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ASSESSING OF THE OVERALL QUALITY OF GNSS DETERMINATIONS, USING SPECIFIC VALUES OF PARAMETERS

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ASSESSING OF THE OVERALL QUALITY OF GNSS DETERMINATIONS, USING SPECIFIC VALUES OF PARAMETERS

1. Introduction

The contemporary geodetic instruments and technologies provide the professionals with:

-Reliable results and high quality;

- Productivity (*RTK, fast static modes*)

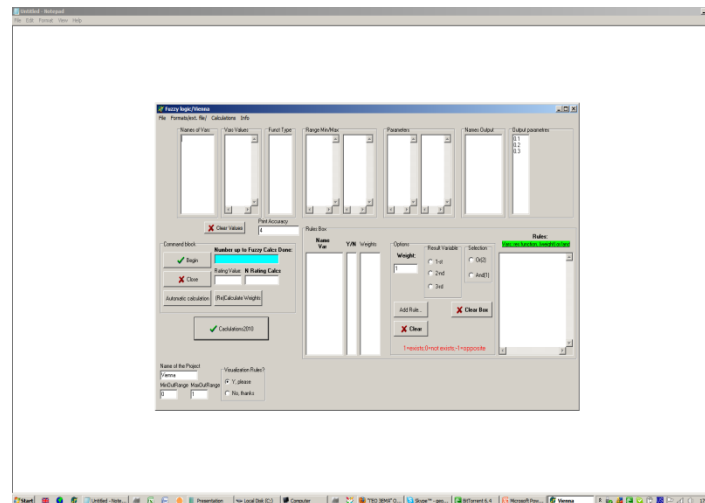- GNSS usage, incl. the available in the future GALILEO and COMPASS

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2. Task of this study

Determination and analysis of the *differences, which <u>may appear</u>* in the overall quality of measured spatial chords if using:

-Record rate of the satellite signals - set ***from 1 sec. to 60 sec.,***
-Session length - of ***up-to 5 min.,***
-Occupied control points, situated in open areas;
-Value for the cut-off angle - set to ***0 degrees*** in the firmware.

In the experiment Fuzzy logic was applied and application Vienna_Fuzzy was used:
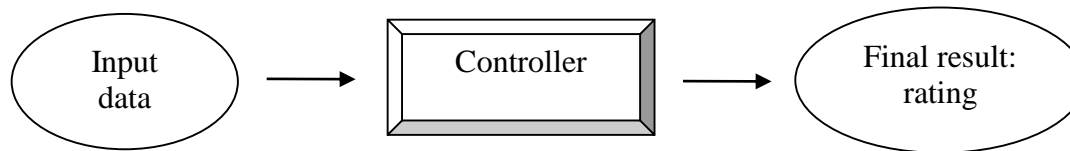

interface of the application

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3. Fuzzy logic-Basic Information

-In the beginning exact values of the variables are entered;
- Values are then fuzzified; They get their degree of membership;
- In the Inference, the weights and the operator ("and", "or") are applied.
- Defuzzification - used to obtain an exact value - the rating.

General Scheme:
Input>Fuzzification>Inference>Defuzzification

```
  ┌─────────┐         ┌────────────┐         ┌──────────────┐
  │  Input  │  ──────>│ Controller │  ──────>│ Final result:│
  │  data   │         │            │         │    rating    │
  └─────────┘         └────────────┘         └──────────────┘
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4. Performed geodetic measurements

In this paper studies are performed with seven spatial chords with lengths:

a) up-to **5** km.;

b) from **5** up-to **10** km.;

c) from **10** up-to **15** km.;

d) from **15** up-to **20** km.;

e) from **20** up-to **25** km.;

f) from **25** up-to **30** km.;

g) over **30** km.

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5. Used criteria for accuracy

In this paper the following accuracy criteria were used:

a) Quality in position and height M_{3D} ;

b) Elements of the co-variance matrix for the chord: Q_{xx} Q_{yy} Q_{zz} ;

c) Number $Gdop(\max)$;

d) Number $Pdop(\max)$.

These criteria were used as input data in the application Vienna_Fuzzy.

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6. Results from the geodetic measurements. Analysis

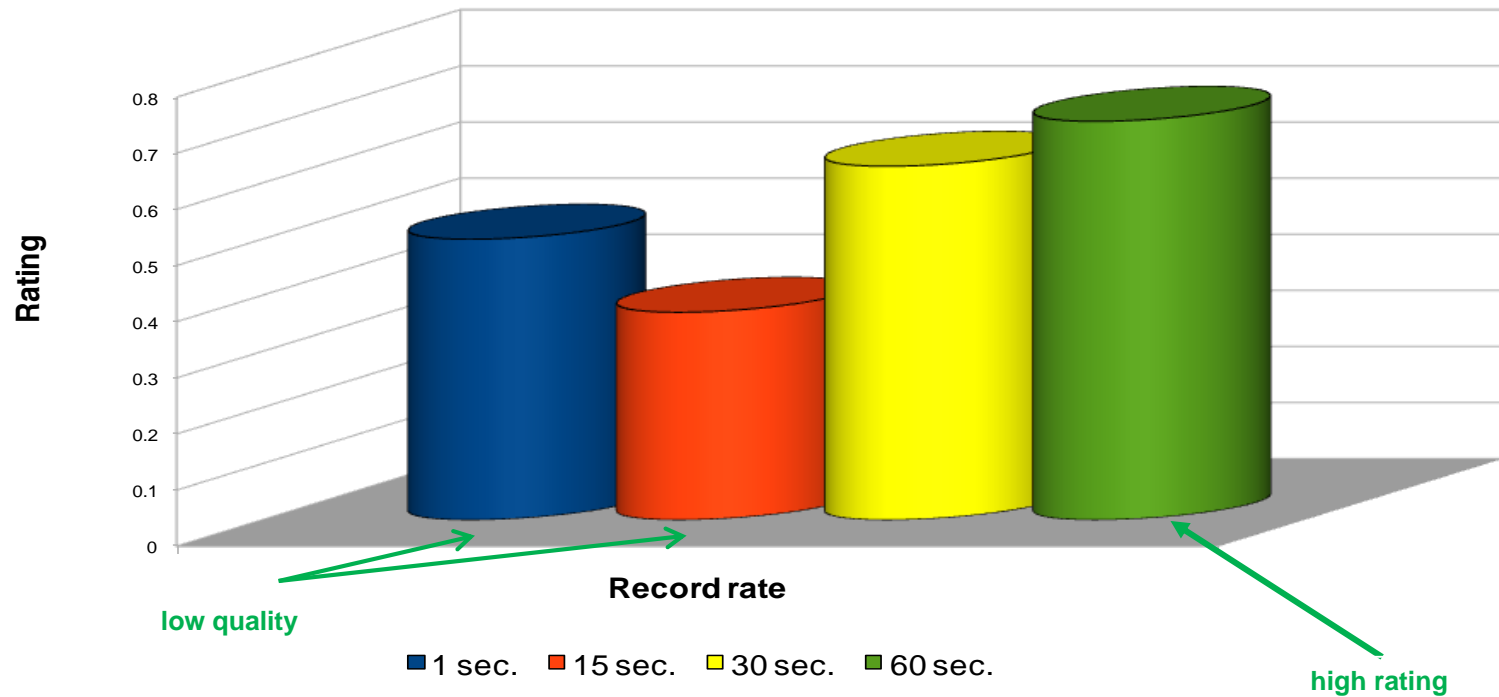The rating value for each measured chord, subject of assessment was calculated for each session.

In this specific case, the *bigger* **the rating value, the** *better* **the overall quality.**

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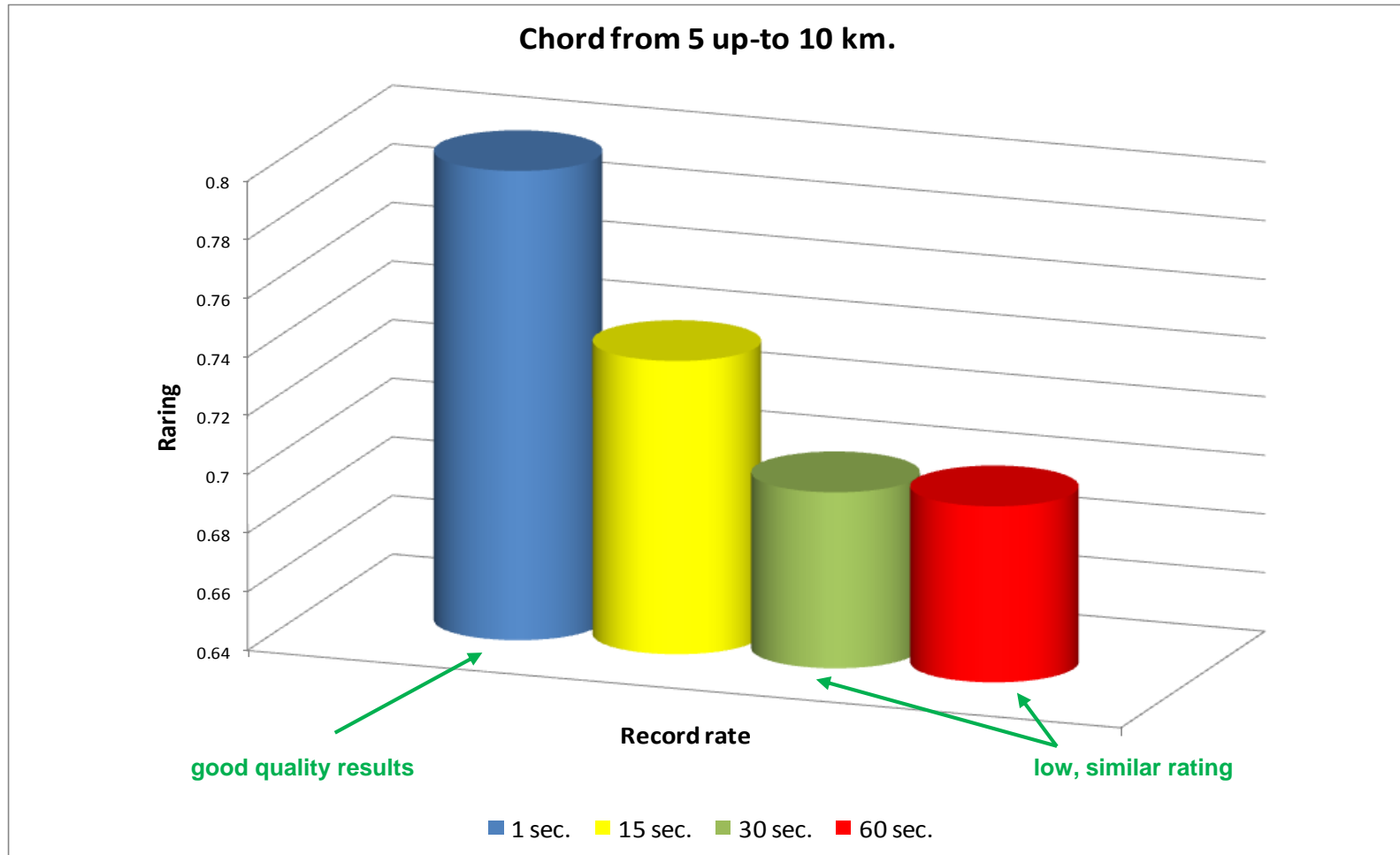
6.1. Analysis of the results from the geodetic measurements
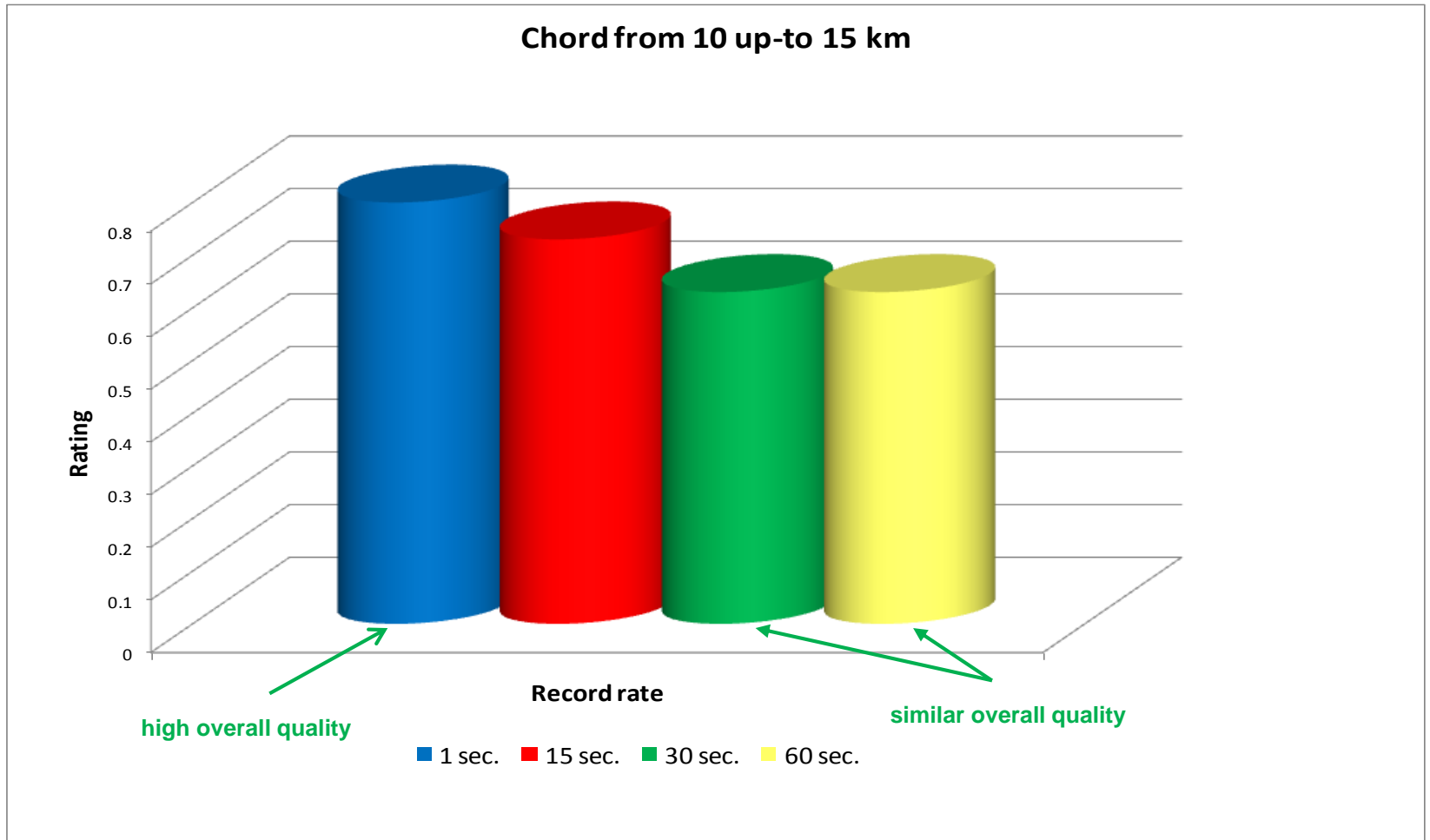
Chord up-to 5 km.

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6.2. Analysis of the results from the geodetic measurements

Chord from 5 up-to 10 km.

6.3. Analysis of the results from the geodetic measurements
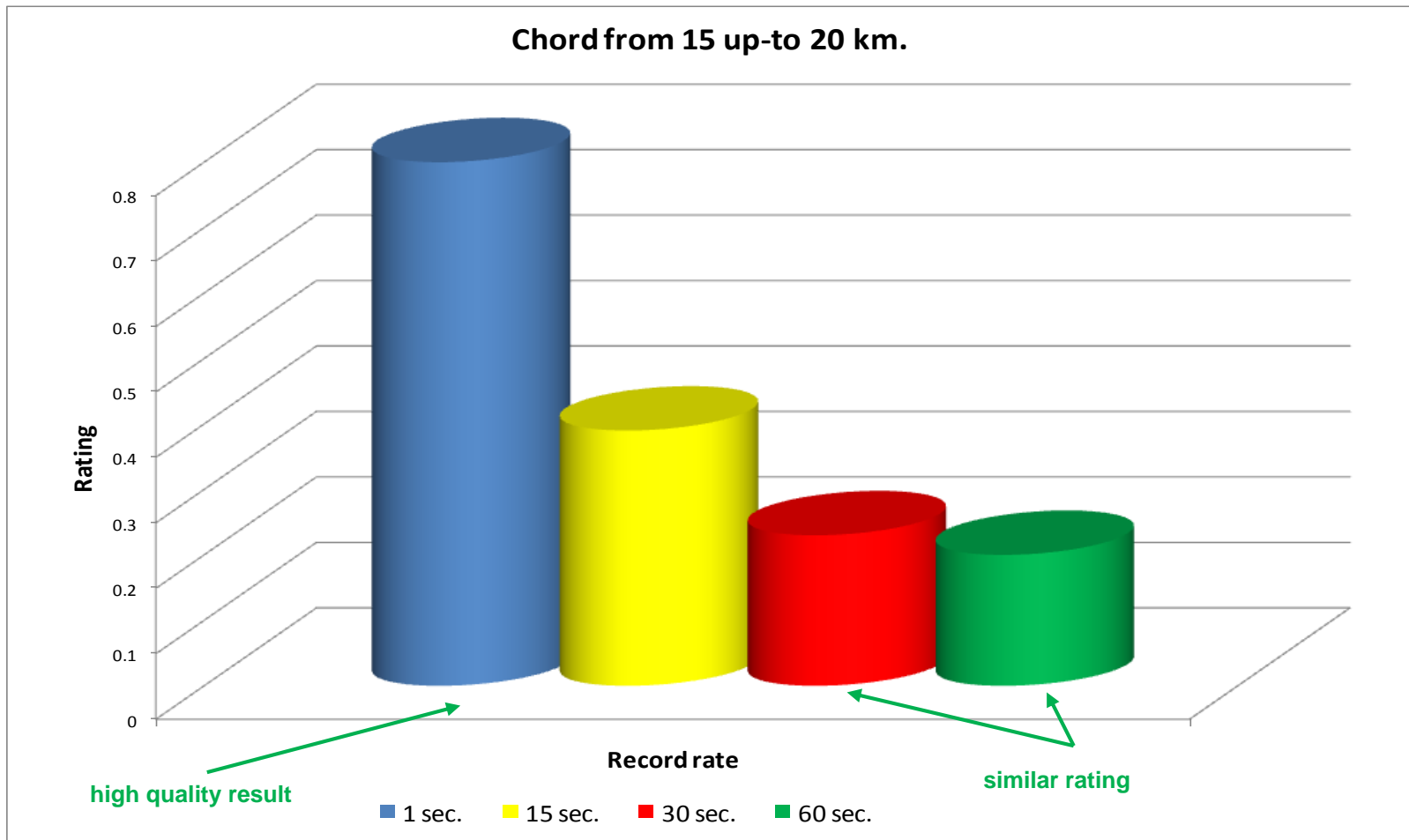

Chord from 10 up-to 15 km

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6.4. Analysis of the results from the geodetic measurements

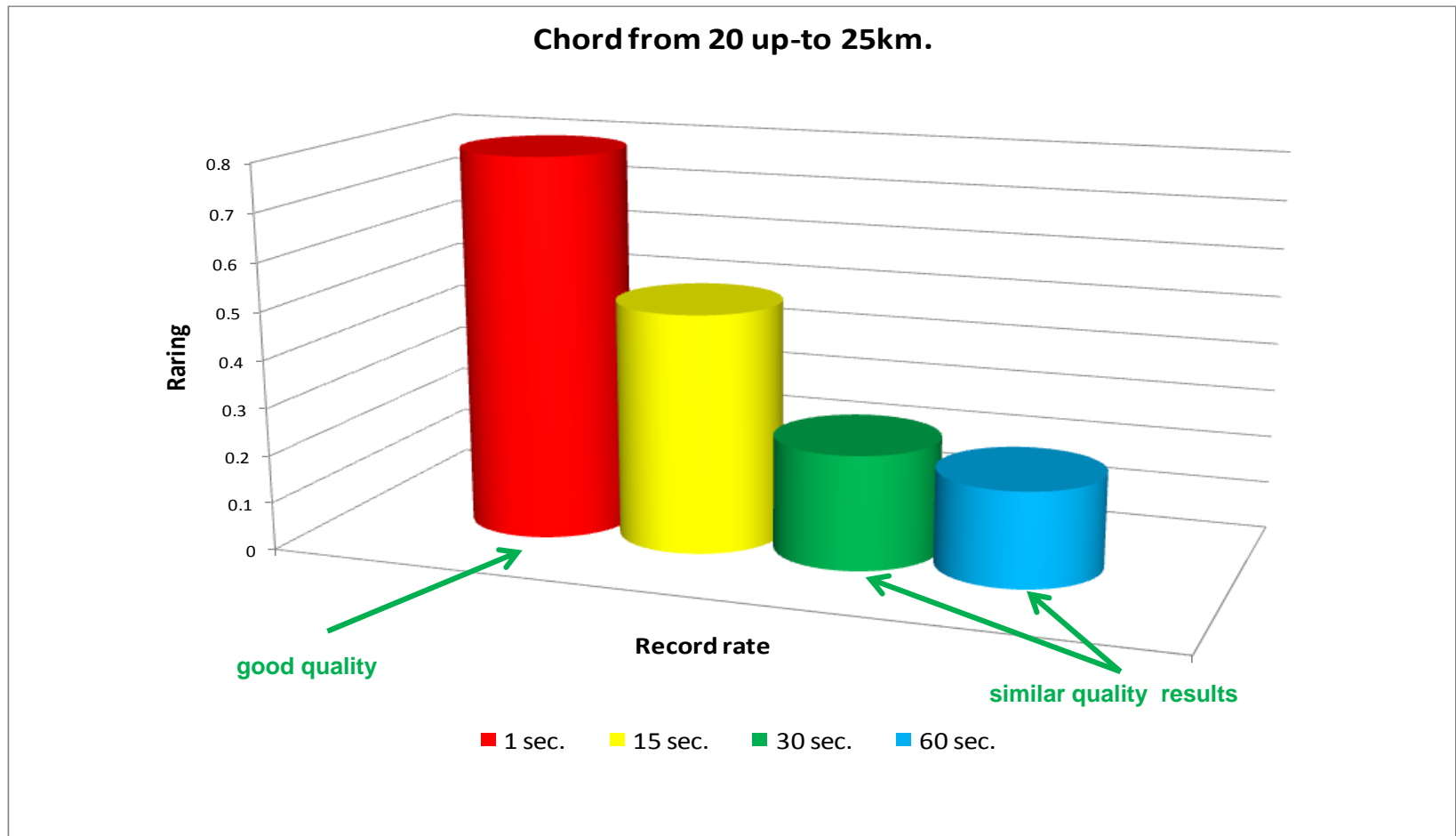Chord from 15 up-to 20 km.

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6.5. Analysis of the results from the geodetic measurements

Chord from 20 up-to 25km.

6.6. Analysis of the results from the geodetic measurements
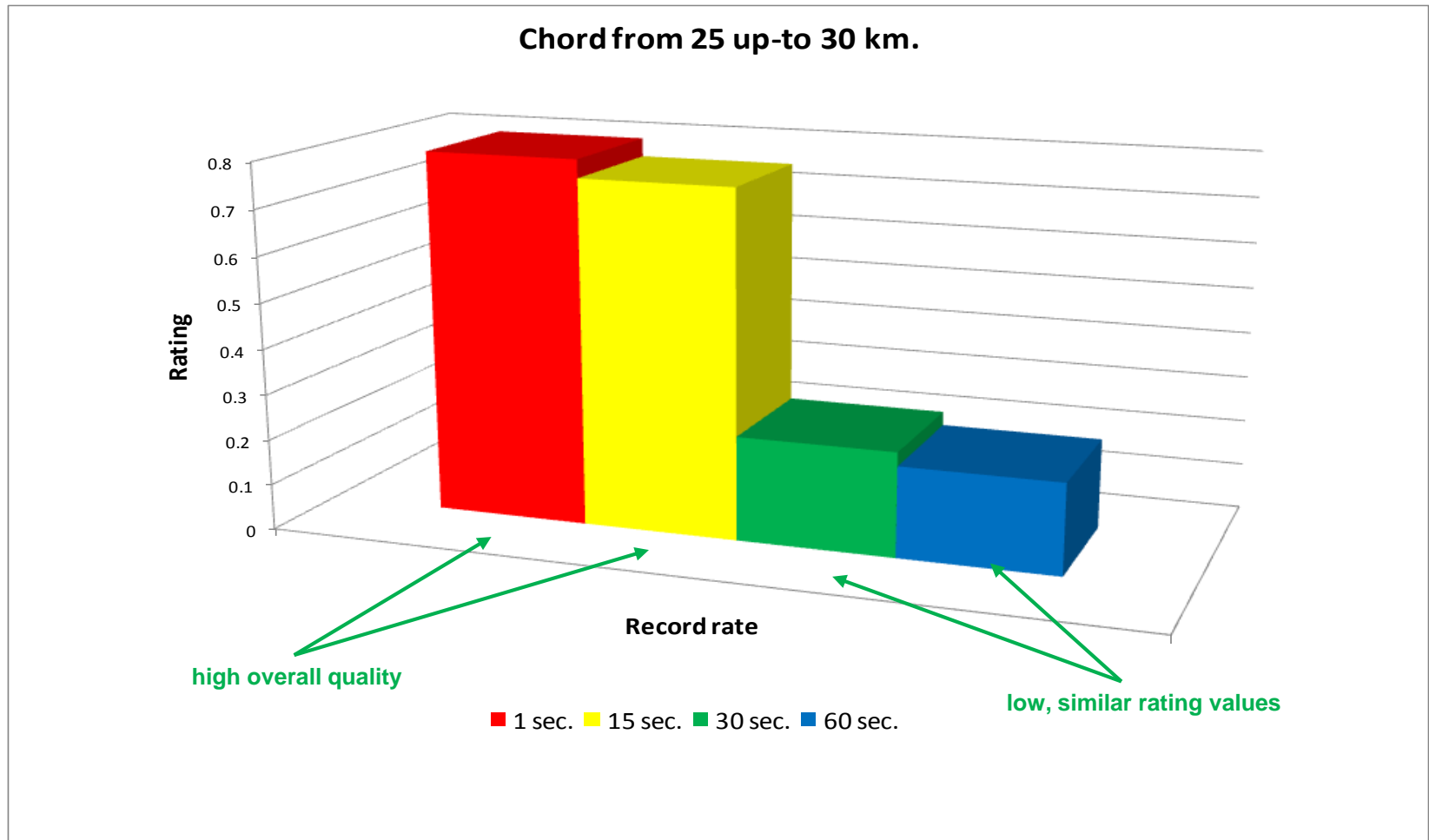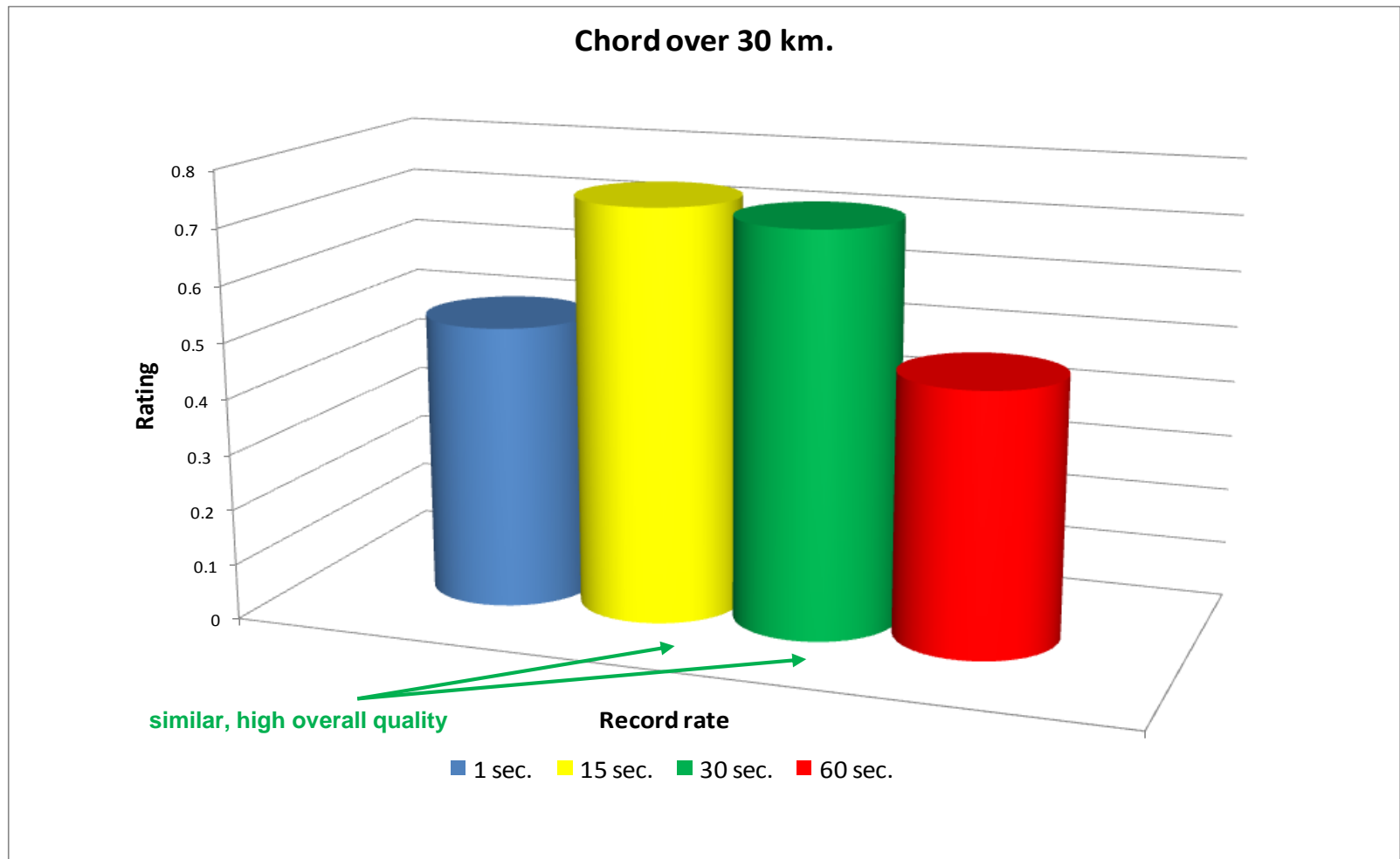

Chord from 25 up-to 30 km.

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6.7. Analysis of the results from the geodetic measurements

Chord over 30 km.

similar, high overall quality

Record rate

■ 1 sec.   ■ 15 sec.   ■ 30 sec.   ■ 60 sec.

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7. Conclusions. Remarks:

Taking in mind the values of the ratings for each spatial chord, it could be summarized:

The possible reason for the low overall quality of the chord with length of up-to 5 km. for record rate of 1 sec. could be the high values of GDOP and PDOP numbers.

The same likely reason for low quality should be valid for the chord with length over 30 km. using record rate of 1 sec.

If no other instructions or rules must be applied to the geodetic satellite measurements, in order to obtain good productivity and produce results with required *high* overall quality, then the following specific parameters:

1. **Record rate for example set to 1 sec.;**
2. **Cut-off angle set to 0 degrees;**
3. **Session length for instance of up-to 5 min.** could be used

when conducting fast static GNSS measurements.

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REFERENCES:

1. Grigoriadis, Vassilios, I. Tziavos, Development of a Software Package for the Automation of Measurements in Bathymetric Mapping, Workshop – Hydro WSH2 – Marine Cadastre / CZM FIG Working Week 2004, Athens, Greece, May 22-27, 2004, pp10

2. Haberler, M., 2003, A Fuzzy System for the Assessment of Landslide Monitoring Data, VGI, 1/2003, pp 92-98, Wien

3. Kostov, G., 2005, Assessment of the Quality of Geodetic Networks Using Fuzzy Logic, pp 2-7, Vienna University of Technology

4. Kostov, G., 2009, Using of Fuzzy logic for some studies over GNSS determination in fast static mode, UACEG, pp 3-7, Sofia (in Bulgarian)

5. Minchev, M., Iv. Zdravcev, Iv. Georgiev, 2005, Foundations of the application of GPS in geodesy, pp 112-118, Sofia UACEG (in Bulgarian)

6. Valev, G. M. Minchev, 1995, Instruction for determination of coordinates with GPS, pp 12-15, "Cartography" Ltd., Sofia (in Bulgarian)

7. Wellenhof, B., Herbert Lichtenegger, James Collins, 2002, GPS Theory and practice, Springer-Verlag/Wien, pp183, Austria (in Bulgarian)

8. Wieser, A. Robust and fuzzy techniques for parameter estimation and quality assessment in GPS, July 2001, Dissertation Technische Universiтдt Graz, ISBN 3-8265-9807-5. ISSN 1618-6303, pp 49-80, Shaker Verlag, Graz

9. Yeung, C. Velocity, Bearing Estimation from GPS Measurements, May 2006, pp21, Department of Land Surveying and Geo-Informatics The Hong Kong Polytechnic University

WEB:

10. http://facility.unavco.org/
11. http://www.geo.bv.tum.de/images/stories/lehre/docman/GPSBasics_en.pdf

Used geodetic software:

1. Geomax Geo Office;
2. Vienna_Fuzzy.

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Thank you for your attention!