Study of the Behaviour of the Rover and Assessment of the Overall Quality of the Results from RTK Measurements, Conducted in open-Field - Influenced by Active Disturber

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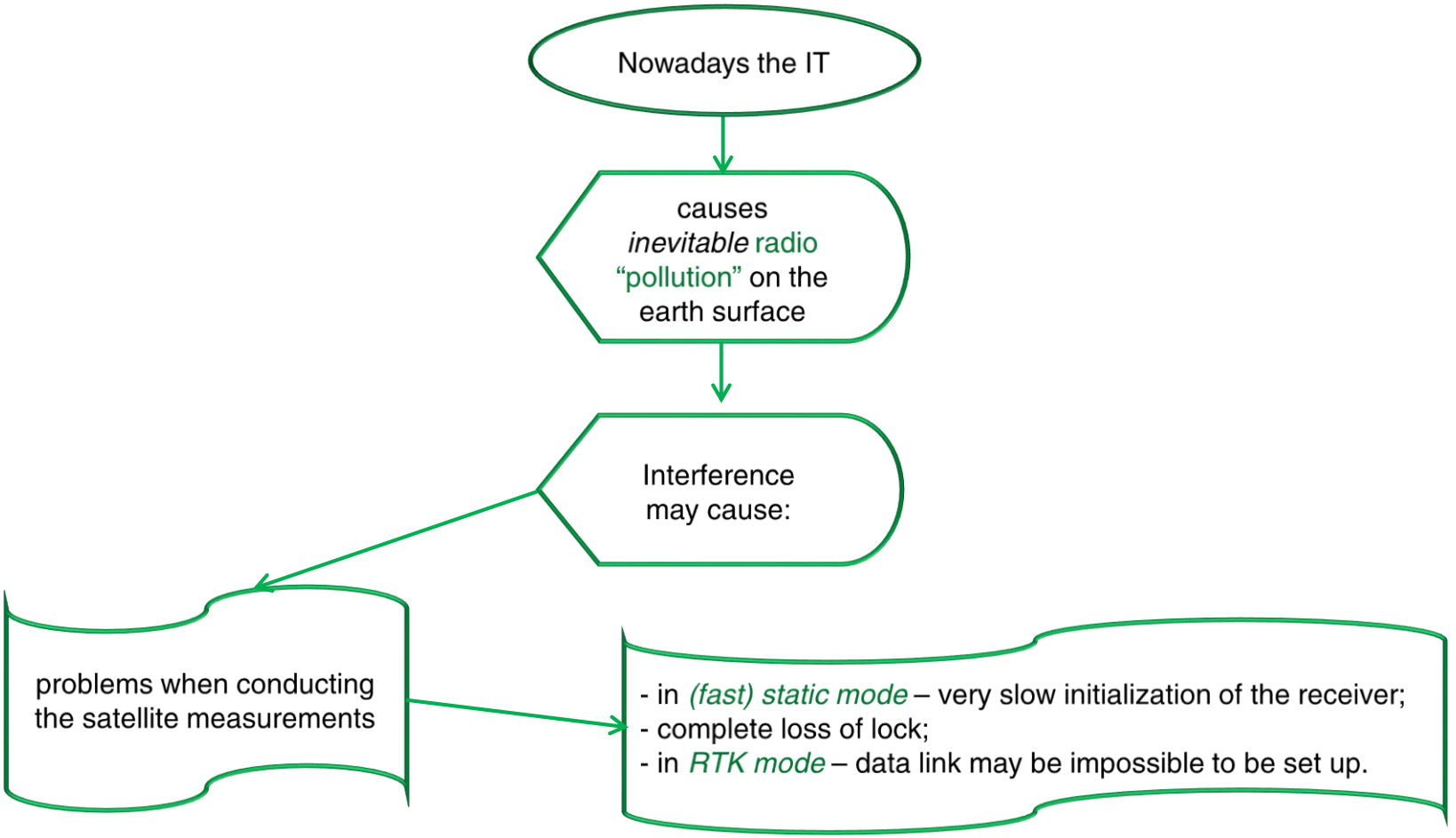
1. Introduction



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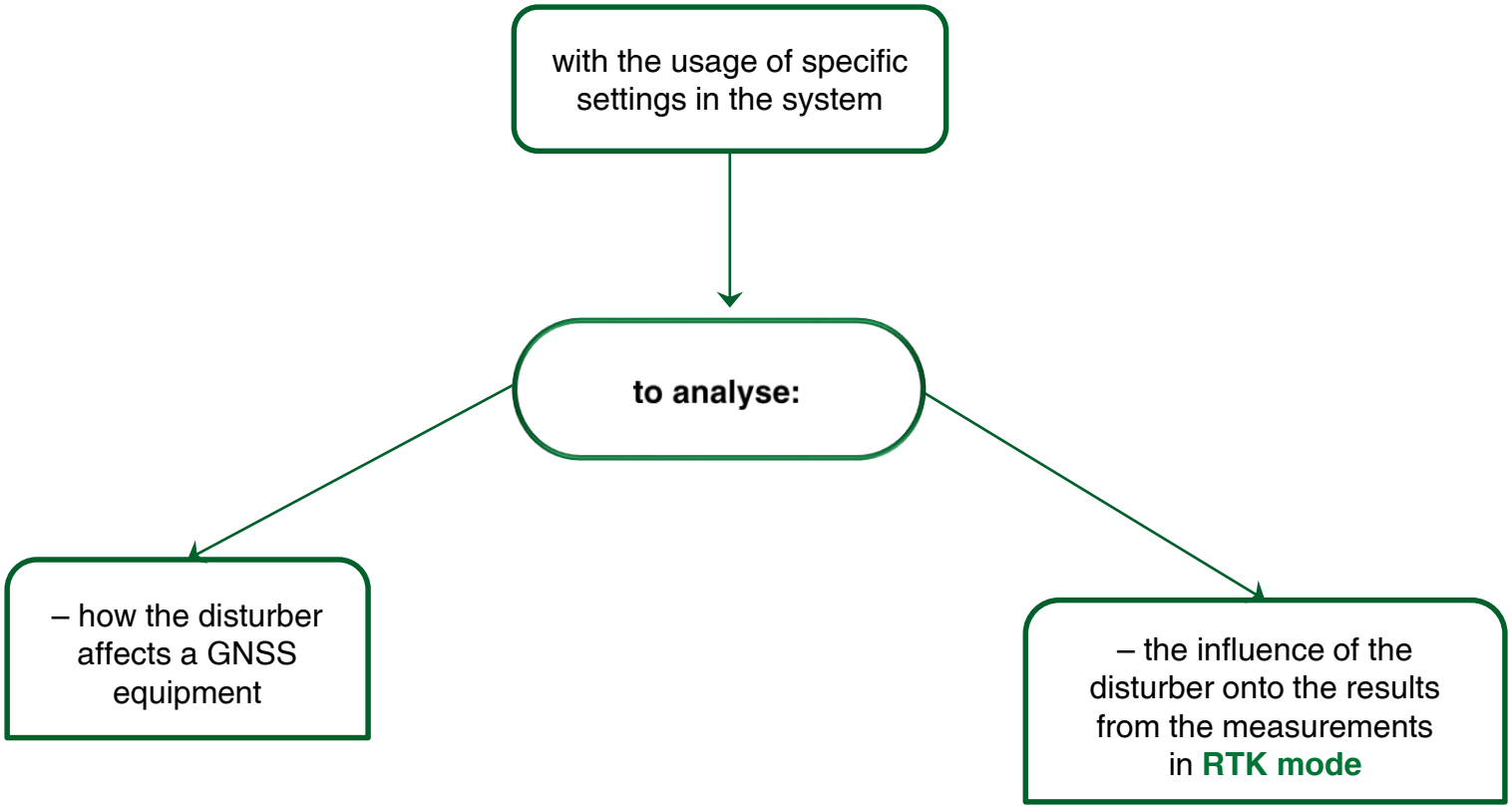
2. Aims of the study



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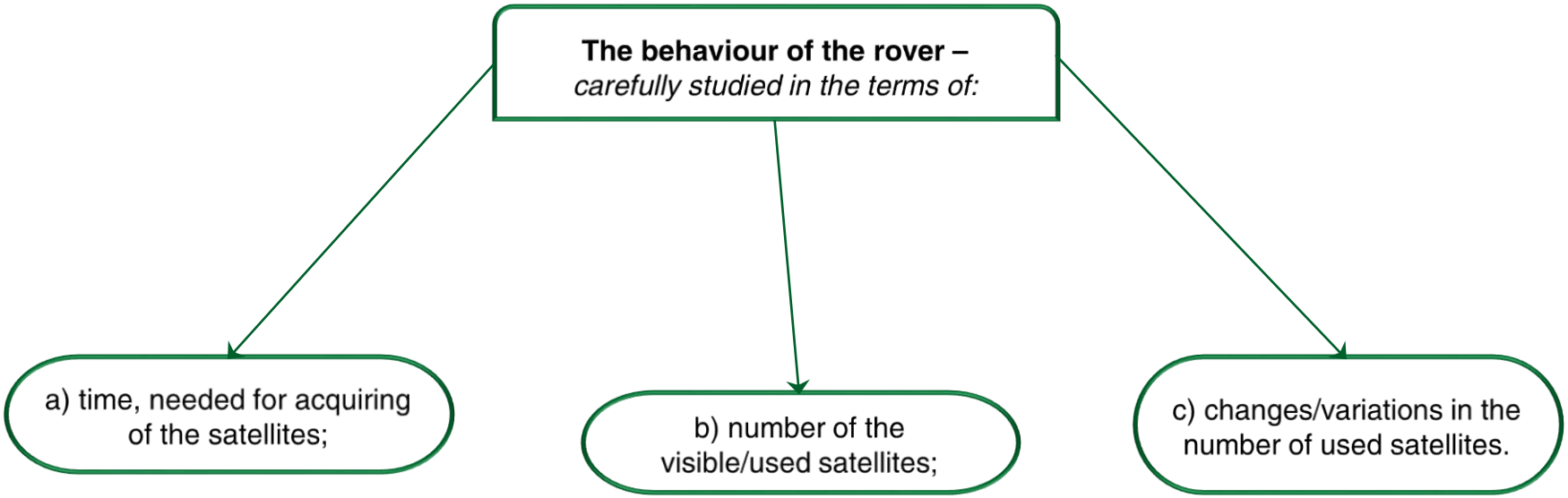
3. Conducted Geodetic Measurements. Study and Specifics of the Behaviour of the Rover

-the reference GNSS station - set up in close proximity to the area under study;
-RTK measurements were conducted inside the disturbed region;
-the lengths of the measured spatial chords were less than 1 km.



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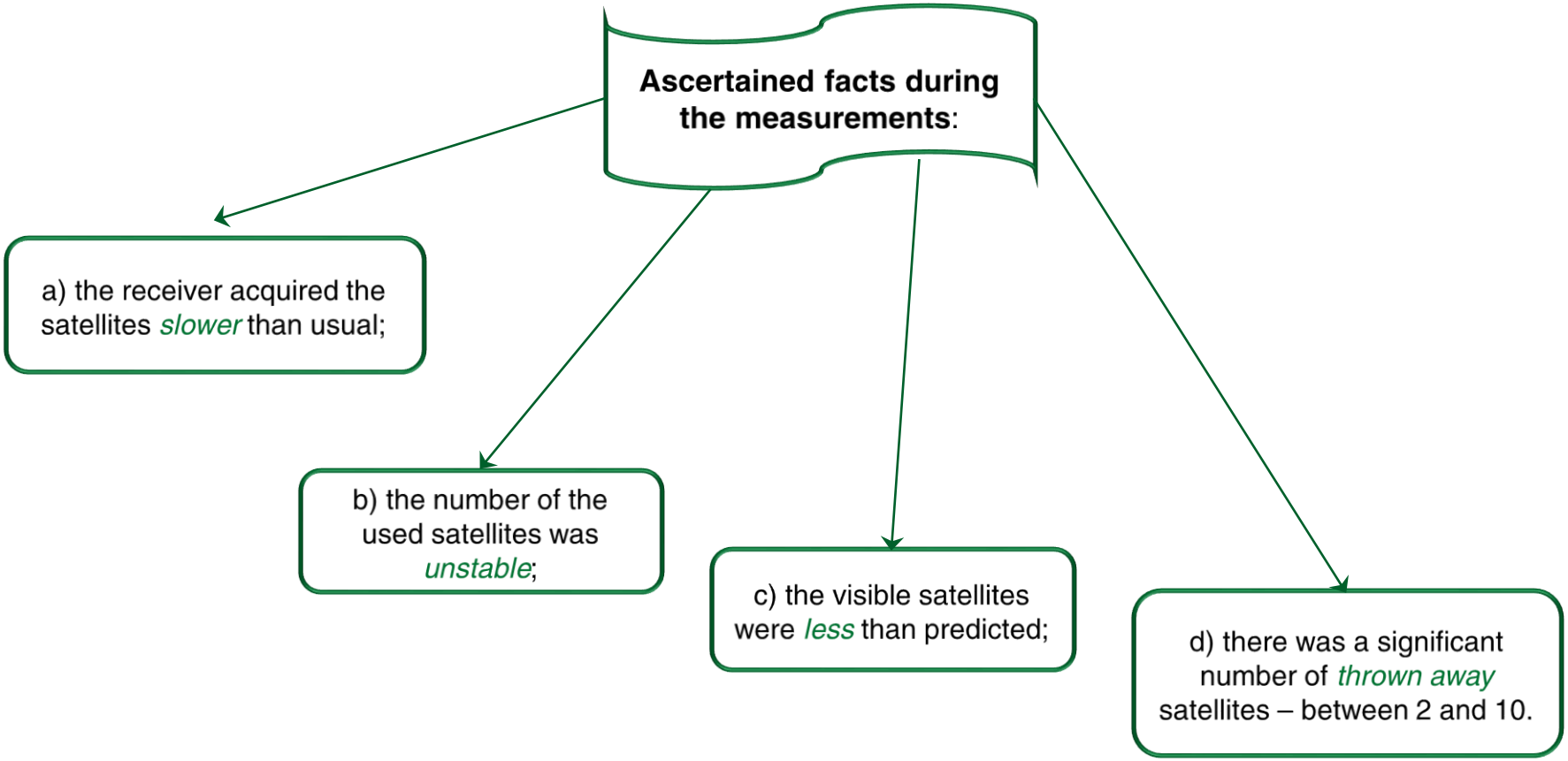
3. Conducted Geodetic Measurements. Study and Specifics of the Behaviour of the Rover



4. Used Criteria for Assessment of the Overall Quality of the Measured points

In this study the following quality criteria were applied:

1. Diagonal elements of the co-variance matrix: Q11, Q22 and Q33;
2. Position quality - Mp;
3. Height quality - Mh;
4. Position and height quality - M3D;

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5. Results and Analysis from the Measurements in RTK mode

due to ***frequent change*** in the number of the used satellites → the points were occupied several times consecutively

point N	Q11	Q22	Q33	Mp [mm]	Mh [mm]	M3D [mm]	rating
335	0.00001915	0.00001231	0.00009714	6	11	12	0.63
336	0.00001916	0.00001281	0.00010978	6	11	12	0.63
350	0.00001914	0.00001280	0.00010994	5	10	11	0.63
351	0.00001933	0.00001282	0.00011988	5	10	11	0.64
352	0.00001583	0.00001265	0.00010010	5	10	11	0.64
353	0.00001903	0.00001269	0.00010491	6	11	12	0.63
354	**0.00002263**	**0.00002574**	**0.00029561**	**7**	**17**	**18**	**0.47**
355	**0.00001560**	**0.00001254**	**0.00009616**	**5**	**10**	**11**	**0.64**
370	0.00001918	0.00001320	0.00010867	5	10	11	0.63
371	0.00001535	0.00001268	0.00010175	5	10	12	0.64

significant difference in the quality

Table 1. Values of the criteria and results for the overall quality assessment

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5. Results and Analysis from the Measurements in RTK mode

variations of the rating

highest overall quality

anomaly - Mp <-> rating

extreme low quality

low quality

point N	Q11	Q22	Q33	Mp	Mh	M3D	rating
385	0.00001155	0.00001037	0.00009547	6	12	13	0.66
390	**0.00001558**	**0.00001339**	**0.00020323**	**6**	**16**	**17**	**0.55**
391	**0.00001143**	**0.00001036**	**0.00009719**	**4**	**9**	**10**	**0.69**
394	0.00001443	0.00001110	0.00012543	6	13	15	0.63
395	0.00001176	0.00001111	0.00012155	5	13	14	0.68
396	**0.00001133**	**0.00001036**	**0.00010028**	**4**	**9**	**10**	**0.70**
397	***0.00001439***	***0.00001105***	***0.00011995***	***4***	***9***	***10***	***0.65***
398	***0.00001137***	***0.00001119***	***0.00011799***	***5***	***11***	***12***	***0.69***
399	**0.00000432**	**0.00000408**	**0.00004336**	**10**	**22**	**24**	**0.56**
400	0.00001135	0.00001070	0.00010613	5	11	12	0.69
401	0.00001174	0.00001180	0.00014581	5	13	14	0.68
402	0.00001173	0.00001129	0.00013052	5	12	13	0.68
403	0.00001196	0.00001178	0.00015797	5	12	13	0.68
404	**0.00001195**	**0.00001119**	**0.00013835**	**6**	**16**	**17**	**0.55**
405	0.00001197	0.00001170	0.00015670	6	15	16	0.58
406	0.00001185	0.00001119	0.00013371	6	15	16	0.58

Table 1. Values of the criteria and results for the overall quality assessment - continued

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5. Results and Analysis from the Measurements in RTK mode

variations in the quality

low quality

equal quality, high rating

point N	Q11	Q22	Q33	Mp	Mh	M3D	rating
419	**0.00001679**	**0.00001275**	**0.00012999**	**8**	**16**	**18**	**0.45**
420	0.00001245	0.00001099	0.00011075	6	13	14	0.65
421	0.00001246	0.00001099	0.00011050	6	12	14	0.66
422	**0.00001254**	**0.00001099**	**0.00010936**	**5**	**11**	**12**	**0.67**
425	**0.00001308**	**0.00001164**	**0.00012041**	**8**	**17**	**18**	**0.47**
426	0.00001312	0.00001165	0.00011957	7	15	16	0.54
434	**0.00001316**	**0.00001102**	**0.00009676**	**5**	**10**	**11**	**0.67**
435	**0.00001331**	**0.00001104**	**0.00009961**	**5**	**9**	**10**	**0.67**
436	0.00001378	0.00001130	0.00010815	5	10	11	0.66
437	0.00001363	0.00001107	0.00010058	6	13	14	0.64
438	0.00001415	0.00001240	0.00010750	6	12	13	0.64
439	0.00001417	0.00001241	0.00010731	6	12	14	0.64
440	0.00001381	0.00001126	0.00010326	6	13	14	0.64
441	0.00001383	0.00001126	0.00010304	6	13	14	0.64
442	0.00001386	0.00001127	0.00010265	7	14	15	0.56
443	0.00001392	0.00001129	0.00010199	6	13	14	0.64

Table 1. Values of the criteria and results for the overall quality assessment - last

6. Analysis of the Results

According to the calculated results, it could be summarized:
1. variations in the accuracy were ascertained;
2. a degradation of the accuracy *up to 24 mm in the open field* was observed;
3. M3D quality criterion was not sufficient for complete control of the accuracy – for points NN 397 and 398. More criteria should be considered and used.

It must be noted that several years ago in the region under study GNSS measurements could not be conducted due to the strong influence of the active disturber.

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7. Conclusions

Based on:
- continuous improvement of the system;
- considering the accuracy results,

Geodetic measurements conducted with GNSS equipment nowadays are characterised *with better overall quality and reliability* in comparison with the passed last years.

Taking in mind the quality assessment, the current status of the system and GNSS modernizations it could be concluded:
- Currently enough operational satellites exist, which can be used for geodetic determinations and be delivered good quality results in a region with operating active disturber.
- The future efforts for GNSS improvements are highly encouraged in order to be obtained: better reliability in the determinations and higher overall quality of the results within places with operating active disturber.

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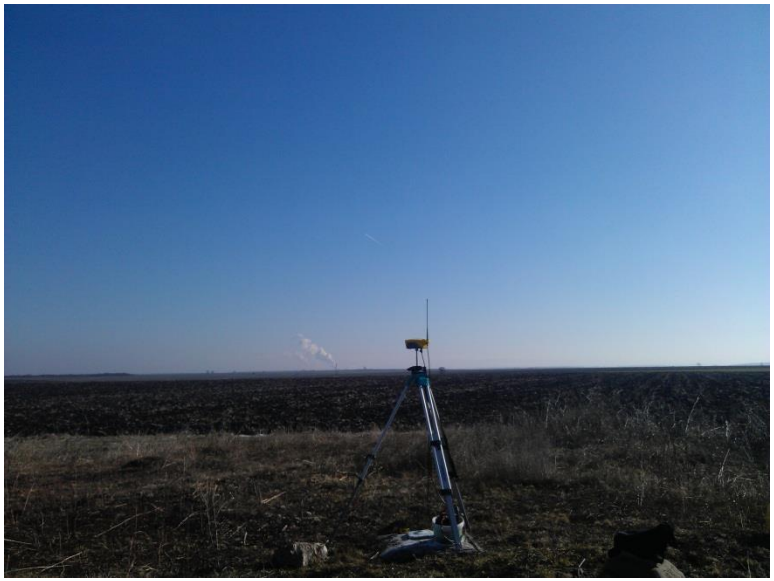

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