

Processing Report

Project name: Madrid-2025

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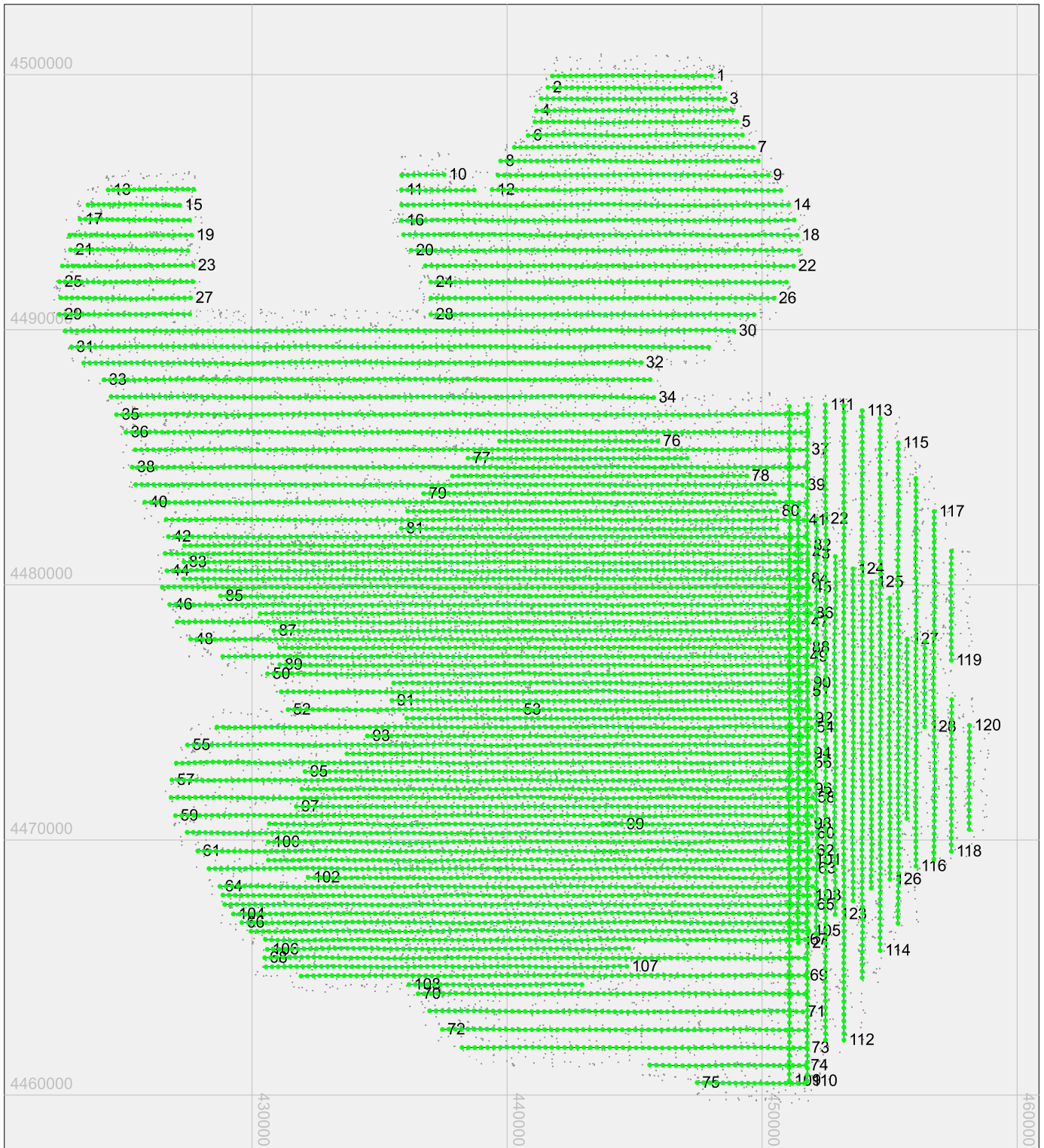
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General project information

Project name	Madrid-2025
Process	Geo-referencing
Computer node	RESTITUCION-1
Operating system	Microsoft Windows 10 Professional (build 19045), 64-bit, version 10.0
Machine	12th Gen Intel(R) Core(TM) i700K, 20 cores, 63.7 GByte RAM
Program version	13.2.0.10038
User name	Restitucion-1
Source time (*.sta)	Tue Mar 17 16:30:52 2026
Report time (*.pdf)	Wed Mar 18 06:59:23 2026
Project file	G:/Vuelos/Madrid_2025/AeroNadir_v2_dense/Madrid2025_NADIR.prj
Statistic file	G:/Vuelos/Madrid_2025/AeroNadir_v2_dense/Madrid2025_NADIR.sta
Active block	Complete
Number of used images	8764 of 8764
Number of used cameras	1 of 1
Number of strips	128
Flying height	min=2449.9 / avg=2521.4 / max=2595.2 [m]
Terrain height	min=532.9 / avg=660.9 / max=994.7 [m]
Average photo scale	1 : 23509
Coordinate system	PROJCS["UTM Zone 30 N", GEOGCS["ETRS89",DATUM["European Terrestrial Reference System 1989", SPHEROID["GRS 1980",6378137, 298.2572221011,AUTHORITY["EPSG","7019"]], TOWGS84[0,0,0,0,0,0,0], AUTHORITY["EPSG","6258"]], PRIMEM["Greenwich",0,AUTHORITY["EPSG", "8901"]], UNIT["Degree",0.01745329251994, AUTHORITY["EPSG","9102"]], AXIS["Long",EAST], AXIS["Lat",NORTH], AUTHORITY["EPSG","4258"]], PROJECTION["Transverse_Mercator"], PARAMETER["False_Easting",500000], PARAMETER["False_Northing",0], PARAMETER["Latitude_Of_Origin",0], PARAMETER["Central_Meridian",-3], PARAMETER["Scale_Factor",0.9996], UNIT["Meter",1,AUTHORITY["EPSG","9001"]], AXIS["East",EAST], AXIS["North",NORTH], AUTHORITY["EPSG","25830"]]

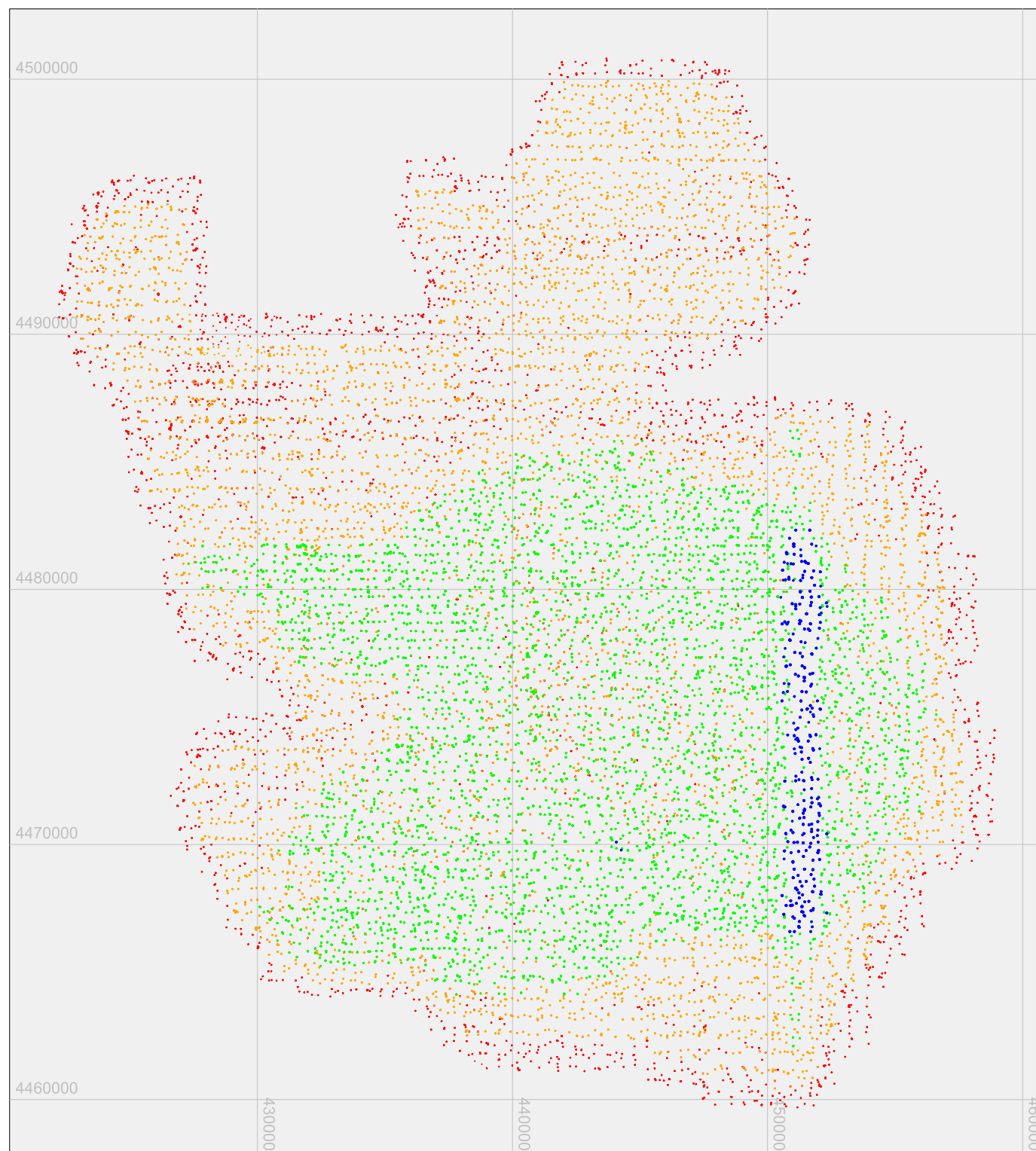
Flight overview



Graphic with 128 strip definitions for the aerial triangulation. The area has a planimetric extent of about: 40566 x 45013 [m].

- : Camera location for 8764 adjusted photos.
- : Camera location for 0 eliminated photos.
- : Defined strip in the project.
- : Tie point location for 98797 points.

Tie point distribution



Tie point distribution of 98797 points in the statistic file. The point size and colour reflects the number of images containing the point. The area has a planimetric extent of about: 40566 x 45013 [m] and a height range of about: 533 - 995 [m].

- : Point found in (0-12) images.
- : Point found in (13-24) images.
- : Point found in (25-36) images.
- : Point found in (>36) images.

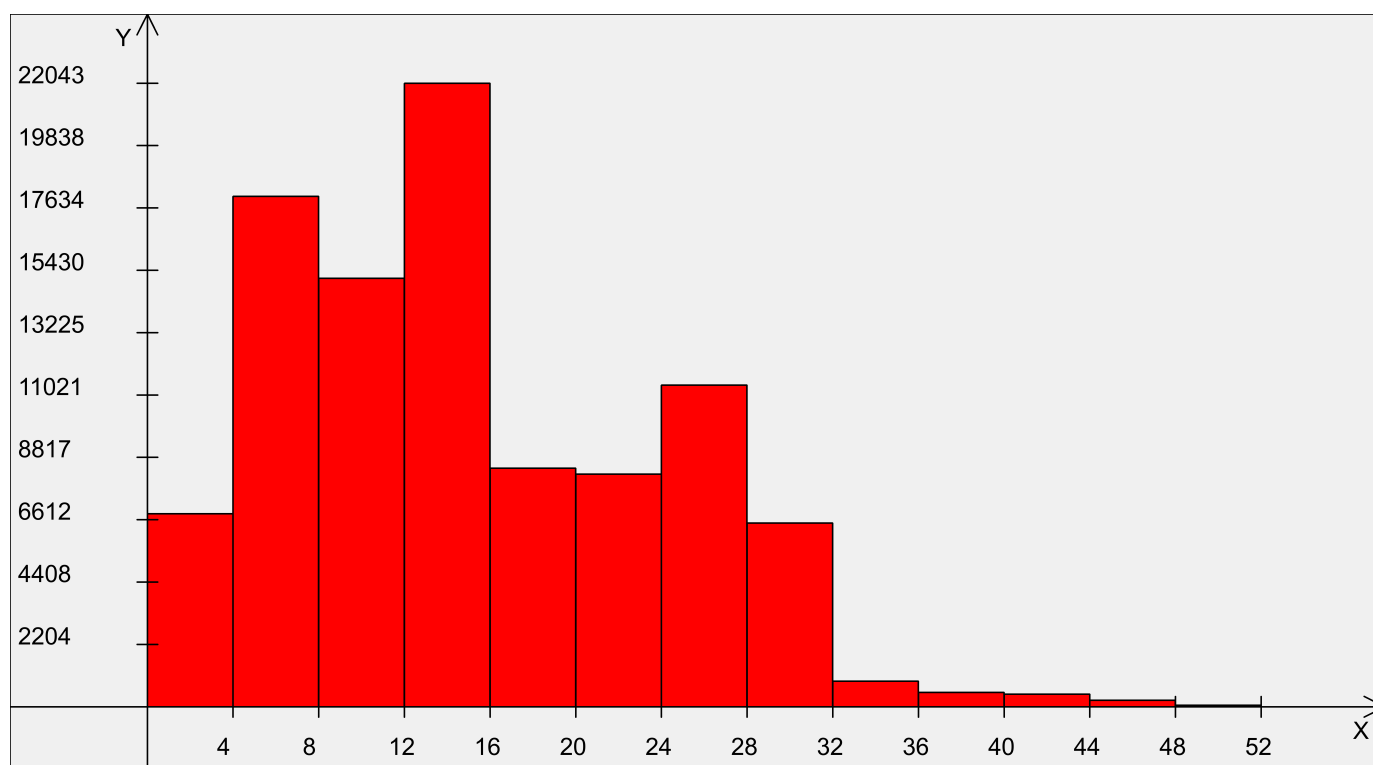
Image points

Frequency of image point observations in the photos

X	Number of image points (Y)	%
>0 - 4	6831	6.91
>4 - 8	18051	18.27
>8 - 12	15154	15.34
>12 - 16	22043	22.31
>16 - 20	8437	8.54
>20 - 24	8229	8.33
>24 - 28	11377	11.52
>28 - 32	6498	6.58
>32 - 36	912	0.92
>36 - 40	514	0.52
>40 - 44	453	0.46
>44 - 48	236	0.24
>48 - 52	62	0.06

Appearance of 98797 image points from the statistic file. The table contains all image observations of the points.

Histogram for image point frequency in the photos



Graphic for 8764 photos and 98797 image points. Number of image points (Y) within a given range for number of photos (X).

Camera

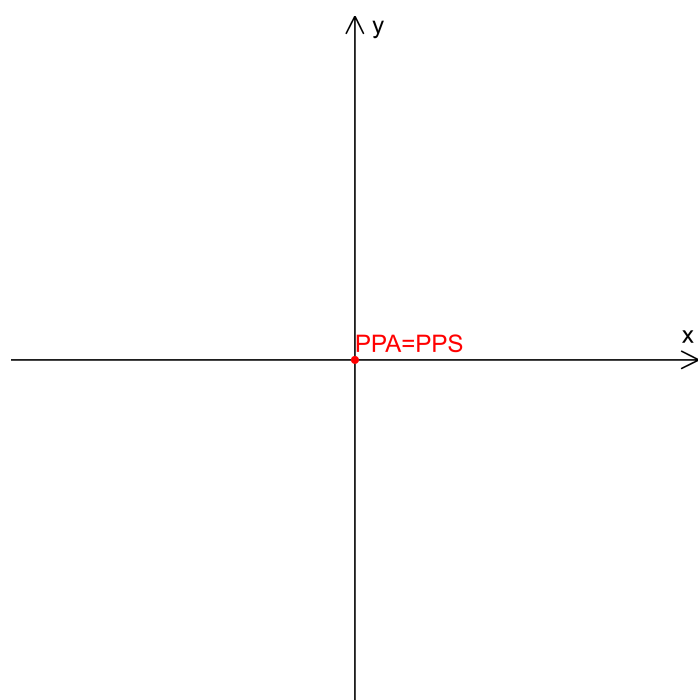
Camera data (Madrid2023_nadir)

Data source	Madrid2025_NADIR.sta	
Sensor type	CCD sensor	
Manufacturer	Vexcel	
Model	Osprey 4.1	
Serial number	not defined	
Camera UUID	not defined	
Sensor (width / height) [pixel]	20544	14016
Pixel size (x / y) [micron]	3.7600	3.7600
Ground sampling distance (x / y) [m]	0.0884	0.0884
Calibration process	OFF	
Calibration status	Initial	
Calibration direction	INPHO (from ideal to measured)	
Distortion type	Undefined	
Additional parameters	OFF	
Focal length [mm / pixel]	79.6000	21170.2128
Focal length (Fx / Fy) [pixel]	21170.2128	21170.2128
Principal point (x / y) [mm pixel]	0.0000 10271.5000	0.0000 7007.5000

Platform data (Madrid2023_nadir)

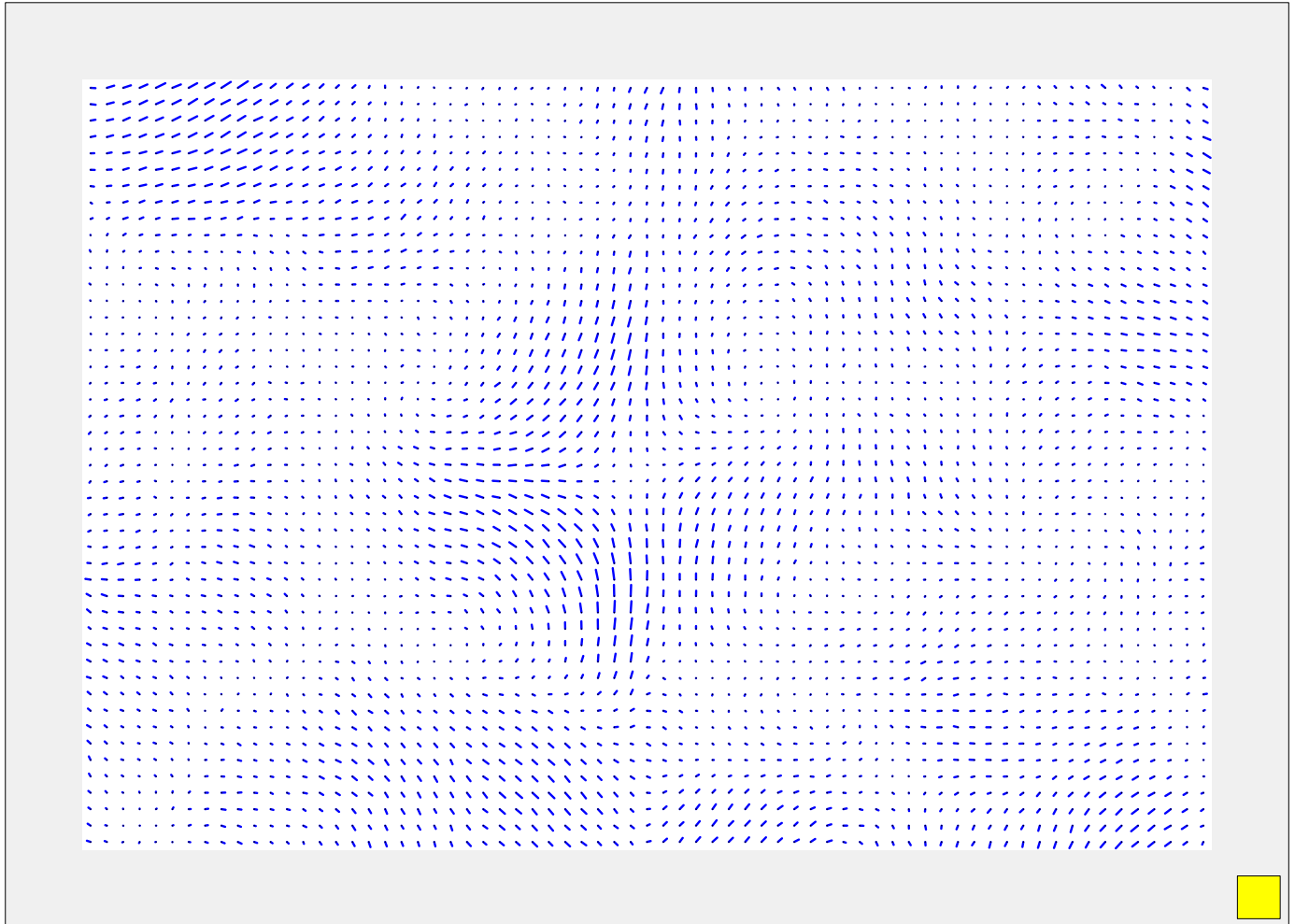
	X [m]	Y [m]	Z [m]
GNSS antenna offset	---	---	---
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
IMU boresight alignment	---	---	---
Camera mount rotation	---		

Camera data (Madrid2023_nadir)



Principle point ($x=0.0000$, $y=0.0000$ [mm]) in the image.

Image residuals (Madrid2023_nadir)



Graphic of 1536285 back-projected adjusted points from the statistic file. Average image residual matrix vectors (min=0.001, avg=0.072, max=0.278 [pixel]) for image matrix elements. An image matrix element is defined with about (300 x 300) pixels. Image residual is defined as: residual = observed - adjusted. Number of invalid image residual vectors outside the graphic: 0.

-  : Scale for the residual vectors. Symbol in the graphic is correlated to 1 [pixel] in the image.
-  : Average image residual vector for points in (0-2) images.
-  : Average image residual vector for points in (3-4) images.
-  : Average image residual vector for points in (5-10) images.
-  : Average image residual vector for points in (>10) images.

Exterior orientation evaluation (Madrid2023_nadir)

ImageID	# of points	Distribution	RMS Ds [pixel]	Max Ds [pixel]	Remark
h50_0534_fot_131-17514_N	119	6 of 9	0.56	4.49	
h50_0534_fot_147-23093_N	197	9 of 9	0.56	3.57	
h50_0534_fot_145-23389_N	257	9 of 9	0.53	3.08	
h50_0534_fot_121-17132_N	140	8 of 9	0.52	3.58	
h50_0559_fot_169-17567_N	189	9 of 9	0.52	4.09	
h50_0558_fot_170-13548_N	86	4 of 9	0.51	3.02	
h50_0534_fot_123-17245_N	150	8 of 9	0.51	5.66	
h50_0582_fot_185-09951_N	121	8 of 9	0.50	3.68	
h50_0534_fot_127-17372_N	157	8 of 9	0.50	3.78	
h50_0559_fot_165-18137_N	140	8 of 9	0.49	4.40	
h50_0559_fot_169-17565_N	102	8 of 9	0.48	3.47	
h50_0559_fot_169-17566_N	137	9 of 9	0.48	3.75	
h50_0534_fot_121-17133_N	162	9 of 9	0.48	4.14	
h50_0534_fot_121-17134_N	170	9 of 9	0.48	4.46	
h50_0534_fot_127-17378_N	139	9 of 9	0.48	4.94	
h50_0534_fot_123-17240_N	175	8 of 9	0.48	3.98	
h50_0534_fot_145-23390_N	264	8 of 9	0.47	2.97	
h50_0534_fot_145-23388_N	164	7 of 9	0.47	2.03	
h50_0534_fot_144-23488_N	80	6 of 9	0.47	1.81	
h50_0534_fot_127-17371_N	172	9 of 9	0.47	4.04	
h50_0534_fot_143-23598_N	122	9 of 9	0.46	4.85	
h50_0533_fot_142-23780_N	139	9 of 9	0.46	2.86	
h50_0534_fot_125-17266_N	111	9 of 9	0.46	3.20	
h50_0559_fot_169-17563_N	148	9 of 9	0.46	3.35	
h50_0558_fot_170-13549_N	52	4 of 9	0.27	1.61	
h50_0534_fot_145-23344_N	64	5 of 9	0.27	1.19	
h50_0534_fot_115-16960_N	143	5 of 9	0.23	1.46	
h50_0534_fot_146-23203_N	88	5 of 9	0.22	1.27	
h50_0559_fot_170-13533_N	80	5 of 9	0.18	0.44	
h50_0559_fot_170-13532_N	62	5 of 9	0.17	0.41	
h50_0534_fot_147-23087_N	138	5 of 9	0.16	0.44	
h50_0559_fot_170-13534_N	87	5 of 9	0.15	0.36	

Statistic of 1536285 back-projected adjusted points from the statistic file. The table list 32 of 32 photos with an EO beyond the thresholds. The project consist of 8764 of 8764 photos from this camera. The table contain differences between the matched image points and back-projected adjusted points. Photos with at least one of the following conditions are visible:

- * **# of points** : Number of points/photo < 30 [points]
- * **Distribution** : Number of image tiles with more than 3 points < 6 [image tiles]
- * **RMS Ds [pixel]** : RMS difference in pixel > 0.5 [pixel]

Exterior orientation evaluation summary

Legend of histogram for number of tie points

X : Range for the number of tie points/photo.
Y : Number of images for the defined range (X).
Thr : Empirical threshold (30 points/photo) for the definition of weaker images.

Legend of histogram for distribution of tie points

X : Number of sufficient occupied image tiles with tie points. The image is divided into 9 equal image tiles.
Y : Number of images for the defined image tile occupation (X).
Thr : Empirical threshold (6 image tiles) for the definition of weaker images.

Legend of histogram for RMS values of tie points

X : Range for the RMS value.
Y : Number of images for the defined range (X).
RMS : RMS value for differences between the matched image points and back-projected adjusted points.
Thr : Statistical threshold ($0.45 \text{ [pixel]} = 3 \cdot \sigma$ from the block adjustment) for the definition of weaker images.

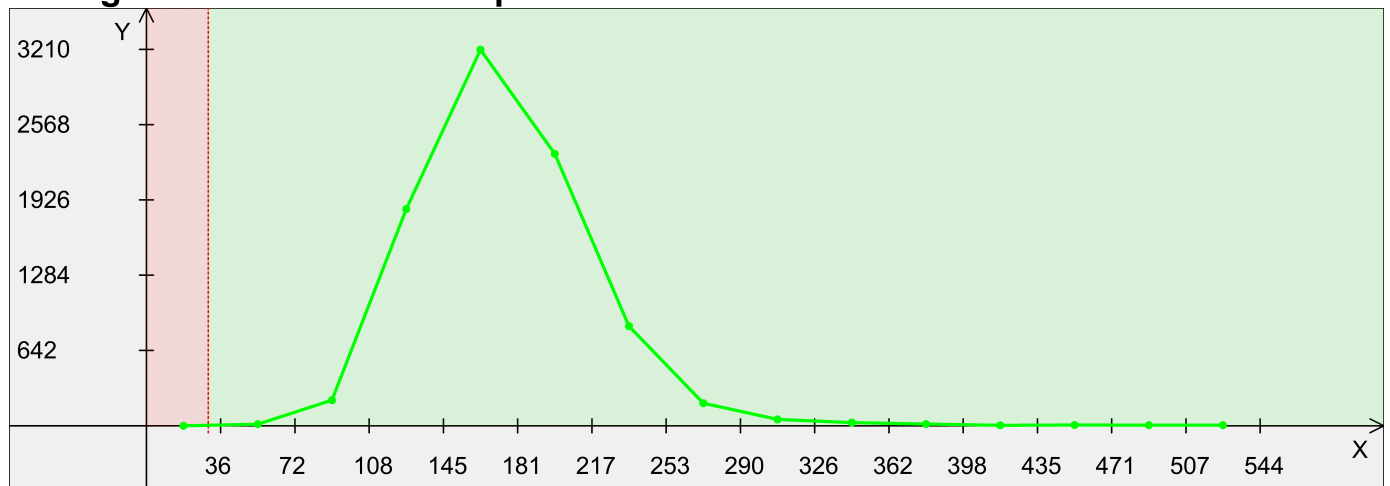
Statistical information about used elements for EO evaluation

Data base	: Statistic file (*.sta)
Number of photos	: 8764 of 8764
Number of camera(s)	: 1 of 1
Number of used image observations	: 1536285
Number of adjusted points	: 98797

Camera color assignment

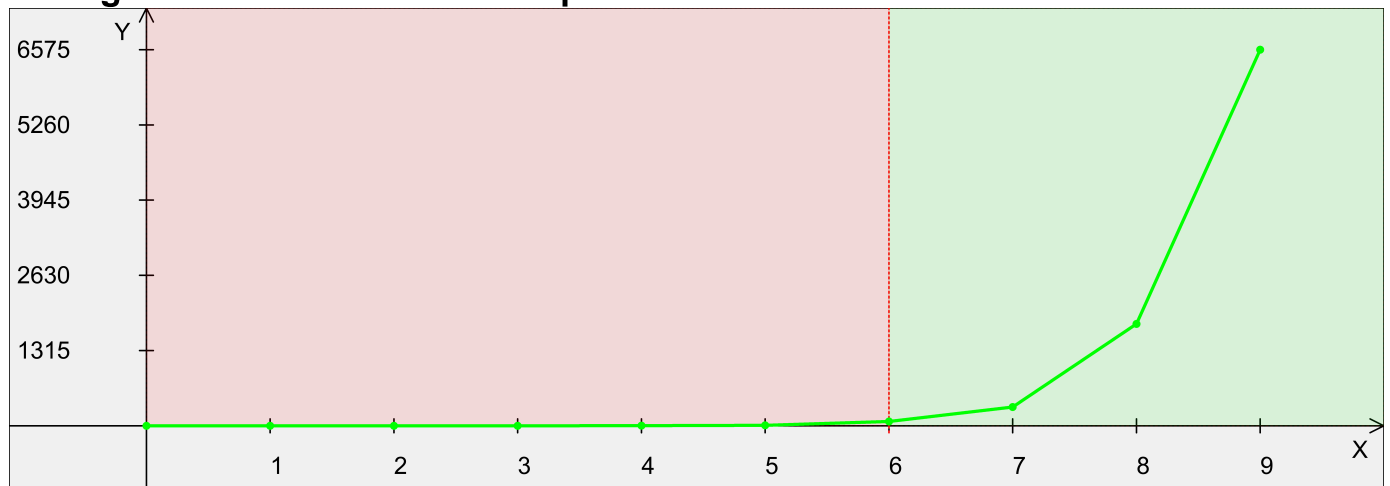
 : Threshold (Thr) for the actual evaluation criteria.
 : for Camera : Madrid2023_nadir.
 : Range with acceptable photos.
 : Range with suspect photos.

Histogram for number of tie points



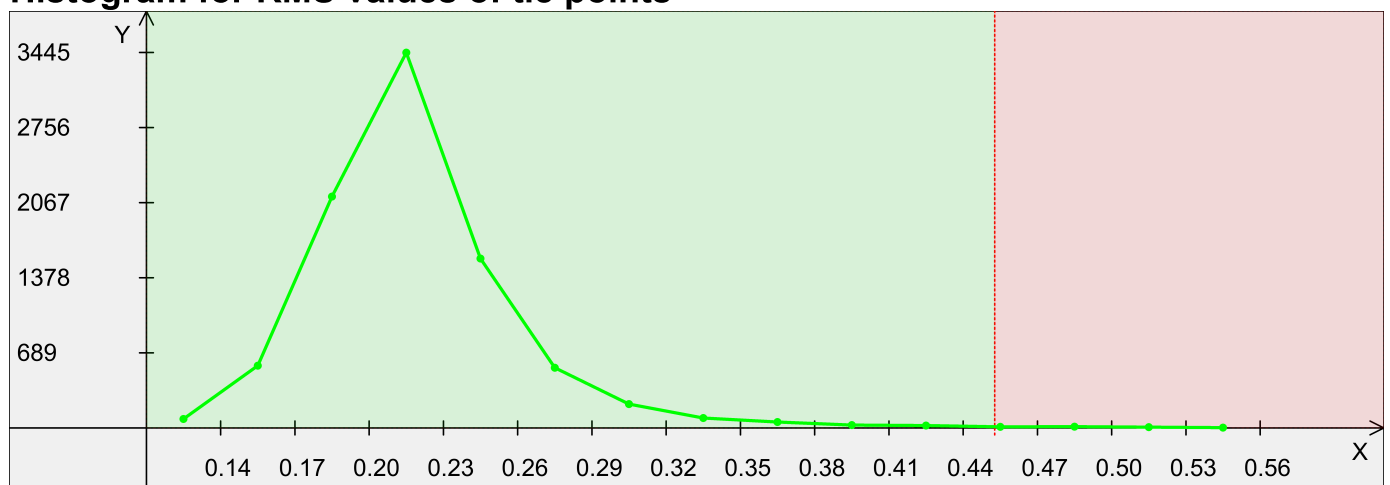
Graphic for 8764 photos with 1 camera(s). Evaluation criteria: [# of points/photo] < Thr (=30 [points/photo]).

Histogram for distribution of tie points



Graphic for 8764 photos with 1 camera(s). Evaluation criteria: [Distribution] < Thr (=6 [image tiles]).

Histogram for RMS values of tie points



Graphic for 8764 photos with 1 camera(s). Evaluation criteria: [RMS] > Thr (=0.45 [pixel]).

Block adjustment settings

Block Parameters

Image standard deviation:	X [mm]	Y [mm]	
automatic	0.001800	0.001800	
manual	0.001800	0.001800	
Object standard deviation:	X [m]	Y [m]	Z [m]
control points	0.030000	0.030000	0.045000
Earth curvature correction	ON		
Refraction correction	ON		

GNSS Parameters

Mode	ON		
Shift/Drift	OFF		
	X [m]	Y [m]	Z [m]
Shift	ON	ON	ON
Drift	OFF	OFF	OFF
Standard deviation	0.300000	0.300000	0.300000

IMU Parameters

Mode	ON		
Shift/Drift	OFF		
Boresight alignment	OFF		
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
Shift	---	---	---
Drift	OFF	OFF	OFF
Standard deviation	0.008000	0.008000	0.008000

Block adjustment results

Accuracy

Sigma naught	0.5691 [micron]
	0.1513 [pixel]

Mean standard deviation of translations

X [m]	Y [m]	Z [m]	Total [m]
0.0216	0.0175	0.0078	0.0289

Mean standard deviation of rotations

Omega [deg]	Phi [deg]	Kappa [deg]
0.00079669	0.00076381	0.00021953

Mean standard deviation of terrain points

X [m]	Y [m]	Z [m]	Total [m]
0.0056	0.0062	0.0189	0.0207

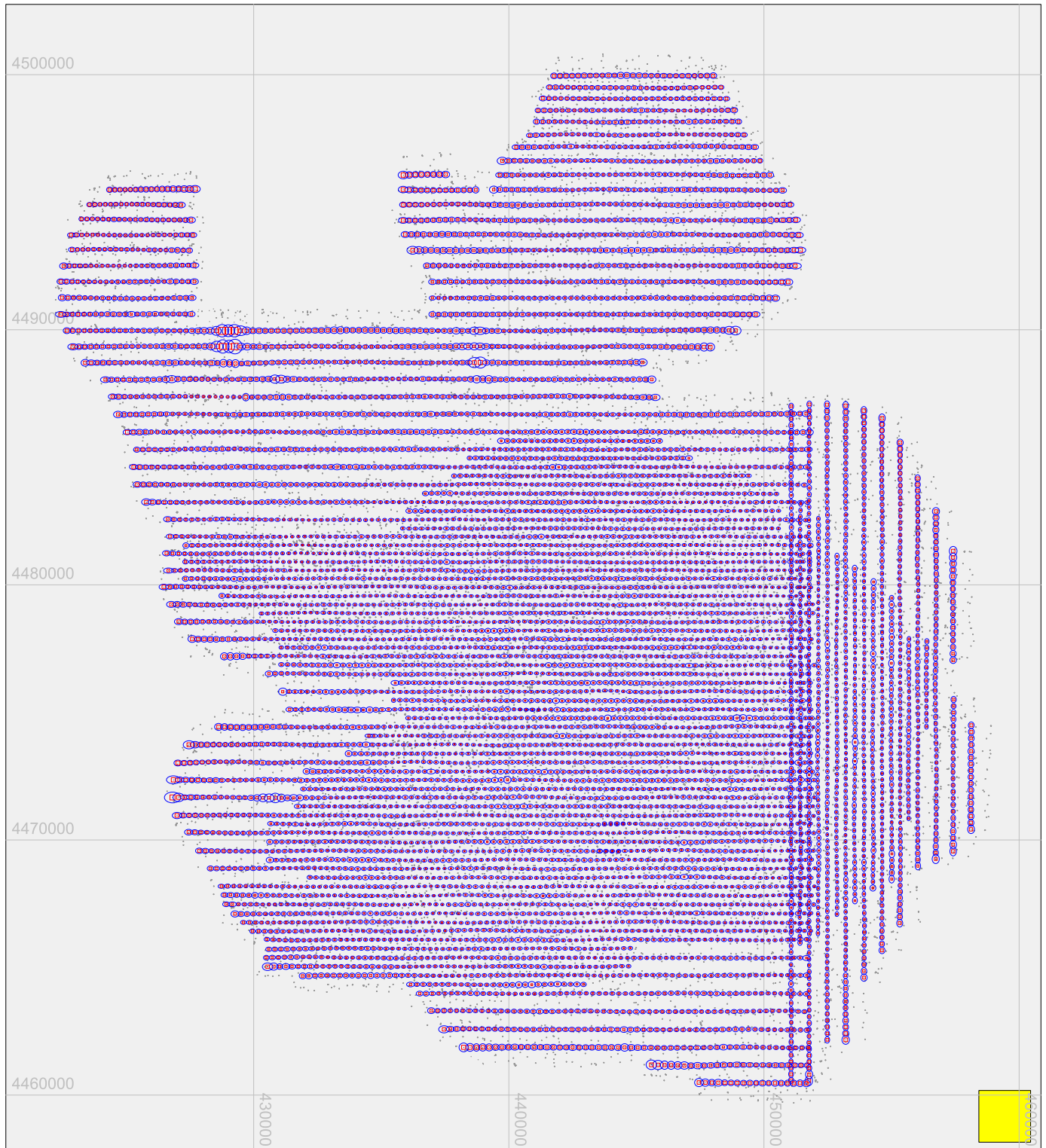
RMS values for GNSS

X [m]	Y [m]	Z [m]	Total [m]
0.1925	0.1990	0.1484	0.3141

RMS values for IMU

Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]	Total [deg]
0.00552120	0.00617974	0.00454075	0.00944940

Exterior orientation (X,Y,Z) standard deviations (Madrid2023_nadir)



Graphic with 8764 photos from the project. The camera locations are shown with its standard deviations for XYZ. The area has a planimetric extent of about: 40566 x 45013 [m].

- : Scale for the symbols. Symbol in the graphic is correlated to 0.221 [m] in the object.
- : Standard deviation XY for 8764 projection centers (min=0.0168, avg=0.0279, max=0.0879 [m]).
- : Standard deviation Z for 8764 projection centers (min=0.0054, avg=0.0078, max=0.0301 [m]).
- : Tie point location for 98797 points.

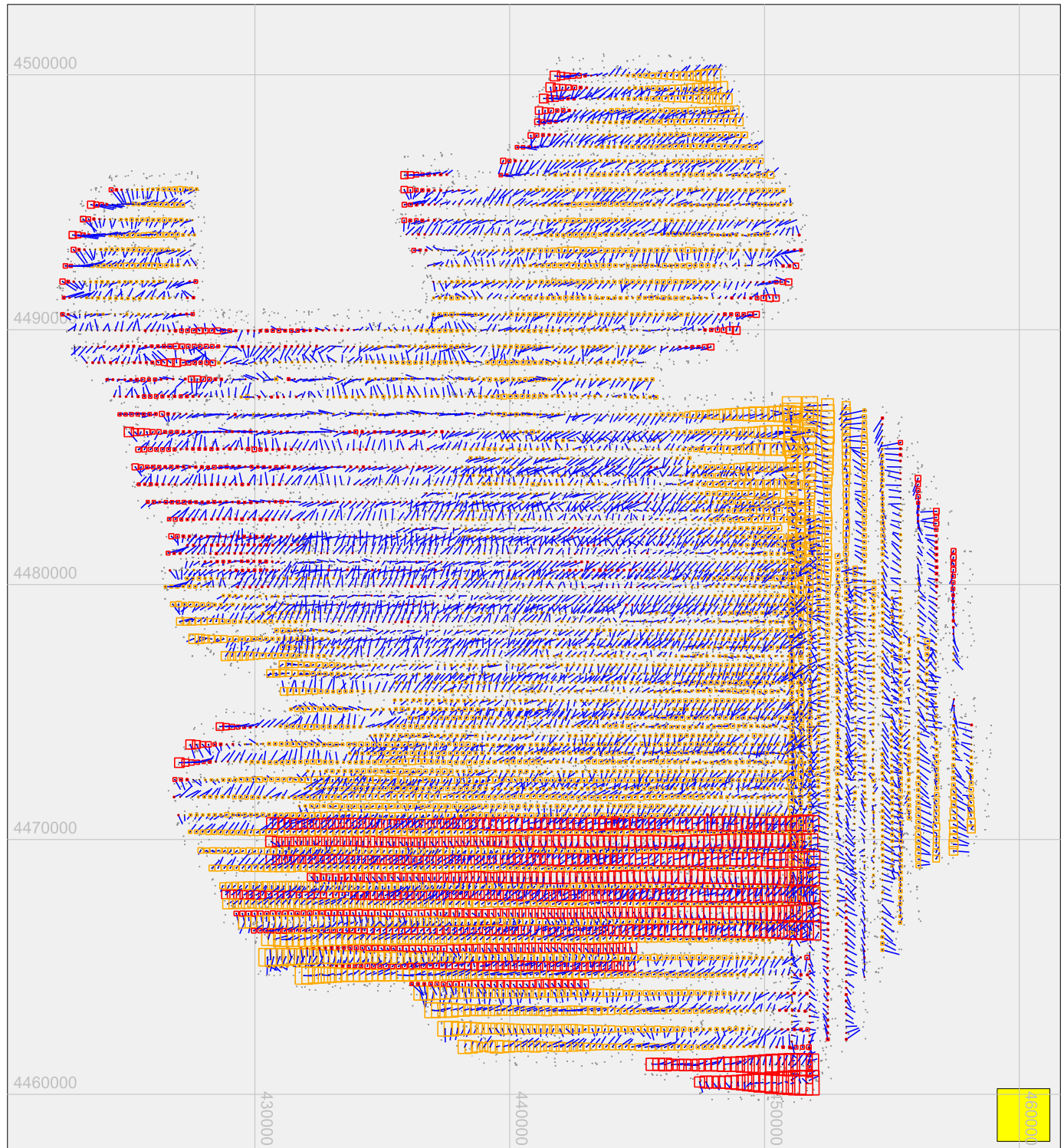
Exterior orientation (Omega,Phi,Kappa) standard deviations (Madrid2023_nadir)



Graphic with 8764 photos from the project. The camera locations are shown with its standard deviations for omega,phi,kappa. The area has a planimetric extent of about: 40566 x 45013 [m].

- : Scale for the symbols. Symbol in the graphic is correlated to 0.00297 [deg] in the object.
- : Standard deviation omega(X) for 8764 projection centers (min=0.00043, avg=0.00080, max=0.00240 [deg]).
- : Standard deviation phi(Y) for 8764 projection centers (min=0.00032, avg=0.00076, max=0.00281 [deg]).
- : Standard deviation kappa(Z) for 8764 projection centers (min=0.00008, avg=0.00022, max=0.00123 [deg]).
- : Tie point location for 98797 points.

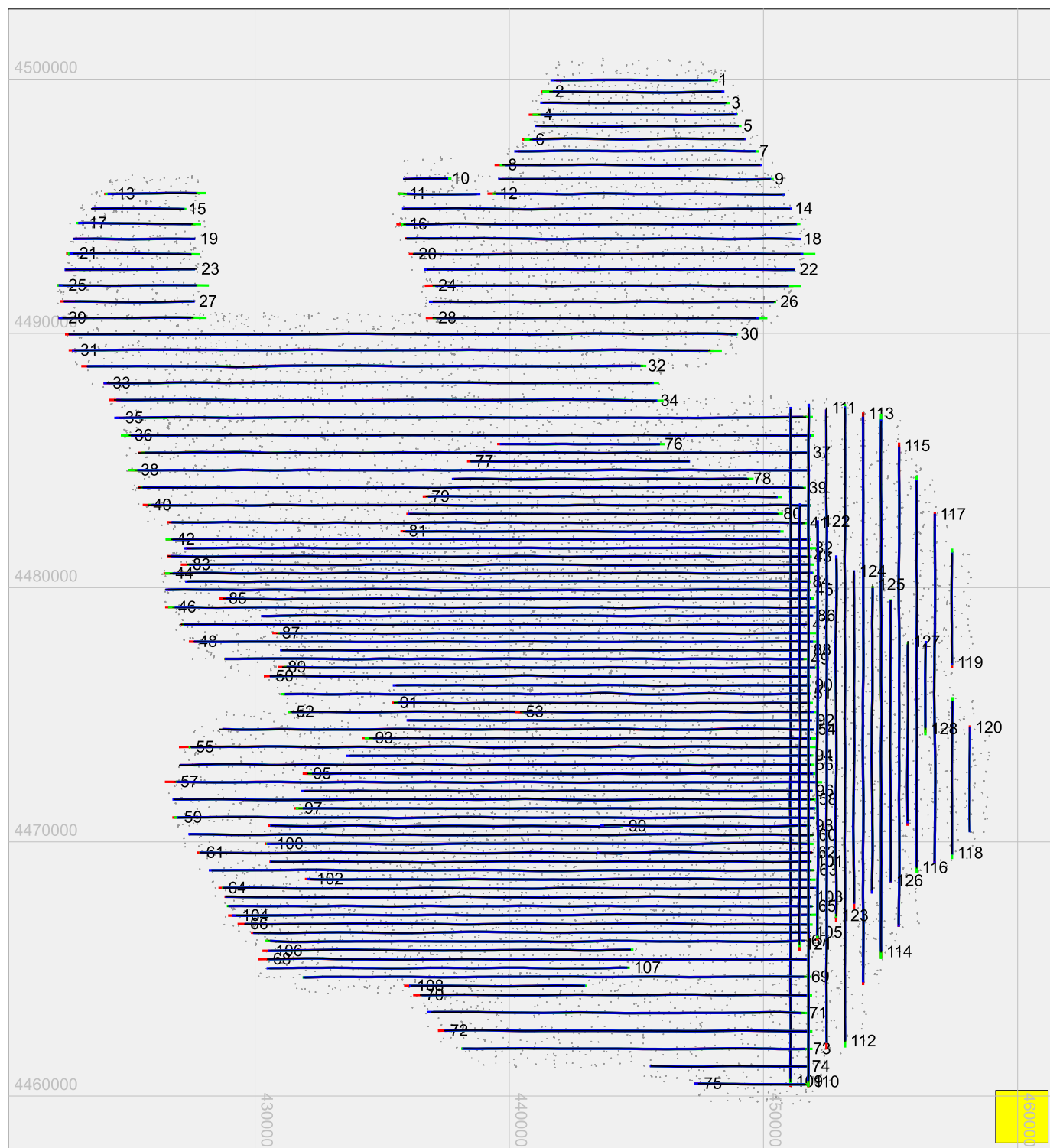
GNSS residuals (observed - adjusted) (Madrid2023_nadir)



Graphic with 8764 used GNSS locations from the adjustment. The points are shown with its residuals for X,Y,Z from the adjustment. The area has a planimetric extent of about: 40566 x 45013 [m]. Residual is defined as: residual = observed - adjusted.

- : Scale for the symbols. Symbol in the graphic is correlated to 1.571 [m] in the object.
- : Residual XY for (8764) GNSS positions (min=0.0039, avg=0.2581, max=0.8250 [m]).
- : Residual Z for (pos.:2249/neg.:6515) GNSS positions (min=-0.5651, avg=0.1076, max=0.7268 [m]).
- : Number of eliminated GNSS observations: 0 of 8764
- : Tie point location for 98797 points.

IMU residuals (observed - adjusted) (Madrid2023_nadir)



Graphic with 8764 IMU locations from the adjustment. The points are shown with its residuals for omega,phi,kappa from the adjustment. The area has a planimetric extent of about: 40566 x 45013 [m]. Residual is defined as: residual = observed - adjusted.

- : Scale for the symbols. Symbol in the graphic is correlated to 0.09449 [deg] in the object.
- : Residual omega(X) for (8764) IMU positions (min=-0.01850, avg=0.00029, max=0.02116 [deg]).
- : Residual phi(Y) for (8764) IMU positions (min=-0.02579, avg=-0.00044, max=0.02764 [deg]).
- : Residual kappa(Z) for (8764) IMU positions (min=-0.00990, avg=-0.00186, max=0.01802 [deg]).
- : Tie point location for 98797 points.

Ground control points

The number of control points (549) exceeds the maximum number of points (500) for the visualization in this context.

Ground control points

The number of control points (549) exceeds the maximum number of points (500) for the visualization in this context.