

Supplementary Files

Table S1. Quality assessment on natural control points.

The statistics of the RMSE on detected natural control points [mm]													
Detector	Pair of scans	Test site I											
		Spherical				Cartographic transformation Orthoimage				Mercator			
		No. of points	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]
SURF	1 - 3	244	2.4	2.2	2.4	489	2.0	2.0	2.2	951	2.2	2.2	2.2
	6 - 8	9	1.9	1.9	2.5	156	1.3	1.8	1.8	6	1.7	0.6	1.8
	8 - 9	179	2.4	2.6	2.5	393	2.1	2.1	2.2	30	2.6	2.8	2.6
	6 - 9	109	2.5	2.6	2.7	393	1.2	1.2	1.3	24	2.4	2.2	2.3
	3 - 19	64	2.4	2.1	2.3	234	2.1	2.3	2.1	11	1.6	2.3	2.0
	8 - 19	139	2.4	1.8	2.3	74	1.9	2.0	2.0	9	1.2	1.8	1.1
FAST	1 - 3	906	2.4	2.0	2.2	1429	2.1	2.0	2.0	198	2.4	2.3	2.4
	6 - 8	-	-	-	-	294	2.0	2.3	2.2	9	2.3	2.3	1.3
	8 - 9	183	2.2	2.2	2.4	2898	2.1	2.3	2.2	17	1.7	2.2	2.3
	6 - 9	-	-	-	-	554	2.2	2.4	2.5	246	2.5	2.4	2.6
	3 - 19	52	2.5	2.1	1.9	866	2.1	2.1	2.0	30	1.8	1.8	2.7
	8 - 19	477	2.4	1.7	2.2	157	2.3	2.2	2.5	227	2.2	2.0	2.3
The statistics of the RMSE on detected natural control points [mm]													
Detector	Pair of scans	Test site II											
		Spherical				Cartographic transformation Orthoimage				Mercator			
		No. of points	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]
SURF	3 - 4	19404	1.5	1.5	1.7	2036	1.9	2.1	2.2	12893	1.6	1.6	1.8
	3 - 5	1245	1.6	1.9	1.6	4372	1.4	1.7	1.7	1021	1.8	2.0	2.3
	3 - 6	364	1.8	2.0	1.8	4437	1.5	1.6	1.7	958	1.9	1.9	2.2
	4 - 5	1644	1.6	1.8	2.1	727	1.9	2.2	2.2	1270	1.9	2	2.3
	4 - 6	549	1.7	1.9	2.0	612	1.9	2.0	2.1	1105	1.8	1.9	2.2
	5 - 6	135	1.3	2.1	1.8	1217	1.5	1.7	1.6	204	1.7	1.8	1.6
FAST	3 - 4	19404	1.5	1.5	1.7	24	2.1	2.3	2.1	57187	1.7	1.7	1.8
	3 - 5	973	1.7	1.8	2.5	19446	1.8	2.0	1.8	228	2.1	2.2	2.6

3 - 6	387	1.9	1.8	2.4	21808	1.9	1.9	1.9	372	2.0	2.0	2.5
4 - 5	1107	1.7	1.8	2.4	10	1.4	1.9	2.6	287	2.0	2.2	2.6
4 - 6	560	1.7	1.8	2.5	15	1.7	2.3	1.7	450	1.8	2.0	2.6
5 - 6	20	1	2.2	2.6	8189	1.9	2.1	1.8	6	0.8	1.6	3.4

The statistics of the RMSE on detected natural control points [mm]

Detector	Pair of scans	Test site III											
		Cartographic transformation											
		Spherical				Orthoimage				Mercator			
	No. of points	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	
SURF	1 - 2	724	3.4	3.6	3.6	139	3.8	3.9	3.3	359	3.2	4.2	4.1
	1 - 3	21	1.6	2.5	3.2	40	29.7	20.4	24.3	60	20.9	17.0	16.4
	1 - 4	40	3.0	4.1	3.9	15	30.3	29.8	8.7	110	20.1	32.0	23.5
	1 - 5	88	15.1	15.4	20.2	9	4.3	4.7	2.2	57	8.8	11.5	16.4
	1 - 6	22	4.0	4.2	3.4	8	19.4	32.0	10.5	46	3.6	4.0	3.6
	1 - 8	12	13.8	27.1	17.9	19	20.0	20.5	35.6	18	25.4	21.5	19.4
	1 - 9	370	3.0	3.9	3.8	57	3.8	3.1	2.8	153	3.3	42	3.9
	2 - 3	21	2.3	4.0	3.1	11	18.4	9.1	4.9	58	26.7	20.8	25.4
	2 - 4	31	1.6	3.9	3.9	15	23.5	11.3	34.5	26	2.9	3.4	4.1
	2 - 5	93	18.2	17.0	11.9	14	2.6	2.3	3.5	20	3.0	3.0	3.3
	2 - 6	202	3.5	3.4	4.0	75	3.8	2.0	4.2	208	3.3	3.5	3.6
	2 - 8	34	3.9	18.3	22.4	26	4.0	1.2	3.7	17	48.0	25.7	35.6
	2 - 9	1212	2.9	3.4	3.8	135	3.9	3.8	3.0	921	3.0	3.5	3.7
	3 - 4	113	3.0	3.2	3.2	22	3.3	3.8	4.7	48	2.2	3.0	2.5
	3 - 5	592	3.2	2.9	3.7	132	3.7	3.1	4.2	291	3.5	3.5	3.6
	3 - 6	34	17.6	18.9	15.6	24	171.1	208.6	65.8	27	35.0	20.4	13.4
	3 - 8	69	3.2	3.1	3.4	31	2.3	2.2	3.7	61	4.3	3.9	3.8
	3 - 9	12	3.3	3.2	4.6	8	15.2	17.9	1.4	17	2.3	3.0	5.3
	4 - 5	336	3.0	3.0	3.0	146	3.8	4.2	3.2	48	3.6	3.4	2.9
	4 - 6	19	4.7	3.4	3.1	12	2.8	2.5	3.5	21	17.0	29.5	16.5
	4 - 8	69	3.9	3.5	3.7	33	3.6	4.1	4.0	38	2.7	2.2	2.5
	4 - 9	28	2.9	3.0	4.2	11	1.9	1.8	3.3	33	3.7	4.3	2.4
	5 - 6	48	26.5	10.7	14.3	6	2.9	1.2	1.5	11	9.4	8.1	17.9
	5 - 8	110	3.4	2.9	4.0	35	2.3	3.8	4.6	73	3.9	3.7	3.8
	5 - 9	23	3.2	1.7	4.5	72	3.7	4.0	2.3	25	2.7	1.6	4.2

	6 - 8	27	3.2	2.6	21.8	9	2.6	3.0	2.9	22	26.2	28.7	11.4
	6 - 9	130	3.1	3.7	4.6	20	4.5	3.7	2.8	113	3.4	3.5	2.7
	8 - 9	29	12.6	9.0	15.7	6	19.6	26.9	1.8	8	12.0	3.6	3.2
FAST	1 - 2	678	3.0	3.3	3.3	39	3.2	3.4	3.5	134	3.7	3.6	3.5
	1 - 3	22	87.6	91.8	117.5	36	2.8	2.0	3.5	24	18.3	21.7	19.3
	1 - 4	12	20.2	31.5	5.0	49	4.7	3.9	4.0	12	18.7	18.1	21.0
	1 - 5	15	30.6	16.8	19.2	63	3.4	3.4	3.6	25	14.1	17.1	16.1
	1 - 6	84	3.4	3.8	4.2	119	4.0	3.9	2.4	26	3.9	3.7	4.0
	1 - 8	9	11.9	23.9	4.7	38	2.9	2.5	3.2	10	14.1	8.6	14.7
	1 - 9	225	3.3	3.5	3.3	218	3.6	3.5	2.5	174	3.2	4.2	3.8
	2 - 3	10	10.8	18.6	19.4	23	3.1	1.4	2.6	9	17.5	12.8	33.4
	2 - 4	45	32.4	30.9	23.4	32	3.9	3.8	2.8	48	31.1	27.7	15.0
	2 - 5	33	32.0	33.7	17.4	51	3.8	3.6	3.5	25	15.7	27.6	10.0
	2 - 6	303	2.7	2.8	3.5	174	4.1	2.8	3.0	266	3.2	3.4	3.7
	2 - 8	6	4.4	0.9	5.2	26	4.0	1.2	3.7	7	1.7	0.5	0.8
	2 - 9	1206	2.5	2.9	3.0	412	3.1	3.5	2.5	1043	2.8	3.2	3.4
	3 - 4	165	3.0	3.1	2.5	72	4.2	4.2	2.7	104	2.8	3.3	3.3
	3 - 5	31	38.0	29.4	29.5	327	3.6	3.5	2.7	31	38.0	29.4	29.5
	3 - 6	13	13.6	12.1	4.6	28	3.7	3.3	3.8	15	24.5	16.6	27.7
	3 - 8	11	3.2	2.8	2.4	81	3.0	2.7	3.4	92	3.0	2.8	3.2
	3 - 9	17	35.0	45.2	11.4	35	3.5	2.4	2.6	12	19.2	12.0	18.2
	4 - 5	336	3.0	3.0	3.0	724	4.2	4.1	2.6	187	2.9	3.0	3.1
	4 - 6	13	20.9	12.1	18.5	58	3.9	3.7	3.5	9	11.4	9.6	10.2
	4 - 8	97	2.5	2.4	3.3	135	4.1	4.3	3.6	62	2.7	3.1	2.8
	4 - 9	49	25.8	30.6	22.5	114	4.2	4.1	1.8	11	4.5	2.4	3.8
	5 - 6	8	6.9	7.5	9.3	42	3.3	3.7	3.4	12	12.8	31.5	12.9
	5 - 8	120	2.7	2.5	3.4	115	3.4	4.5	3.1	106	3.2	2.7	2.9
	5 - 9	45	31.8	29.7	11.6	72	3.7	4.0	2.3	8	2.9	2.1	1.2
	6 - 8	12	13.8	28.4	17.1	42	2.7	2.7	3.5	9	6.0	10.5	5.8
	6 - 9	159	3.7	3.1	3.6	83	4.3	3.5	3.1	237	3.3	3.1	3.3
	8 - 9	13	160.6	107.4	3.3	57	3.2	4.1	2.9	13	160.6	107.4	3.3

The statistics of the RMSE on detected natural control points [mm]

Test site IV

Cartographic transformation

Orthoimage

Mercator

Detector

Pair of
scans

Spherical

		No. of points	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]
SURF	6 - 7	15	2.8	3.8	4.6	9	2.5	3.4	2.6	18	23.3	25.3	72.4
	6 - 8	12	19.3	15.1	20.5	52	27.0	20.4	44.5	7	102.1	67.4	13.0
	6 - 9	-	-	-	-	-	-	-	-	-	-	-	-
	6 - 10	-	-	-	-	-	-	-	-	-	-	-	-
	7 - 8	9	5.8	3.1	3.0	60	36.5	26.2	30.5	23	100.8	194.9	236.6
	7 - 9	4	82.3	191.8	93.8	13	69.9	107.6	1.5	-	-	-	-
	7 - 10	-	-	-	-	-	-	-	-	-	-	-	-
	7 - 11	-	-	-	-	-	-	-	-	-	-	-	-
	8 - 9	10	2.1	2.8	2.8	6	53.2	17.5	8.0	16	203.8	138.3	150.7
	8 - 10	15	12.4	39.4	28.9	-	-	-	-	8	77.3	109.8	196.7
	8 - 11	-	-	-	-	-	-	-	-	-	-	-	-
	9 - 10	26	12.2	24.6	16.3	-	-	-	-	-	-	-	-
	9 - 11	-	-	-	-	-	-	-	-	-	-	-	-
	10 - 11	75	4.2	3.0	3.8	-	-	-	-	15	19.3	8.9	37.9
	10 - 12	25	4.6	3.5	4.2	-	-	-	-	12	18.9	63.0	214.9
FAST	6 - 7	14	3.4	2.9	3.4	45	2.7	3.7	3.6	6	136.5	121.9	114.3
	6 - 8	7	4.7	1.6	4.6	9	152.4	203.9	66.0	-	-	-	-
	6 - 9	-	-	-	-	-	-	-	-	-	-	-	-
	6 - 10	-	-	-	-	-	-	-	-	-	-	-	-
	7 - 8	37	4.6	2.9	4.4	35	29.4	20.7	28.3	-	-	-	-
	7 - 9	12	20.3	26.2	7.5	13	69.9	107.6	1.5	9	42.0	18.8	0.0
	7 - 10	-	-	-	-	-	-	-	-	-	-	-	-
	7 - 11	-	-	-	-	-	-	-	-	-	-	-	-
	8 - 9	41	24.1	28.9	7.4	-	70.2	99.9	85.6	-	-	-	-
	8 - 10	12	2.3	2.6	4.1	-	-	-	-	12	1.5	5.6	7.3
	8 - 11	-	-	-	-	-	-	-	-	-	-	-	-
	9 - 10	26	12.2	24.6	16.3	-	-	-	-	12	131.2	56.5	0.0
	9 - 11	-	-	-	-	-	-	-	-	-	-	-	-
	10 - 11	75	2.6	3.0	3.7	-	-	-	-	-	-	-	-
	10 - 12	25	32.0	25.4	21.9	-	-	-	-	-	-	-	-

Table S2. Quality assessment on natural and marked check points

The statistics of the RMSE on detected natural and marked checked points [mm]																						
Detector	Pair of scans	Test site I																				
		Spherical									Cartographic transformation							Mercator				
		Natural				Marked			Orthoimage				Marked			Natural				Marked		
		No. of points	X [mm]	Y [mm]	Z [mm]	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	X [mm]	Y [mm]	Z [mm]
SURF	1 - 3	81	2.7	2.4	2.5	3.2	2.8	3.6	162	2.2	2.2	2.3	3.2	4.2	4.5	316	2.2	2.2	2.4	3.2	2.8	3.6
	6 - 8	2	2.2	4.9	4.2	5.1	5.6	3.3	51	1.6	1.8	2.0	6.0	4.7	3.1	1	3.3	5.7	10.6	3.7	5.8	2.3
	8 - 9	59	2.3	2.8	2.5	1.4	3.7	2.5	306	2.1	2.2	2.2	5.1	3.0	3.1	9	3.3	2.3	3.1	2.2	3.7	2.7
	6 - 9	36	2.4	2.6	2.7	4.0	4.2	3.2	131	1.3	1.1	1.4	4.7	5.3	4.2	8	3.3	3.6	3.6	5.3	5.2	3.9
	3 - 19	21	2.6	2.2	2.1	4.3	2.7	4.6	78	2.0	2.1	2.4	2.6	3.0	4.9	3	3	0.9	2.2	2.1	1.9	3.5
	8 - 19	46	2.7	1.6	2.1	4.1	2.9	2.1	24	2.4	2.8	2.0	3.9	4.8	7.9	3	4.8	1.8	9.6	4.0	2.7	1.5
FAST	1 - 3	302	2.5	2.2	2.1	3.2	2.8	3.7	476	2.1	2.1	2.0	3.1	4.4	4.8	66	2.3	2.4	2.9	3.3	2.8	3.6
	6 - 8	-	-	-	-	-	-	-	97	1.2	2.2	2.2	5.8	4.8	3.3	3	12.6	25.7	14.7	3.7	5.8	2.3
	8 - 9	61	2.2	2.1	2.8	1.6	4.1	2.7	966	2.0	2.0	2.2	5.2	3.0	2.8	5	2.1	3.2	3.7	2.5	4.3	3.1
	6 - 9	-	-	-	-	-	-	-	184	2.4	2.5	2.3	5.1	5.0	4.0	81	2.4	2.7	2.6	4.8	4.2	3.2
	3 - 19	17	2.9	2.4	2.6	2.5	2.2	4.1	288	2.2	2.2	2.2	2.3	3.2	4.7	10	11.2	10.6	16.7	2.1	1.9	3.5
	8 - 19	159	2.3	1.6	2.3	4.2	3	2.1	52	2.4	2.6	2.5	4.2	5.9	4.0	66	2.3	2.4	2.2	4.5	2.9	2.4
The statistics of the RMSE on detected natural and marked checked points [mm]																						
Detector	Pair of scans	Test site II																				
		Spherical							Cartographic transformation							Mercator						
		Natural				Marked			Orthoimage				Marked			Natural				Marked		
		No. of points	X [mm]	Y [mm]	Z [mm]	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	X [mm]	Y [mm]	Z [mm]	No. of points	X [mm]	Y [mm]	Z [mm]	X [mm]	Y [mm]	Z [mm]
SURF	3 - 4	6468	1.5	1.5	1.7	-	-	-	678	1.8	2.0	2.2	-	-	-	4297	1.6	1.6	1.8	-	-	-
	3 - 5	414	1.6	1.9	2.2	-	-	-	1457	1.4	1.7	1.8	-	-	-	340	1.8	2.0	2.2	-	-	-
	3 - 6	121	1.8	2.1	2.1	-	-	-	1478	1.6	1.6	1.8	-	-	-	319	1.8	1.8	2.3	-	-	-

FAST	4 - 5	548	1.6	1.7	2.0	-	-	-	242	1.9	2.1	2.0	-	-	-	423	1.9	2.2	2.4	-	-	-
	4 - 6	183	1.7	1.9	2.1	-	-	-	203	2.0	2.0	2.0	-	-	-	368	1.8	1.9	2.2	-	-	-
	5 - 6	45	1.3	1.6	2.0	-	-	-	405	1.5	1.8	1.7	-	-	-	68	1.6	18.	2.0	-	-	-
	3 - 4	6468	1.7	1.5	1.5	-	-	-	8	3.6	2.0	3.3	-	-	-	19062	1.7	1.7	1.8	-	-	-
	3 - 5	324	1.8	1.9	2.5	-	-	-	6482	1.8	1.9	1.8	-	-	-	76	2.0	2.2	2.7	-	-	-
	3 - 6	128	1.8	1.8	2.3	-	-	-	7269	1.8	1.9	1.8	-	-	-	124	2.1	2.1	2.7	-	-	-
	4 - 5	369	1.7	1.8	2.5	-	-	-	3	5.8	2.8	4.8	-	-	-	95	2.1	2.4	2.5	-	-	-
	4 - 6	186	1.8	1.9	2.3	-	-	-	4	1.6	2.1	6.0	-	-	-	149	2.0	2.1	2.6	-	-	-
	5 - 6	20	1.0	2.8	1.7	-	-	-	2729	1.9	2.1	1.8	-	-	-	0	-	-	-	-	-	-

The statistics of the RMSE on detected natural and marked check points [mm]

Detector		Test site III																				
		Spherical									Cartographic transformation									Mercator		
											Orthoimage											
		Natural			Marked			Natural			Marked			Natural			Marked					
Pair of scans	No. of point s	X [m m]	Y [mm]	Z [mm]	X [m m]	Y [m m]	Z [m m]	No. of point s	X [m m]	Y [mm]	Z [mm]	X [mm]	Y [m m]	Z [m m]	No. of point s	X [m m]	Y [m m]	Z [m m]	X [mm]	Y [m m]	Z [mm]	
SURF	1 - 2	241	3.4	3.6	3.6	0.6	0.8	1.2	46	3.9	4.1	3.4	1.5	1.0	1.0	119	3.3	3.9	4.1	0.5	1.1	1.1
	1 - 3	7	1.6	2.5	3.2	2.8	3.8	8.8	40	23.7	18.0	24.3	12.5	3.3	17.0	20	18.4	17.4	11.9	3.4	4.5	6.5
	1 - 4	13	3.0	4.1	3.9	19.9	37.1	3.6	4	25.4	31.4	34.9	21.9	76.3	23.6	36	38.5	32.7	30.0	6.7	39.0	18.5
	1 - 5	29	23.0	23.3	22.8	37.0	12.0	6.1	3	11.2	7.8	2.2	16.7	9.0	1.7	18	13.4	10.8	11.2	4.1	14.1	6.5
	1 - 6	22	4.0	4.2	3.4	1.1	1.5	1.9	2	95.1	30.6	116.2	46.0	70.6	34.5	15	3.1	4.6	2.8	0.8	1.4	2.4
	1 - 8	12	13.8	27.1	17.9	31.6	7.4	6.8	6	22.8	20.0	46.6	21.1	3.2	21.8	6	34.0	44.0	26.7	93.3	74.9	10.6
	1 - 9	123	3.0	3.9	3.8	0.7	1.9	1.9	19	3.7	4.1	2.8	1.4	1.6	1.7	51	3.1	3.8	2.9	1.2	1.2	1.5
	2 - 3	6	2.3	4.0	3.1	4.7	3.9	5.7	3	31.9	8.0	3.4	48.2	3.9	2.6	19	26.1	13.1	35.3	9.5	13.4	20.0
	2 - 4	10	3.7	5.0	5.0	3.9	0.9	2.7	5	16.3	12.4	45.6	27.0	21.9	32.6	8	4.0	5.6	2.7	3.5	7.7	1.6
	2 - 5	31	14.3	20.2	11.0	9.0	40.4	14.0	4	9.3	2.9	1.2	3.3	2.0	3.5	6	3.5	8.0	6.0	3.6	5.2	5.4
	2 - 6	67	3.3	3.2	4.2	0.8	1.0	0.8	25	4.6	1.3	4.9	1.8	1.7	1.6	69	4.0	4.0	3.8	1.0	1.2	0.8
	2 - 8	34	17.7	27.5	50.9	15.6	117	18.8	8	1.9	1.8	5.2	3.9	2.8	2.4	5	46.3	31.0	28.2	49.8	24.3	64.9
	2 - 9	403	2.8	3.1	3.7	1.2	1.1	0.9	44	3.6	3.7	3.8	0.7	1.6	1.2	307	3.0	3.7	3.8	1.0	1.2	1.0
	3 - 4	113	3.7	3.3	3.7	2.6	2.2	2.2	7	3.3	5.5	6.1	5.4	3.6	5.7	16	3.9	4.1	2.5	2.4	2.3	2.3
	3 - 5	592	3.3	3.2	3.8	1.5	2.2	2.0	43	4.2	3.0	4.1	1.8	2.2	2.8	97	3.3	3.3	4.0	1.4	2.1	2.1
	3 - 6	11	28.0	15.0	21.6	121.5	14.1	76.6	8	278	180.5	64.5	270.2	248	36.1	8	35.0	20.4	33.9	46.0	26.1	27.7

FAST	3 - 8	23	3.5	3.6	4.4	5.2	2.0	1.7	10	4.7	4.0	6.2	6.0	5.3	2.6	20	4.3	3.7	4.4	2.0	2.3	1.7
	3 - 9	4	3.3	5.0	3.0	4.1	2.8	1.8	2	17.9	20.4	1.8	62.4	21.9	10.7	5	3.2	3.4	3.9	2.6	3.5	12.6
	4 - 5	112	2.8	2.7	3.0	1.4	1.7	2.8	48	4.0	3.3	3.0	1.5	1.4	2.2	48	3.4	3.6	3.3	1.0	2.1	2.0
	4 - 6	6	4.7	3.4	3.1	1.9	2.8	5.0	3	7.2	5.4	11.2	5.2	4.5	2.7	7	40.1	30.9	25.3	20.6	23.0	38.8
	4 - 8	22	3.9	3.5	3.7	2.5	1.1	2.8	10	3.8	5.2	4.9	1.1	0.9	1.8	12	4.3	3.7	3.0	1.3	0.8	3.0
	4 - 9	9	2.9	3.0	4.2	1.3	2.2	1.9	3	6.1	4.4	7.9	9.9	13.3	5.3	10	3.9	4.4	4.1	1.7	1.7	5.3
	5 - 6	15	27.0	28.8	33.9	8.6	6.3	74.8	2	4.3	9.2	2.4	4.2	5.8	8.0	3	64.2	19.7	42.4	35.1	31.8	13.8
	5 - 8	40	3.0	2.1	4.0	1.8	1.8	1.9	11	1.0	4.8	5.7	2.2	4.7	2.4	24	3.9	3.7	3.8	1.3	1.6	0.8
	5 - 9	14	24.6	35.4	23.8	40.8	67.9	9.1	24	3.4	2.8	1.9	2.3	2.0	1.4	8	4.7	1.6	3.8	3.3	3.3	5.0
	6 - 8	3	37.7	14.2	9.1	37.0	30.1	43.8	2	9.0	12.1	4.4	9.8	10.3	5.1	7	14.4	28.5	12.1	22.7	14.5	19.7
	6 - 9	52	4.3	3.4	4.0	1.4	1.6	1.6	6	3.4	3.2	2.2	3.4	4.1	2.3	37	3.7	3.7	2.9	1.5	1.7	0.7
	8 - 9	4	214	169	3.0	86.4	64.3	12.6	2	97.5	642.5	92.2	75.5	727	15.4	2	21.2	65.6	2.8	1461	269	6.1
	1 - 2	225	3.5	2.9	3.4	0.6	0.8	1.2	39	3.4	3.4	3.6	1.4	1.1	0.9	134	4.3	3.9	3.8	0.5	0.8	1.3
	1 - 3	7	77.0	169.8	73.6	113. 7	60.9	115	12	3.6	2.7	3.6	2.4	4.7	2.2	7	31.7	32.6	16.8	12.3	9.8	7.7
	1 - 4	3	61.5	56.8	13.0	74.2	40.8	11.2	16	3.1	3.5	2.8	2.0	1.9	1.8	4	52.5	52.1	72.1	139	76.6	147.8
	1 - 5	5	31.2	49.4	21.7	24.3	35.8	13.7	20	3.2	3.5	3.8	1.8	2.2	1.7	8	16.2	21.4	13.0	7.2	16.5	12.4
	1 - 6	27	4.3	4.8	3.5	1.2	1.3	0.8	39	4.5	4.2	2.6	0.8	1.3	1.3	18	3.8	4.4	3.5	0.6	1.8	1.7
	1 - 8	2	39.3	64.8	9.4	10.5	24.5	4.7	12	3.0	2.8	4.8	2.2	4.4	2.9	3	29.7	22.8	14.1	87.3	749	82.0
	1 - 9	84	2.9	3.5	3.4	1.0	1.3	1.5	72	4.1	3.6	2.5	0.5	1.7	1.5	57	3.9	3.7	3.1	0.6	1.3	1.0
	2 - 3	3	116	52.2	67.9	52.5	36.6	42.0	7	4.1	2.7	2.6	6.9	2.0	5.6	2	254	449	570	281	482	664
	2 - 4	15	37.9	20.7	18.6	45.3	25.9	21.5	10	4.4	6.4	4.1	2.4	5.2	2.1	48	27.9	34.8	15.1	45.6	25.1	63.4
	2 - 5	10	23.2	20.6	9.3	132. 6	115	45.8	16	2.8	3.0	3.4	1.9	3.3	1.7	8	23.6	30.1	9.7	13.5	15.0	22.0
	2 - 6	100	2.7	2.6	3.5	1.0	1.3	0.9	57	4.4	3.6	3.7	1.4	1.4	1.3	88	3.3	3.3	3.7	1.2	1.1	0.8
	2 - 8	2	75.0	26.3	3.3	69.4	239	1143	8	1.9	1.8	5.2	3.9	2.8	2.4	2	1.4	3.4	3.3	8.4	57.0	81.6
	2 - 9	402	2.6	2.8	3.1	1.2	1.1	1.0	137	2.5	3.5	2.0	1.2	1.2	1.2	347	2.8	3.4	3.5	1.0	1.1	1.0
	3 - 4	55	3.5	3.5	3.5	5.4	2.1	2.9	23	2.7	3.5	3.8	2.6	2.0	2.2	34	3.3	3.5	2.8	2.8	4.9	2.4
	3 - 5	10	48.0	30.2	44.5	28.1	53.7	34.6	109	3.4	3.8	2.2	1.4	2.1	2.8	10	48.0	30.2	44.5	28.1	53.7	34.6
	3 - 6	4	7.0	14.1	8.8	87.1	18.7	18.7	9	3.4	1.2	3.0	2.0	2.9	2.1	4	24.1	20.0	27.2	90.8	54.6	241
	3 - 8	39	2.4	2.3	3.3	2.3	2.0	2.1	26	4.4	3.8	4.0	1.9	2.4	2.7	30	2.8	3.5	3.6	2.6	2.4	2.4
	3 - 9	5	23.1	25.0	6.4	28.3	23.4	9.1	11	3.1	3.1	4.2	2.2	2.8	2.7	4	8.5	12.5	27.8	72.4	35.9	31.5
	4 - 5	112	2.8	2.7	3.0	1.4	1.7	2.8	241	4.1	3.9	3.3	0.8	1.5	2.5	62	3.0	2.5	2.7	1.1	2.0	2.1
	4 - 6	4	37.5	28.0	22.4	12.7	20.1	30.8	19	4.0	4.8	4.1	1.0	1.3	2.3	3	19.3	14.9	6.1	18.1	3.7	8.6
	4 - 8	32	3.7	2.8	3.4	2.8	1.8	2.9	44	3.9	4.2	3.3	1.3	1.4	1.9	20	3.7	2.7	4.3	1.6	0.8	1.6
	4 - 9	16	36.0	26.0	26.7	43.5	58.2	25.3	37	4.8	5.0	2.5	0.4	1.4	2.8	3	10.2	5.1	5.3	2.5	9.3	3.6
	5 - 6	2	17.1	11.0	16.7	7.4	16.7	25.3	42	2.5	5.0	2.9	1.1	2.9	3.4	4	28.8	16.0	6.0	24.6	15.1	9.8

5 - 8	40	3.0	2.1	4.0	1.8	1.8	1.9	38	3.4	3.9	3.0	1.9	3.0	2.3	35	2.8	2.6	3.8	1.5	1.6	1.7
5 - 9	14	24.6	35.4	23.8	10.8	67.9	9.1	24	3.4	2.8	1.9	2.3	2.0	1.4	2	0.6	4.3	1.3	12.1	5.3	6.4
6 - 8	3	37.7	14.2	9.1	37.0	30.1	43.8	13	4.2	4.0	4.4	2.2	3.1	0.8	2	89.2	26.7	68.2	105	74.9	30.9
6 - 9	52	4.3	3.4	4.0	1.4	1.6	1.6	27	3.5	3.2	3.8	1.4	1.9	1.5	79	3.1	3.2	3.3	1.2	1.6	1.1
8 - 9	4	214	169.2	3.0	86.4	64.3	12.6	18	4.2	5.0	2.4	2.2	4.4	1.2	4	214	169	3.0	86.4	64.3	12.6

The statistics of the RMSE on detected natural and marked checked points [mm]

Detector		Test site IV																				
		Cartographic transformation																				
		Spherical							Orthoimage							Mercator						
		Natural			Marked			Natural			Marked			Natural			Marked					
Pair of scans	No. of points	X [m m]	Y [mm]	Z [mm]	X [mm]	Y [m m]	Z [mm]	No. of points	X [m m]	Y [mm]	Z [mm]	X [mm]	Y [m m]	Z [m m]	No. of points	X [m m]	Y [m m]	Z [m m]	X [mm]	Y [m m]	Z [mm]	
SURF	6 - 7	4	1.6	0.8	3.4	2.7	1.9	4.5	9	2.3	5.1	8.6	5.3	3.7	5.3	6	22.0	10.5	71.7	132	220	683
	6 - 8	3	10.9	11.7	8.8	23.1	37.1	33.3	52	41.6	23.0	37.6	47.8	28.3	24.5	-	-	-	-	-	-	-
	6 - 9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	6 - 10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	7 - 8	3	2.9	4.0	2.4	2.7	4.3	7.6	19	35.2	26.2	30.5	30.1	7.4	17.5	7	349	173	350	296	82.9	300
	7 - 9	4	137	285	31.9	169	248	119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7 - 10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	7 - 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	8 - 9	3	4.6	10.5	6.3	30.0	16.1	9.4	2	38.4	17.2	12.8	165	300	67.0	5	461	356	511	427	782	988
	8 - 10	5	5.7	36.8	22.0	26.0	130	28.8	-	-	-	-	-	-	-	2	68.9	164	34.5	451	322	301
	8 - 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	9 - 10	8	10.6	4.5	19.5	7.9	20.8	20.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	9 - 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10 - 11	24	4.6	3.9	4.8	2.1	1.7	1.4	-	-	-	-	-	-	-	5	11.8	39.4	34.8	12.6	6.0	36.4	
10 - 12	8	4.4	2.0	6.3	15.7	22.8	36.9	-	-	-	-	-	-	-	4	36.3	202	646	217	678	973	
FAST	6 - 7	4	5.8	11.2	5.0	5.6	7.8	15.3	14	3.0	3.3	5.1	6.2	7.0	9.5	2	133	125	161	278	128	820
	6 - 8	2	1.1	3.9	3.8	26.7	11.0	25.4	3	152	203	66.0	210	373	197	-	-	-	-	-	-	-
	6 - 9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	6 - 10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	7 - 8	12	4.4	5.0	5.8	2.4	12.2	4.6	11	29.0	18.3	26.4	230.2	63.8	175	-	-	-	-	-	-	-
	7 - 9	4	14.9	23.3	4.9	12.9	43.9	11.8	4	160	119	1.5	1727	24.3	63.3	-	-	-	-	-	-	-
	7 - 10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	7 - 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	8 - 9	13	26.4	25.6	12.8	15.5	9.1	12.1	2	160	62.7	346	136.8	387	74.7	3	3.1	11.5	7.5	47.0	58.3	74.8

	8 - 10	3	1.0	0.6	9.1	4.2	16.6	22.2	-	-	-	-	-	-	-	-	-	-	-	-	-	
	8 - 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	9 - 10	8	10.6	4.5	19.5	7.9	20.8	20.9	-	-	-	-	-	-	-	-	-	-	-	-		
	9 - 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	10 - 11	25	3.4	3.2	4.8	2.5	1.9	1.4	-	-	-	-	-	-	-	5	11.8	39.4	34.8	12.6	6.0	36.4
	10 - 12	8	35.1	24.1	29.9	33.5	25.3	10.3	-	-	-	-	-	-	-	4	36.3	202	646	217	678	973