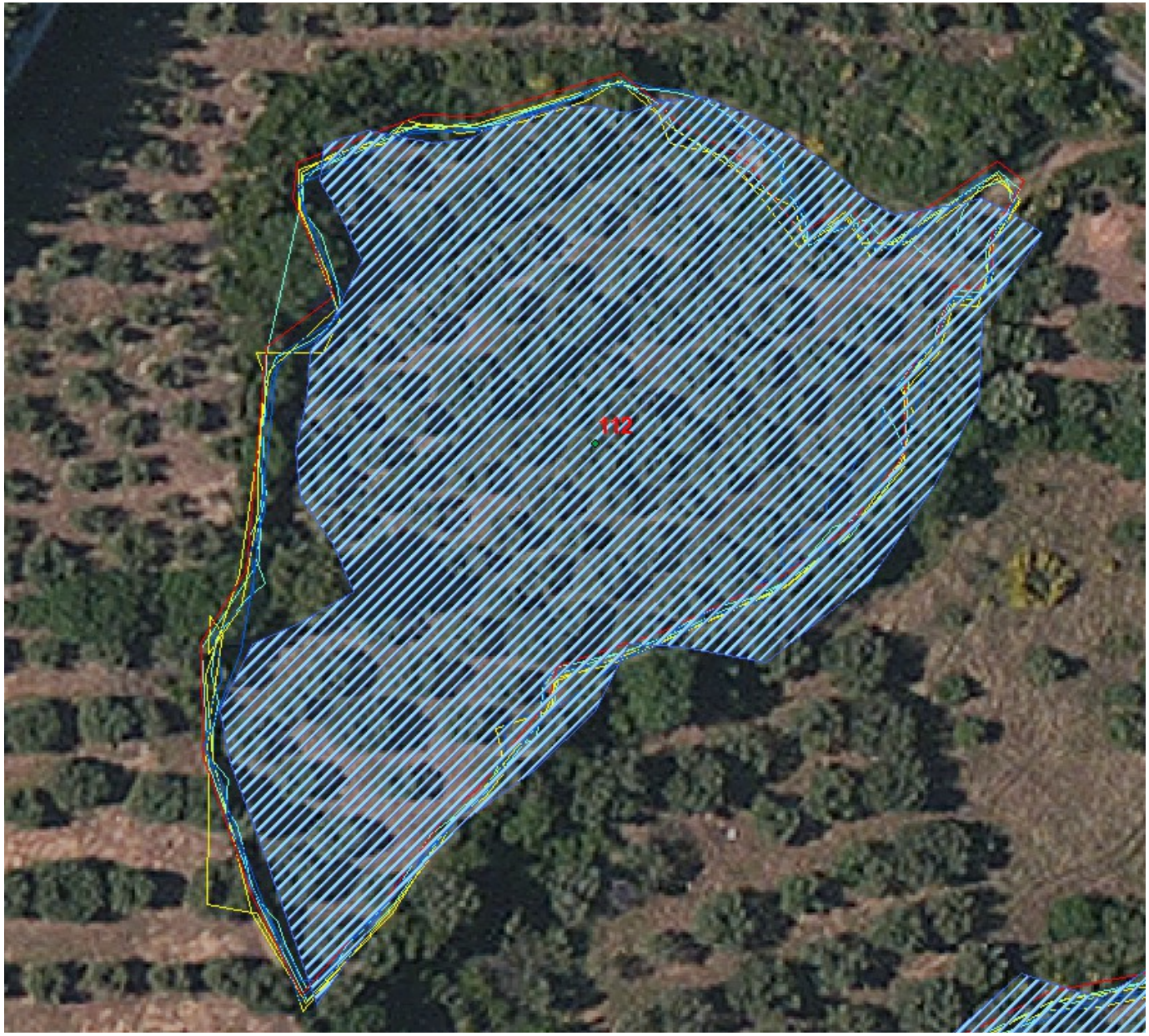
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Results of proficiency tests for orthoimagery 0,20m

	RTK area	RTK perim	diff	buffer	abs(buffer)	
1	11047	459	-207	-0,451	0,451	
2	14480	548	181	0,331	0,331	
3	17966	606	488	0,806	0,806	
4	20434	660	-55	-0,083	0,083	
5	5005	356	151	0,424	0,424	
7	5756	406	-115	-0,283	0,283	
8	18967	611	82	0,134	0,134	trees S N
9	6294	541	-272	-0,502	0,502	
10	12054	567	663	1,170	1,170	
12	6150	475	207	0,435	0,435	
17	2056	217	311	1,432	-	extremelly difficult
18	15062	493	-99	-0,201	0,201	
19	20423	616	-513	-0,833	0,833	
20	5836	310	-122	-0,393	0,393	
101	12937	463	45	0,098	0,098	
102	6031	319	78	0,243	0,243	
103	8829	405	4	0,010	0,010	possibly misunderstanding
104	2297	197	-112	-0,568	0,568	
105	3806	268	-100	-0,374	0,374	
106	5430	390	-71	-0,181	0,181	misunderstanding with pegs
107	3239	254	-201	-0,793	0,793	extremelly difficult
108	6781	331	-173	-0,523	0,523	
110	13335	556	138	0,248	0,248	misunderstanding with pegs
111	1675	168	3	0,015	0,015	
112	4576	320	-244	-0,761	0,761	extremelly difficult
			mean	**-0,024**		
			median	**-0,083**		
			1,96*SD	**1,115**	**0,829**	**percentile(0,95)**

Difficult parcels on orthoimagery 0,20 m

Summary PT for orthoimagery

- Pixel size 0,30 m
  - taking into account all measurement (even removing one gross error doesn't change much) the confirmation PT we obtained for 1,5m buffer limit (1,37 m).
  - **however if excluded also bad borders the PT can be confirmed for buffer of 1,0m (0,88 m).**
- Pixel size 0,20 m
  - taking into account **all measurement** the confirmation PT we obtained for 1,25m buffer limit (1,12 m).
  - **however if excluded one extremaly difficult border the PT can be confirmed for buffer of 1,0m (0,83 m).**

Summary

- Our former recommedation for RS:
  - 1,5 x 0,30 m = 0,45 m
  - 1,5 x 0,20 m = 0,30 m

Is not realistic! What confirms our current recommendation on wiki.

Thank you very much for your attention

and for your collaboration