Study of the Performance of a GNSS Equipment and Assessment of the Quality of the Results from the Geodetic measurements in an open Field Environment with Active Disturber

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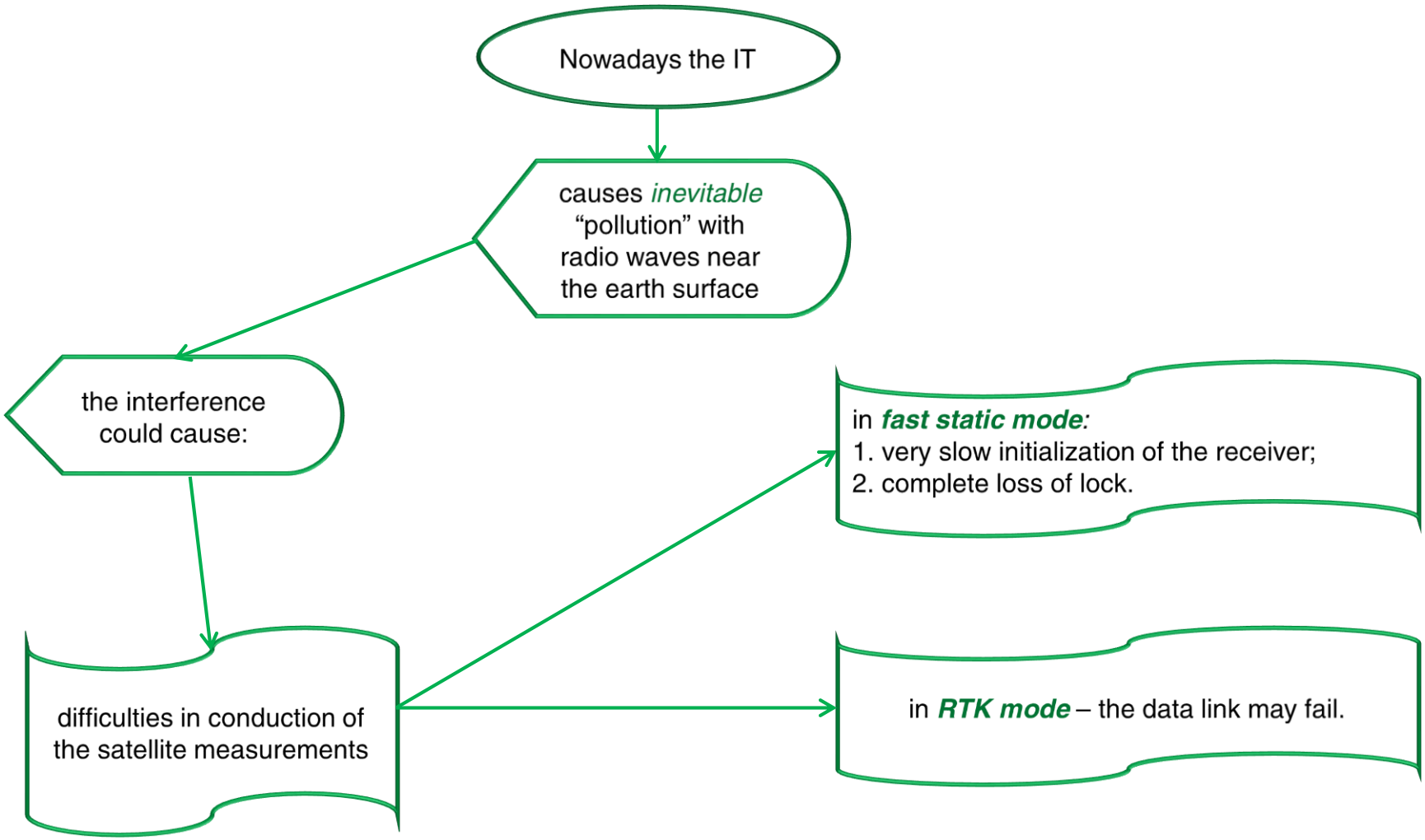
1. Introduction



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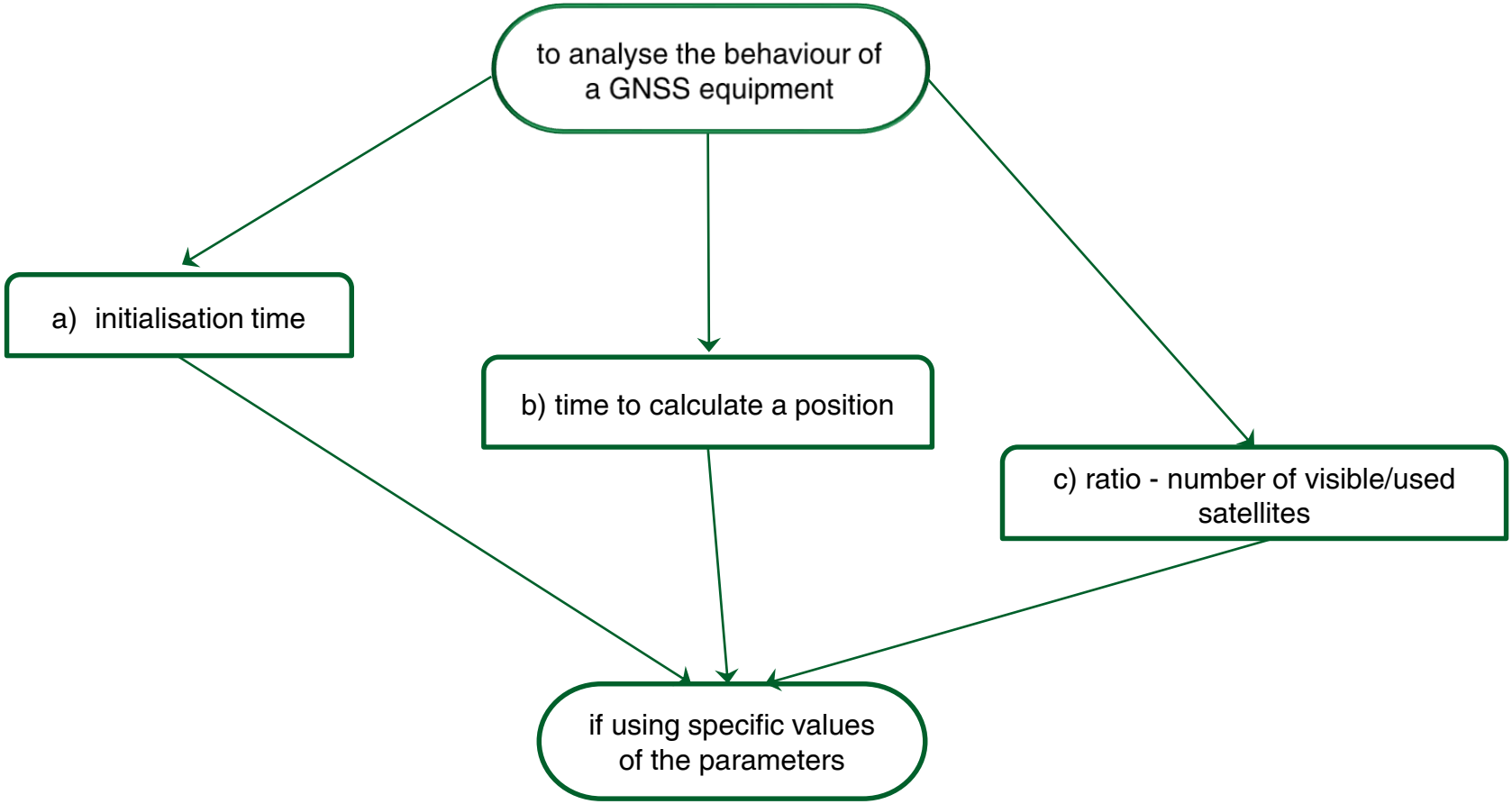
2. Task for this experiment



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3. Conducted Geodetic Measurements in an open-Field Environment

1. A reference GNSS station was installed out of the area under study;
2. Fast static GNSS measurements were conducted ***both outside and inside*** of the disturbed region;
3. The lengths of the measured chords were up to 500 m.

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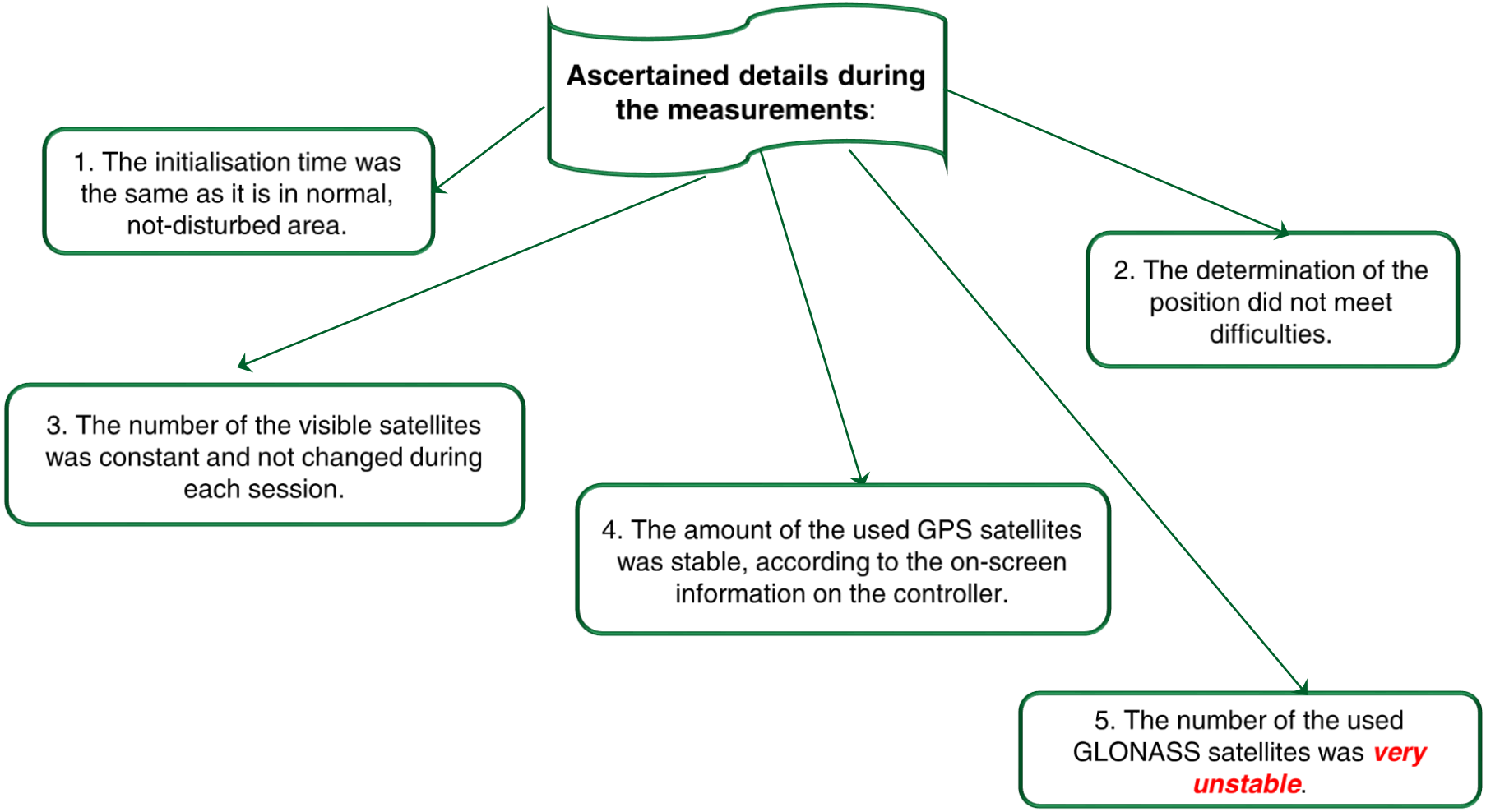
3. Conducted Geodetic Measurements in an open-Field Environment. Study and Specifics of the Behaviour of the Rover



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

In this paper the following quality criteria were involved:

1. Position quality M_P;
2. Position and height quality M3D;
3. Diagonal elements of the co-variance matrix: $Q_{11}, Q_{22}\ and\ Q_{33}$;
4. DOP factor for assessing the geometry of the visible satellites, including: GDOP(max), PDOP(max), HDOP(max) and VDOP(max).

Study of the Performance of a GNSS Equipment and Assessment of the Quality of the Results from the Geodetic measurements in an open Field Environment with Active Disturber

5. Analysis of the Results from the Geodetic Measurements

Table 1. Results from the post-processing - **I-st cycle**

new-determined point ID	**11**	**12**	**13**	**14**	**20**	**25**
Position with respect to the disturbed region	**inside the disturbed region**				**outside of the disturbed region**	
Position quality [m]	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002
Position and height quality [m]	0.0002	0.0002	0.0002	0.0003	0.0002	0.0004
Q11	5.000E-07	5.500E-07	**5.900E-07**	**5.700E-07**	**4.400E-07**	**4.000E-07**
Q22	2.500E-07	2.700E-07	**3.200E-07**	**3.300E-07**	2.900E-07	2.600E-07
Q33	4.100E-07	4.800E-07	**5.600E-07**	**5.700E-07**	4.600E-07	4.000E-07
GDOP max	2.2	2.5	**3.7**	**3.6**	**1.7**	**1.5**
PDOP max	1.8	2.1	**3**	**2.9**	**1.5**	**1.3**
HDOP max	0.9	0.9	**1.1**	**1.1**	0.9	**0.8**
VDOP max	1.6	1.9	**2.8**	**2.7**	**1.2**	**1.1**

same values →

max values (Qii and DOP)

significant differences

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5. Analysis of the Results from the Geodetic Measurements

Table 2. Results from the post-processing - **II-nd cycle**

small variations →

new-determined point ID	**1**	**5**	**6**	**7**
Position with respect to the disturbed region	**outside of the disturbed region**	**inside the disturbed region**		
Position quality [m]	*0.0001*	*0.0002*	***0.0003***	***0.0003***
Position and height quality [m]	0.0002	0.0004	**0.0005**	0.0004
Q11	5.000E-07	4.200E-07	4.000E-07	4.100E-07
Q22	1.900E-07	1.900E-07	2.000E-07	2.100E-07
Q33	3.500E-07	3.700E-07	4.300E-07	**5.600E-07**
GDOP max	1.6	1.5	1.5	1.6
PDOP max	1.4	1.3	1.3	1.4
HDOP max	0.7	0.7	0.7	0.8
VDOP max	1.2	1.1	1.1	1.2

← large value

Study of the Performance of a GNSS Equipment and Assessment of the Quality of the Results from the Geodetic measurements in an open Field Environment with Active Disturber

5. Analysis of the Results from the Geodetic Measurements

Table 3. Results from the post-processing - **II-nd cycle - continued**

new-determined point ID	**8**	**9**	**10**
Position with respect to the disturbed region	**inside the disturbed region**		
Position quality [m]	0.0003	**0.0004**	0.0002
Position and height quality [m]	**0.0005**	**0.0006**	0.0004
Q11	4.200E-07	4.300E-07	4.200E-07
Q22	2.300E-07	**2.500E-07**	***2.700E-07***
Q33	**6.100E-07**	**5.600E-07**	5.200E-07
GDOP max	**4.1**	2.0	1.8
PDOP max	**3.3**	1.7	1.5
HDOP max	**1.6**	1.0	0.9
VDOP max	**2.9**	1.4	1.3

highest values

points 8 and 10

large values (**strong influence**)-point 8

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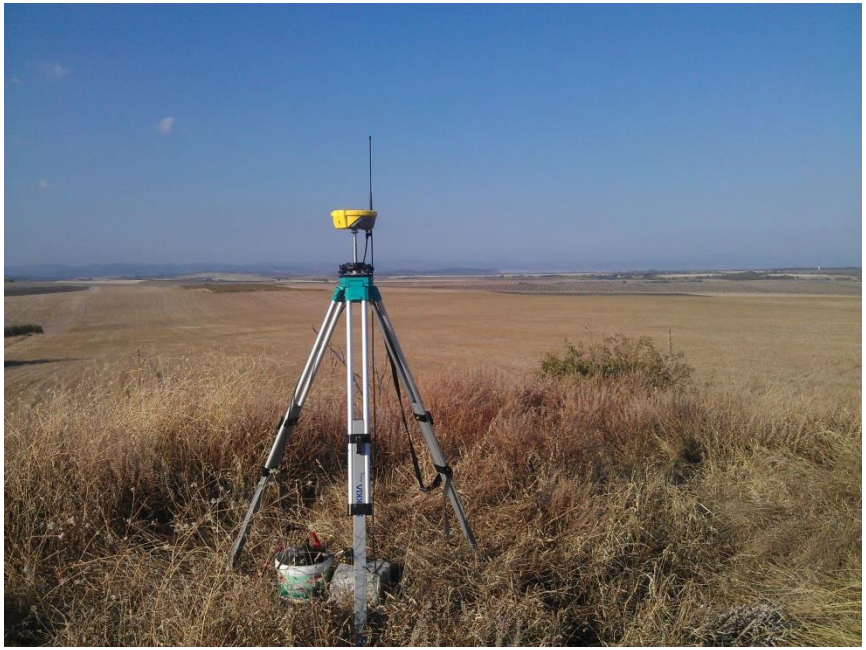
5. Analysis of the Results from the Geodetic Measurements

According to the **field performance** of the equipment, it could be noted:

-the active disturber affects **mainly GLONASS** satellites;
-some of the GLONASS satellites which should be available, were “absent” in the satellites’ windows of the rovers, placed in the area under study;

-significant number of satellites were “**thrown away**” and not used by the controller’s software. The approximate amount of the excluded satellites was at about 20-25%.
- the values of the DOP factor are **abnormally high**.



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6. Conclusion

Taking in mind the continuous improvements of GNSS, the geodetic measurements conducted with satellite equipment nowadays are characterised with better ***overall quality and reliability***.

Based on the conducted fast static measurements, the numerical results and field facts it could be summarised, that the active disturber has ***strong affect onto***:

a) GLONASS satellites;
b) the values of the diagonal elements of the co-variance matrix.

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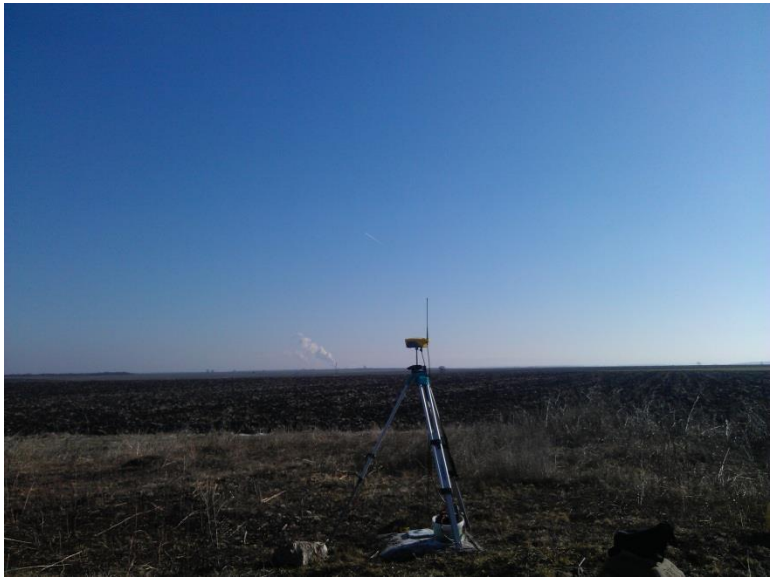
Study of the Performance of a GNSS Equipment and Assessment of the Quality of the Results from the Geodetic measurements in an open Field Environment with Active Disturber



Thank you for your attention!