Analysis of SK***POS*®** users initialisation time**

Branislav Droscak, PhD.

Karol Smolik

Geodetic and Cartographic Institute BRATISLAVA

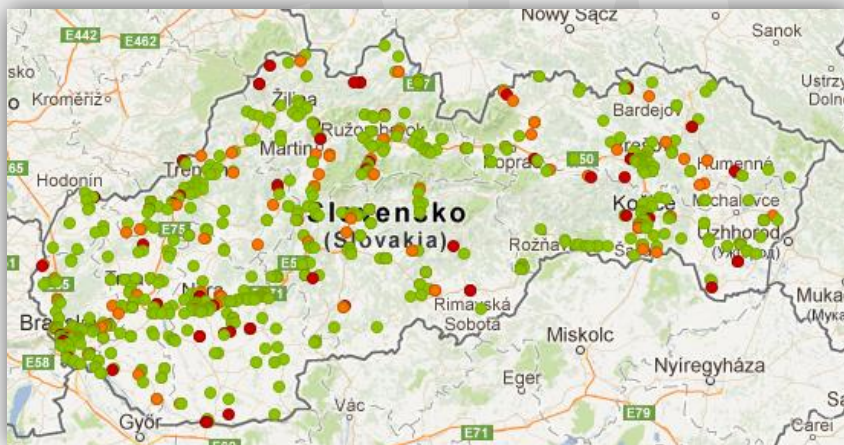branislav.droscak@skgeodesy.sk

Agenda

- Motivation

- What does ASMARUP mean?

- Analysis of $\mathrm{S}\mathbf{K}POS^{®}$ users initialisation time – period 2007-2012

- Results from analysis

- Conclusion

SKPOS® - usage

- the most used surveying service in Slovakia
- over 800 users
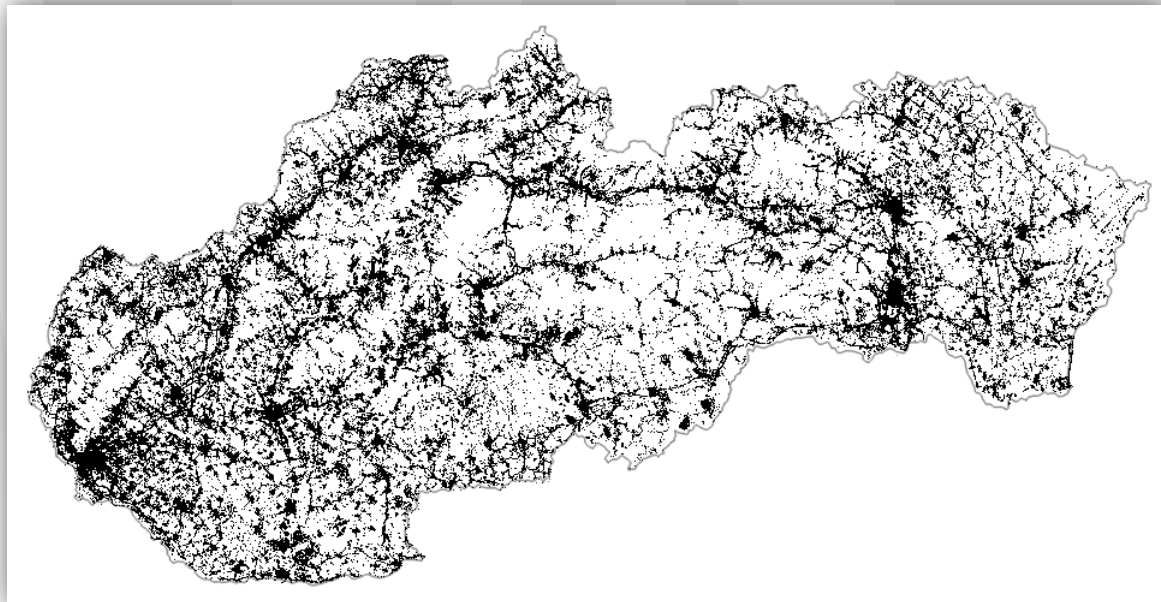- daily around 350 users
- in peaks – over 1,000 connections per day

SKPOS® - usage

- 2007 – 2011: around 680,000 succesfuly connections

Year	Connections
2007	59 800
2008	111 000
2009	123 000
2010	163 700
2011	194 000

Initialisation time determination

- Initialisation time = time to get fix solution

- Determined from NMEA GP GGA messages

$GPGGA,153725.00,4826.57313,N,01712.1181045,E,**0**,13,0.8,408.883,M,42.34,M,,*6F
$GPGGA,153728.00,4826.57313,N,01712.1181045,E,1,13,0.8,408.883,M,42.34,M,,*6F
....
$GPGGA,153755.00,4826.57313,N,01712.1181045,E,**4**,13,0.8,408.883,M,42.34,M,,*6F
....

153755.00-153725.00 = **30sec**
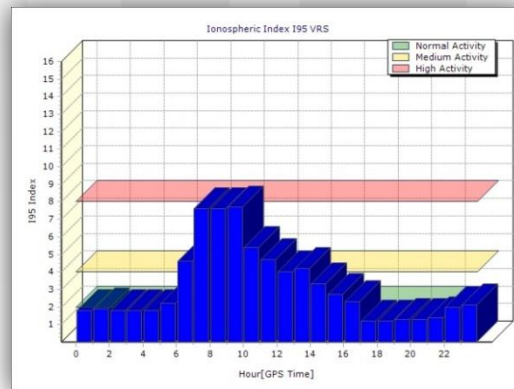
- Accuracy 1-4s – depends on users communication interval with $SKPOS^®$ server

What does ASMARUP stands for?

- ASMARUP = **A**pplication for S**K***POS*® **M**onitoring **A**nd **R**TK **U**sers **P**erformance

Application for SKPOS monitoring and RTK users performance

						Language:
Date from:	01.11.2006	to:	01.11.2012			
User:						
Time (SEC) from:		to:				
Initializations from:		to:				
Number of satellites from:		to:				

MountPoint: ○ SKPOS_CM_2.3   ○ SKPOS_CM_3.0   ○ SKPOS_CM_CMR   ◉ All

Display the reference stations SKPOS: ☑

Choose location: ☐

Show

ASMARUP

- Serves for analysing of $\text{S}\textbf{K}POS^{\circledR}$ users initialisation times according to different factors

- Use
  - PHP language
  - HTML/CSS Web interface
  - MySQL database
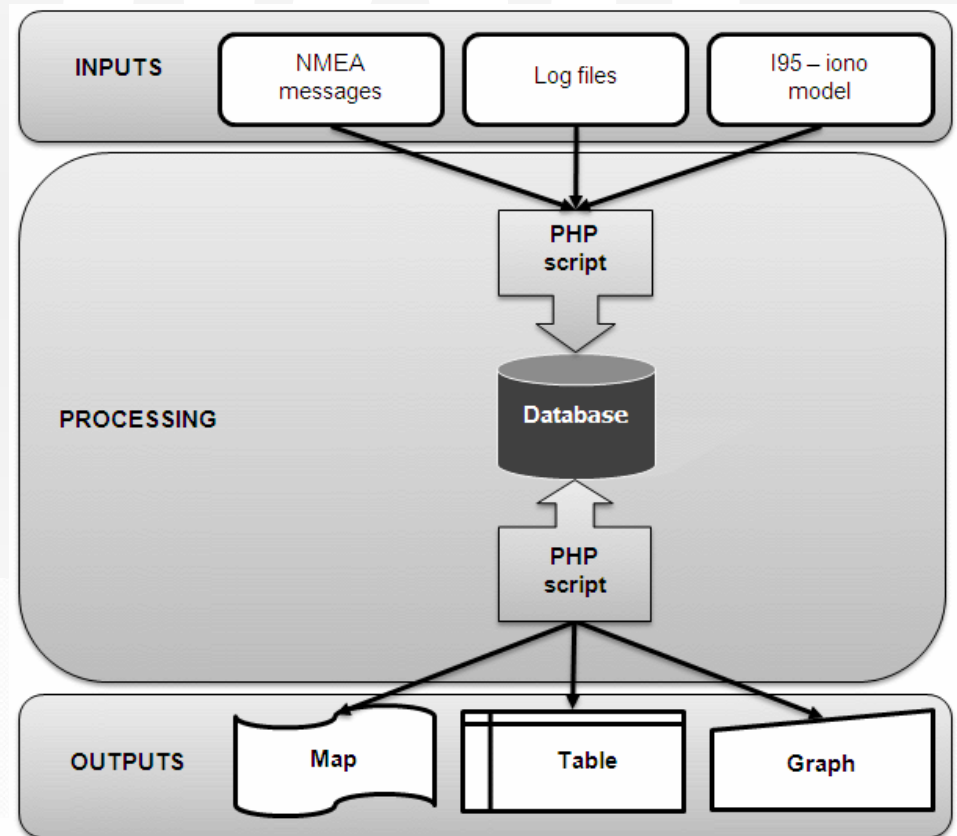
- ASMARUP allows to analyse initialisation times according to:
  - Time and date
  - User
  - Length of initialisation time
  - Number of satellites
  - Mountpoint
  - site

  - ...

- slovak/english language
- Available only for GKU

Application for SKPOS monito[r]

Date from:	01.11.2006	to: 01.11.2012
User:		
Time (SEC) from:		to:
Initializations from:		to:
Number of satellites from:		to:
MountPoint:	○ SKPOS_CM_2.3	○ SKPOS_CM_3.0
Display the reference stations SKPOS:	☑	
Choose location:	☐	

Show

ASMARUP
INPUTS

- ## NMEA GP GGA message

```
$GPGGA,153725.00,4826.57313,N,01712.1181045,E,1,13,0.8,408.883,M,42.34,M,,*6F
$GPGGA,095430.00,4846.77378,N,01836.4038814,E,2,07,1.1,265.749,M,43.29,M,,*78
$GPGGA,122726.00,4911.44735,N,02027.4511912,E,4,12,1.4,665.231,M,0.00,M,,0*5F
$GPGGA,090433.00,4636.17818,N,01851.1058655,E,4,10,1.4,224.845,M,42.12,M,,*7E
```
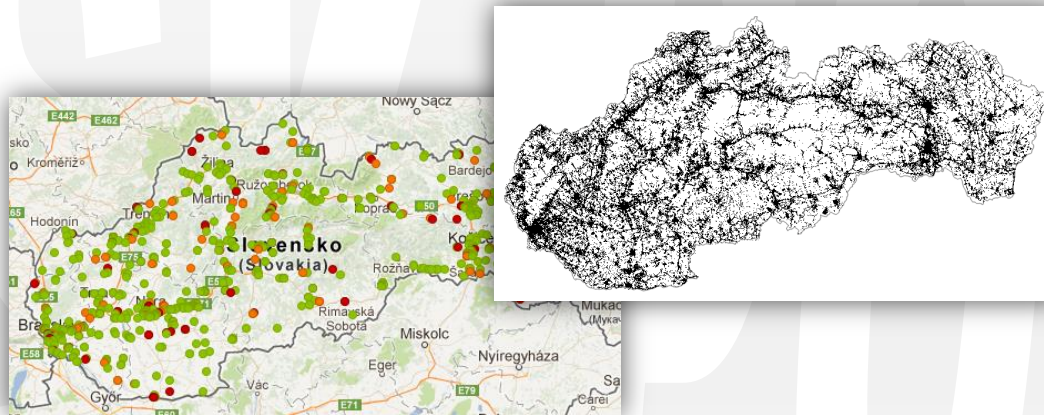
- ## Log files from service control software

```
2.1.2008 10:03:46   RTCM VRS_RTCM3.0_8202: Client 127.0.0.1:4852 has connected.
2.1.2008 10:03:46   RTCM VRS_RTCM3.0_8202: Waiting for new rover position...
2.1.2008 10:03:46   RTCM VRS_RTCM3.0_8202: NMEA record USER received. UserID = geodet
```

- ## Ionosphere model I95

- Map of connections to SKPOS with fix status

- Data table

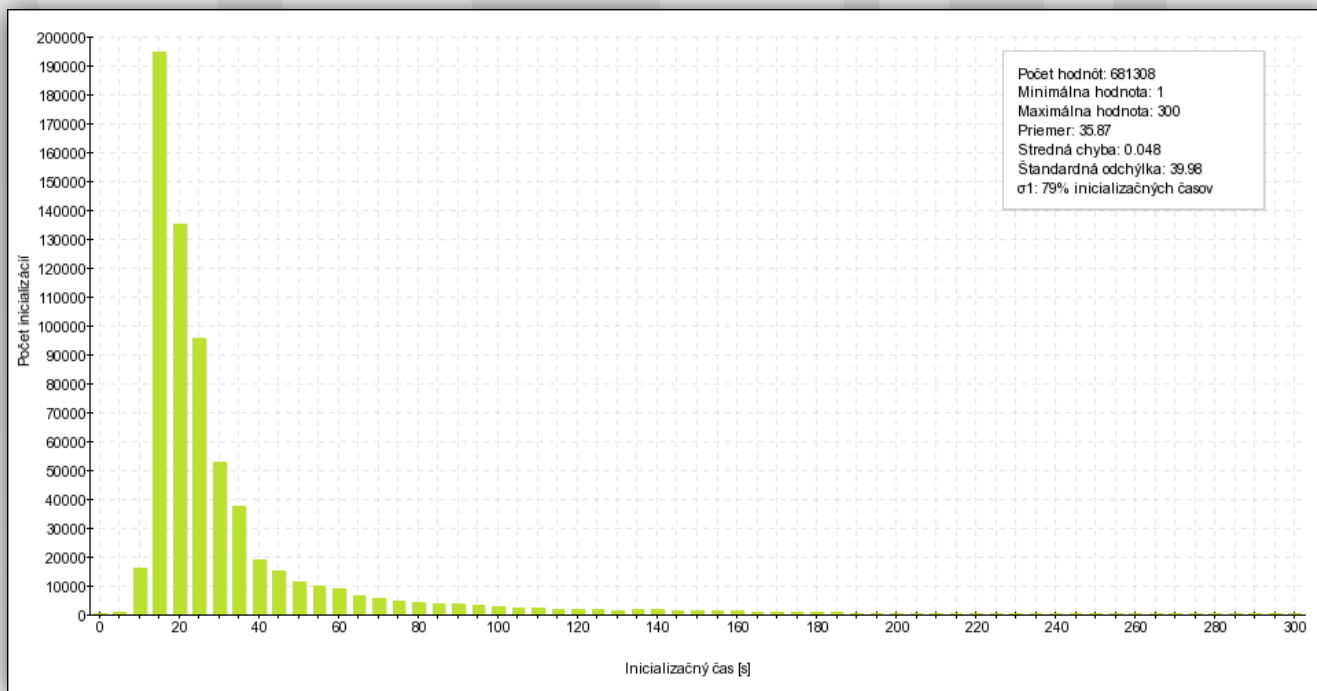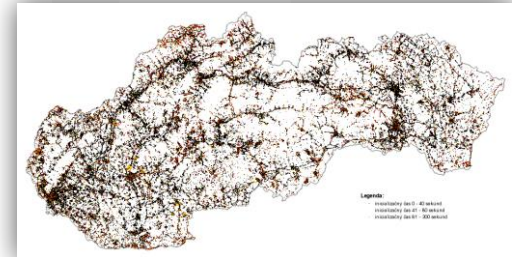- Graphic output – initialisation time frequency chart
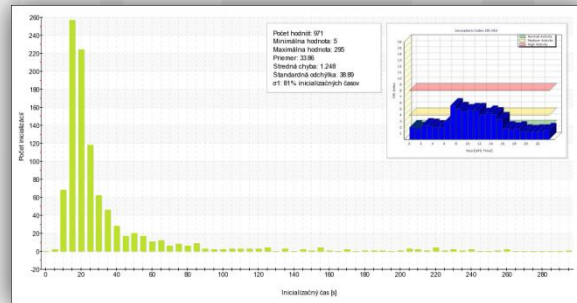
- Animation of initialisation time (only for one day selection)
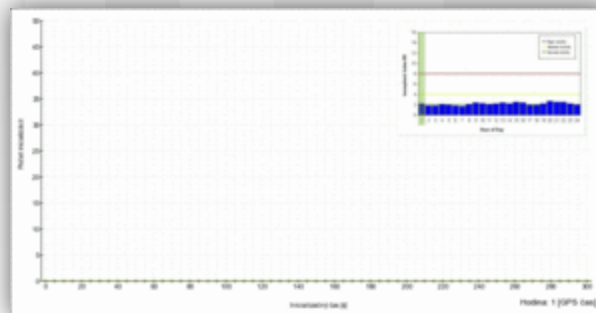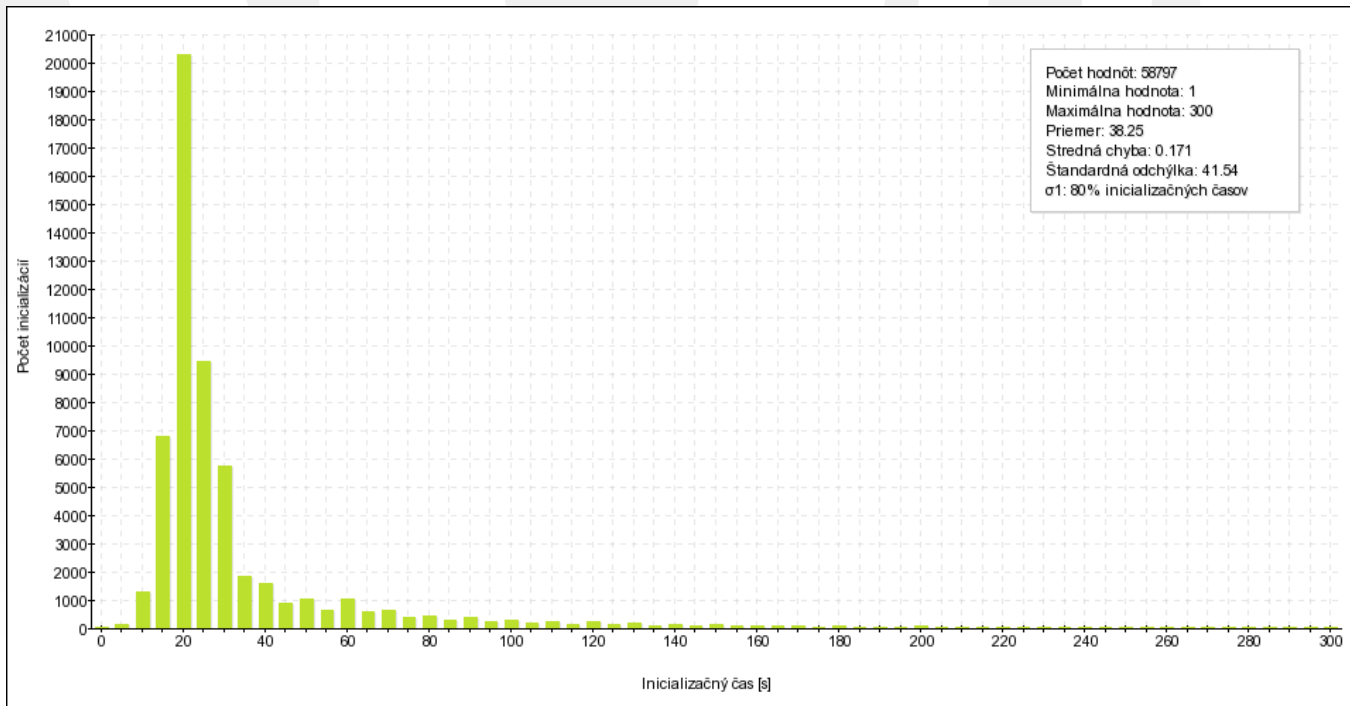
Analysis of $\mathrm{SK}POS^{®}$ users initialisation time

- ## Analysis from **2007-2012** (march) period
  - Values: 681,300
  - Average value: 36 sec

Počet hodnôt: 681308
Minimálna hodnota: 1
Maximálna hodnota: 300
Priemer: 35.87
Stredná chyba: 0.048
Štandardná odchýlka: 39.98
σ1: 79% inicializačných časov

- Mountpoint SKPOS_CM_2.3
  - Values: 58,800
  - Average value: 38 sec

Počet hodnôt: 58797
Minimálna hodnota: 1
Maximálna hodnota: 300
Priemer: 38.25
Stredná chyba: 0.171
Štandardná odchýlka: 41.54
σ1: 80% inicializačných časov

- Mountpoint SKPOS_CM_3.0
  - Values: 386,500
  - Average time: 34 sec

Počet hodnôt: 386499
Minimálna hodnota: 1
Maximálna hodnota: 300
Priemer: 33.73
Stredná chyba: 0.064
Štandardná odchýlka: 39.81
σ1: 81% inicializačných časov
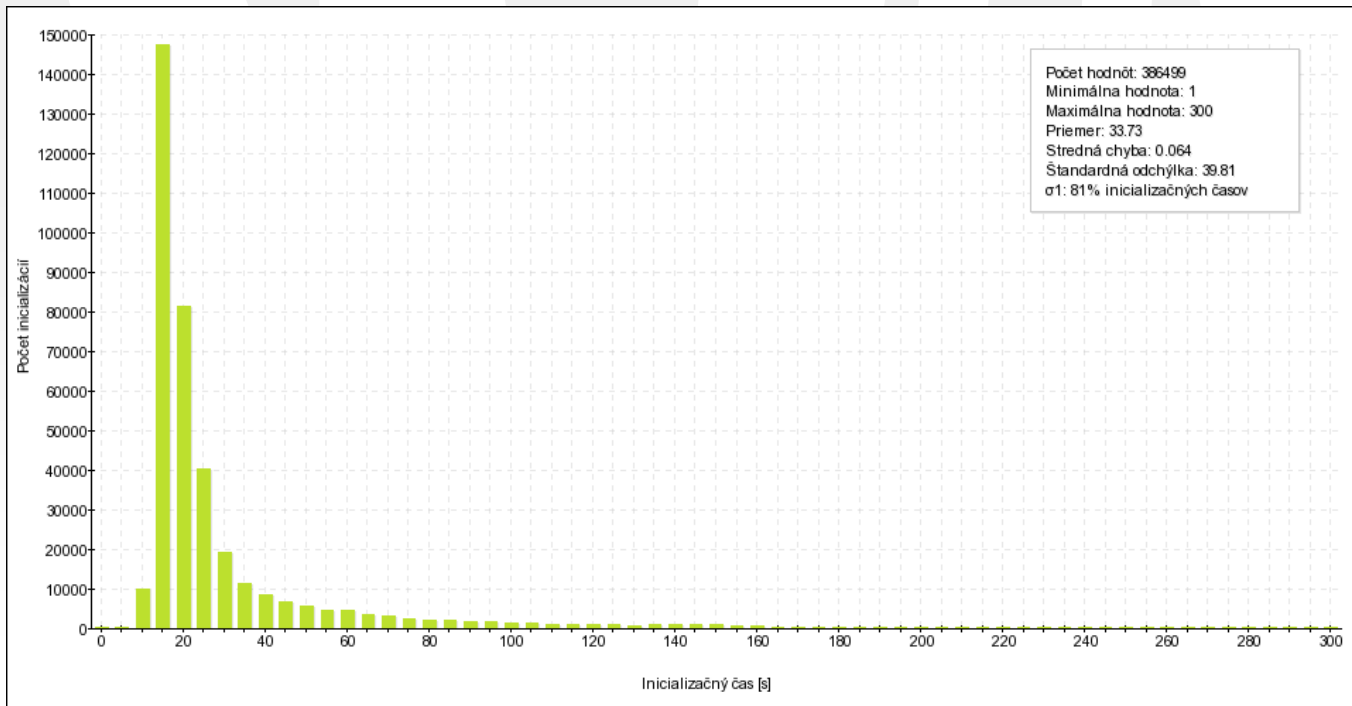
- Mountpoint SKPOS_CM_CMR
  - Values: 95,100
  - Average value: 42 sec
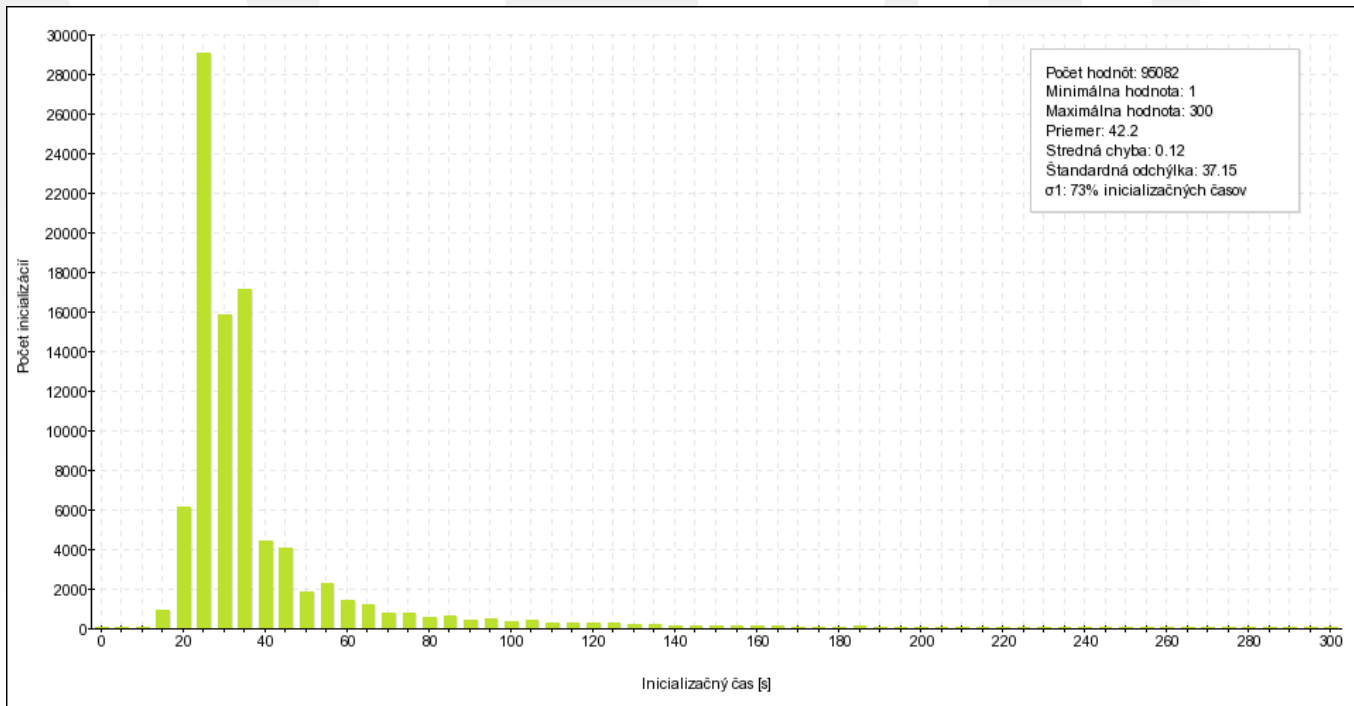
- Number of satellites: 4
  - Values: 3,600
  - Average value: 72 sec
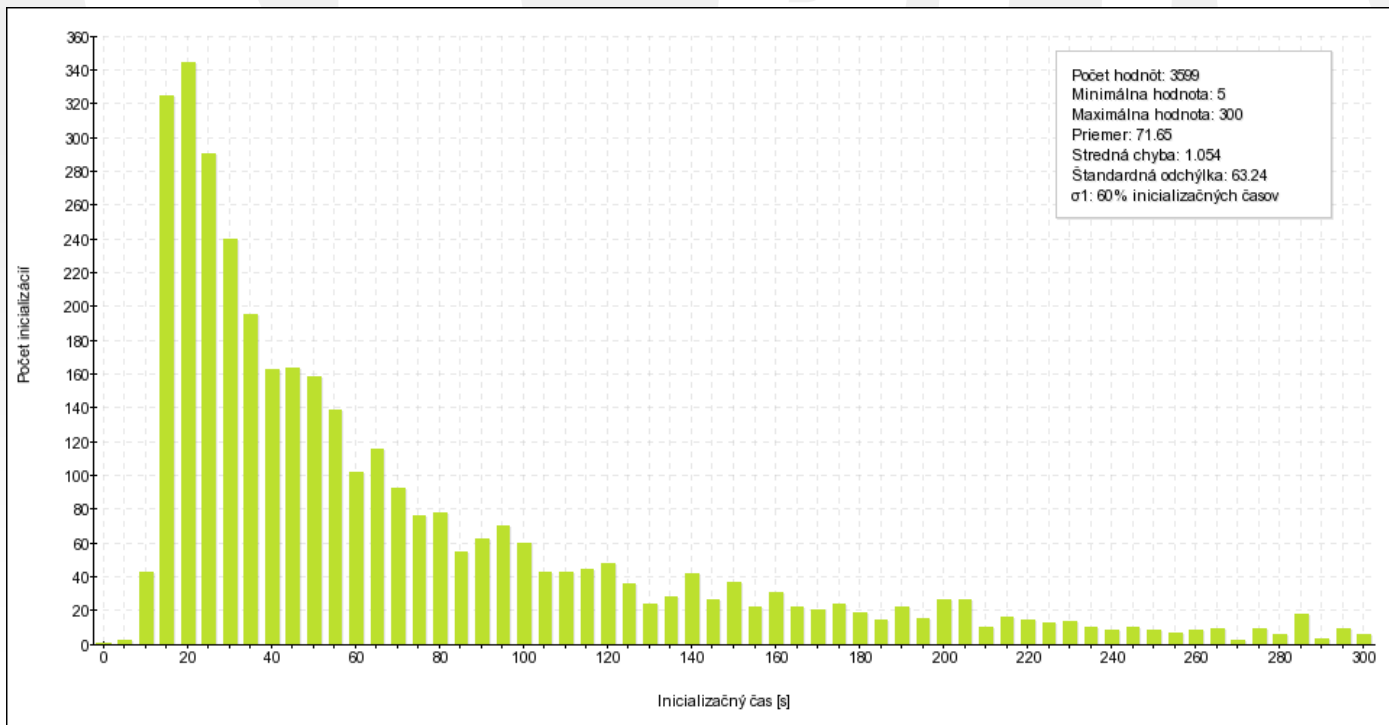
- ## Number of satellites: 5
  - ### Values: 29,1000
  - ### Average value: 58 sec
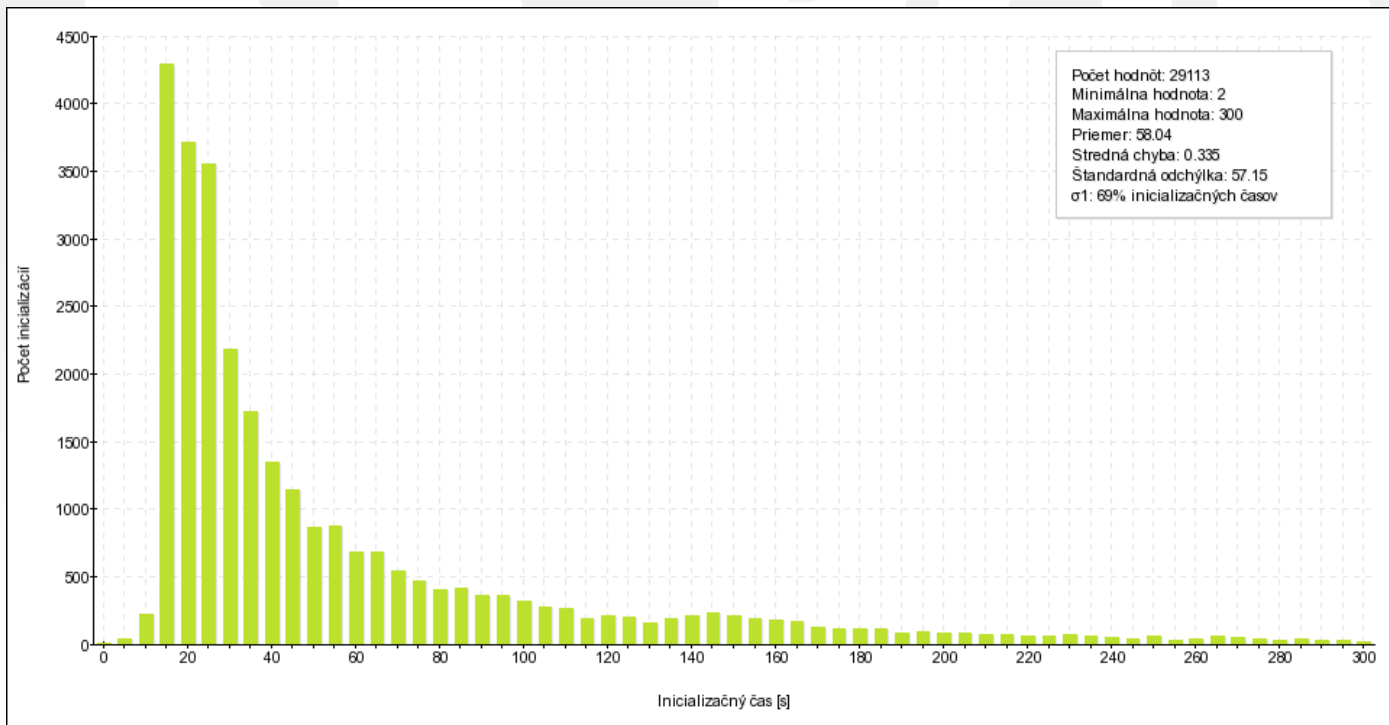
- **Number of satellites: 6**
  - Values: 79,500
  - Average value: 43 sec
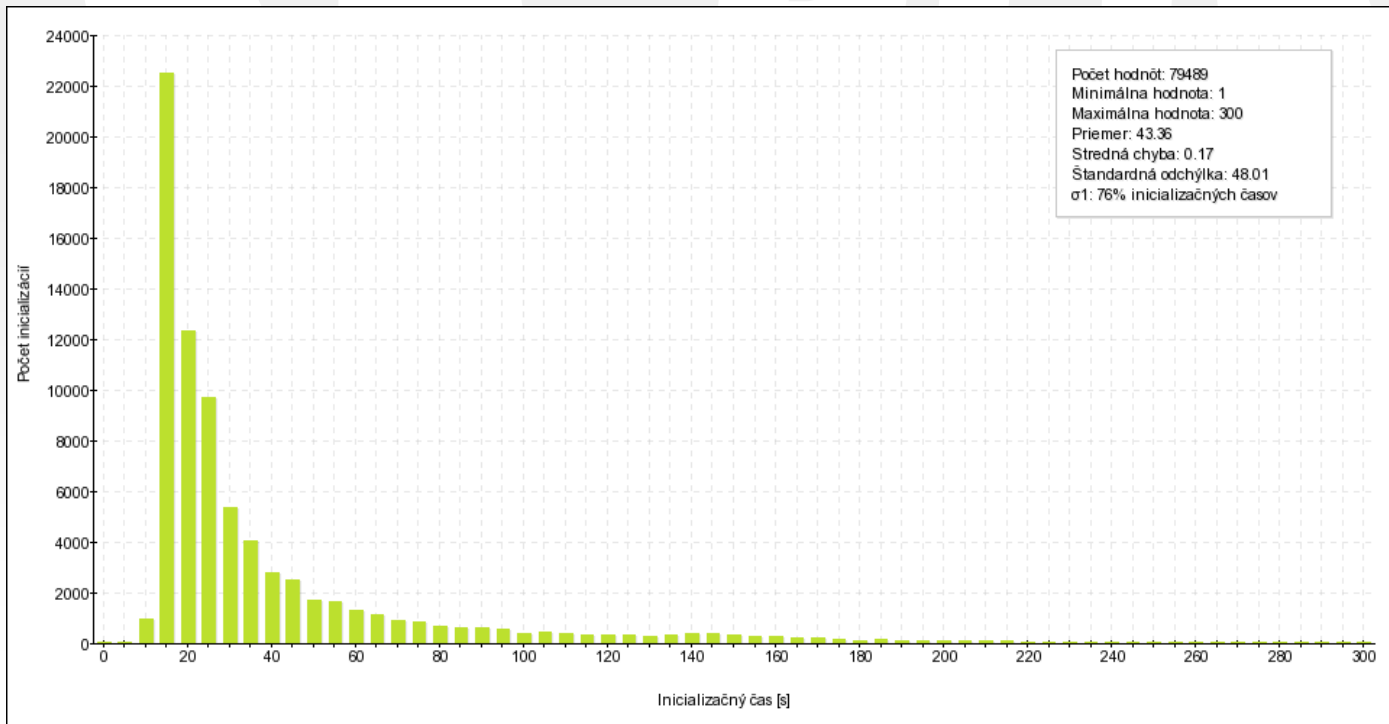
- Number of satellites: 7
  - Values: 113,800
  - Average value: 35 sec

Počet hodnôt: 113810
Minimálna hodnota: 1
Maximálna hodnota: 300
Priemer: 34.78
Stredná chyba: 0.119
Štandardná odchýlka: 40
σ1: 80% inicializačných časov
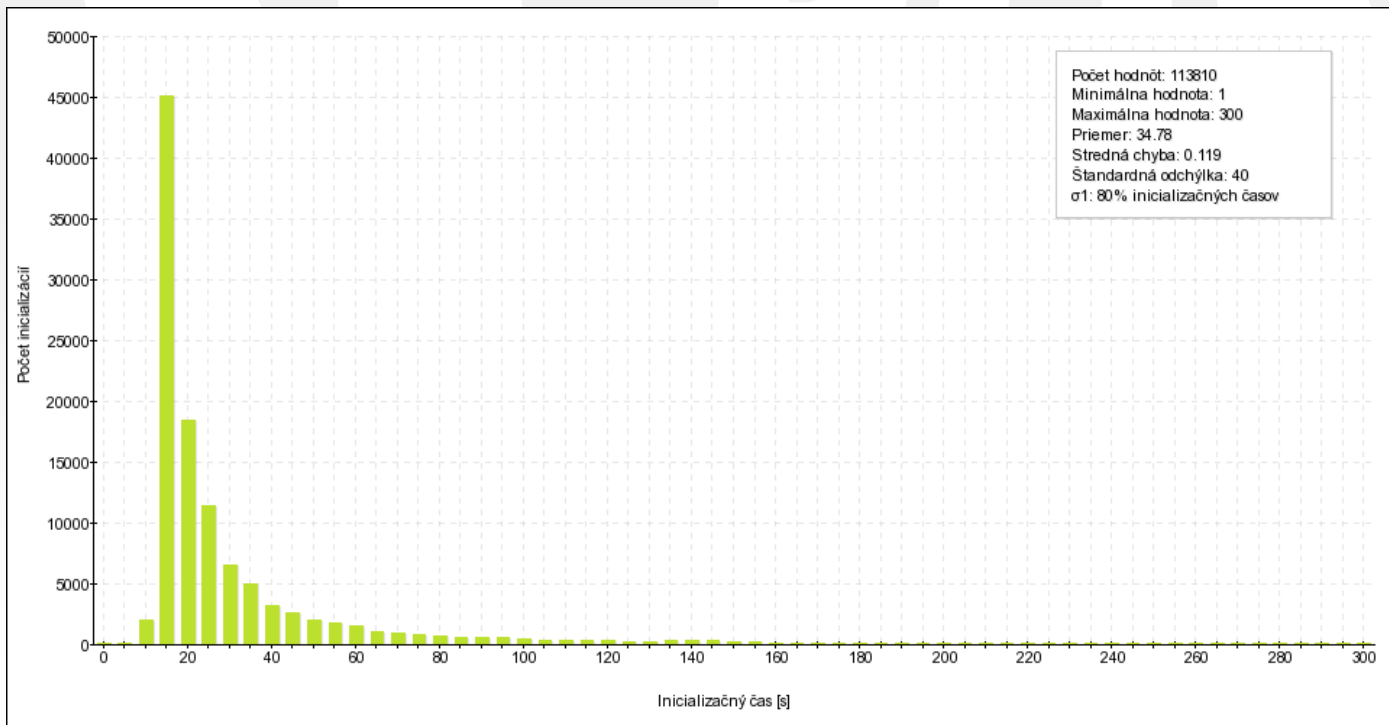
- Number of satellites: 8
  - Values: 455,000
  - Average value: 33 sec

Počet hodnôt: 455261
Minimálna hodnota: 1
Maximálna hodnota: 300
Priemer: 33.13
Stredná chyba: 0.053
Štandardná odchýlka: 35.91
σ1: 81% inicializačných časov
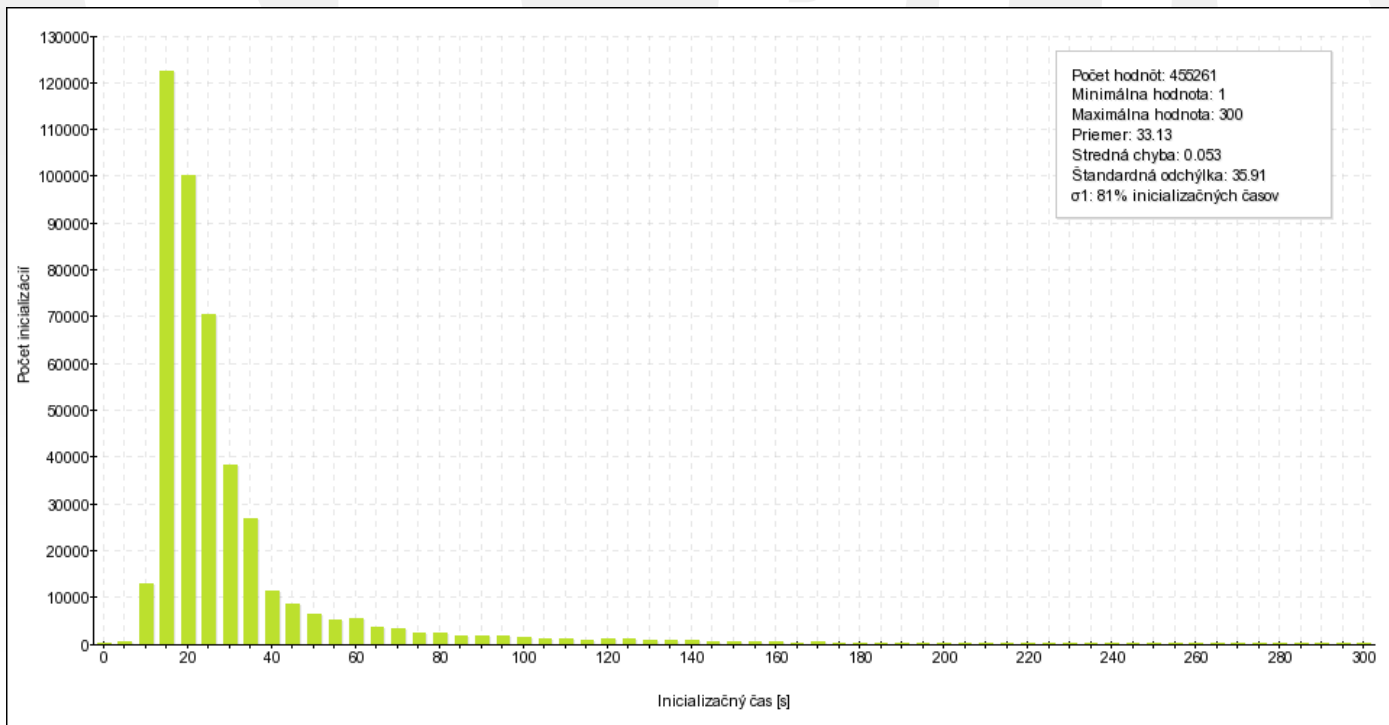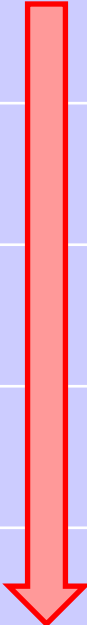
- Summary

Number of satellites used	Number of initialisation times	Average initialisation time [s]
4	3,599	71.6
5	29,113	58.0
6	79,489	43.4
7	113,810	34.8
8 and more	455,261	33.1

- State of Ionosphere activity: Low
  - Values: 402
  - Average value: 28 sec
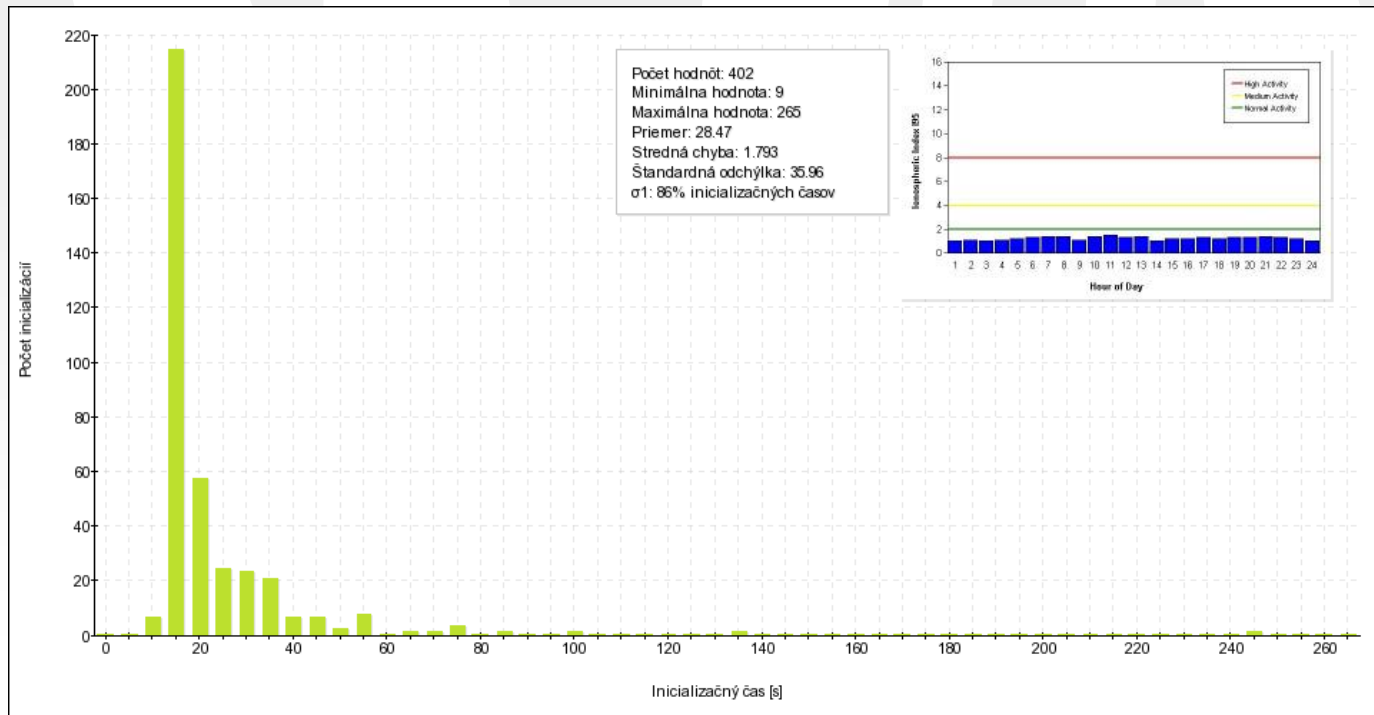
Experience from analysis
influence of ionosphere

- State of Ionosphere activity: High
  - Values: 681
  - Average value: 56 sec

- Before station establishment
  - 10 km x 10 km square around ref. station position

- Station: BREZ
  - Average value: 47 sec

- Station: JABO
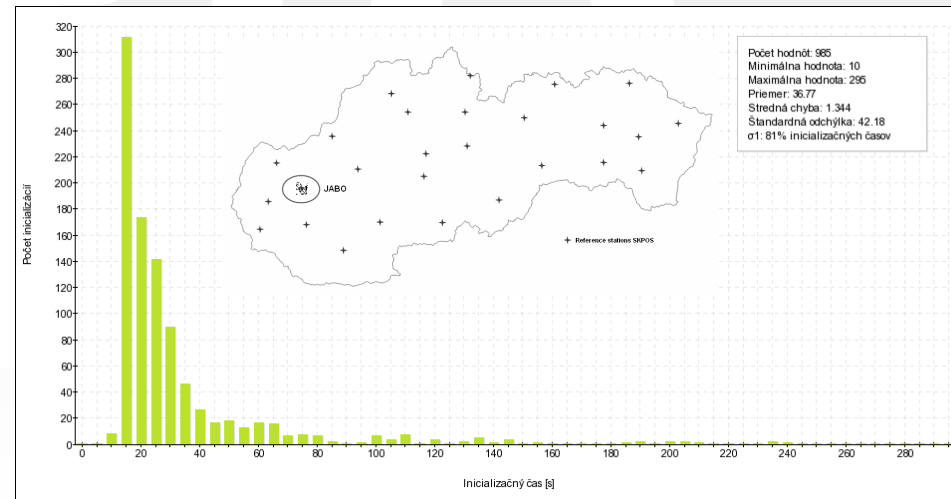 - Average value: 37 sec

- **After station establishment**
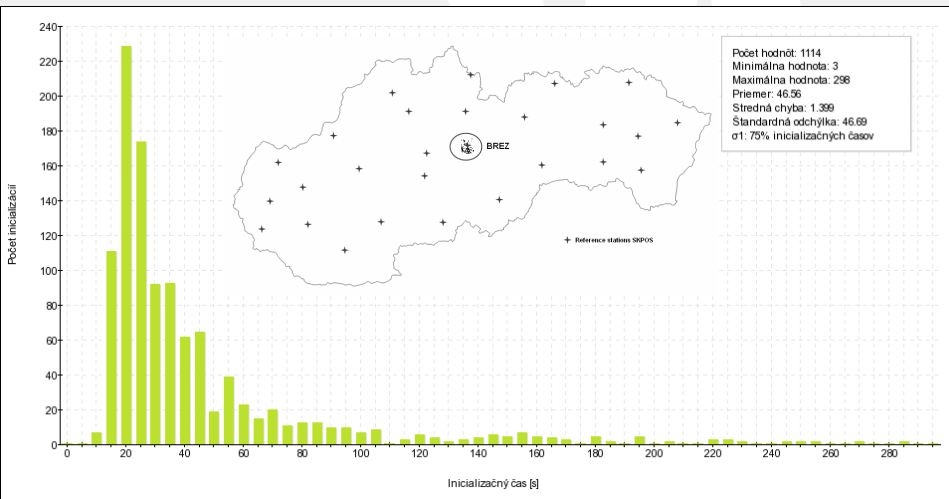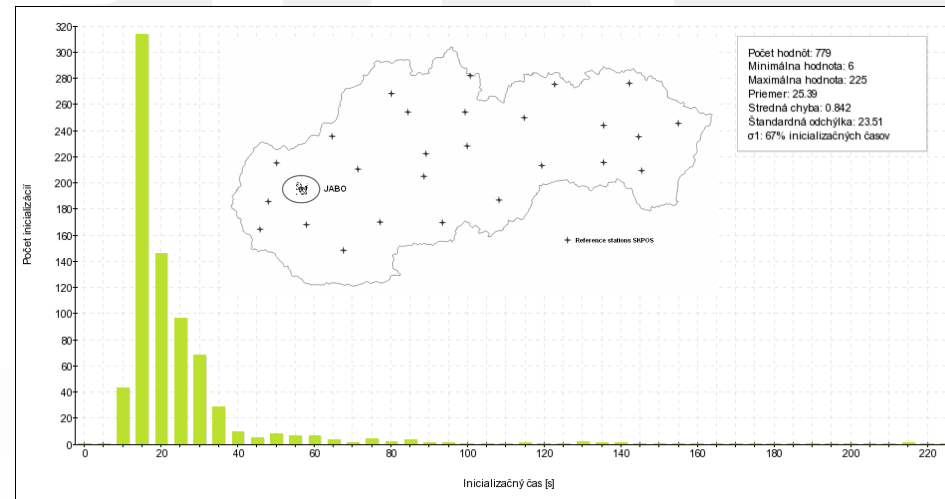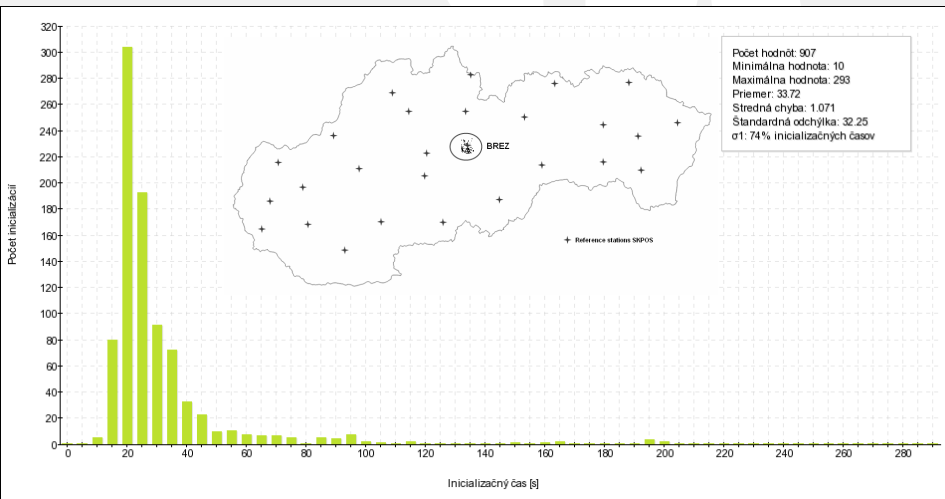 - 10 km x 10 km square around ref. station position

- **Station: BREZ**
  - Average value: 34 sec

- **Station: JABO**
  - Average value: 25 sec

Počet hodnôt: 907
Minimálna hodnota: 10
Maximálna hodnota: 293
Priemer: 33.72
Stredná chyba: 1.071
Štandardná odchýlka: 32.25
σ1: 74% inicializačných časov

Počet hodnôt: 779
Minimálna hodnota: 6
Maximálna hodnota: 225
Priemer: 25.39
Stredná chyba: 0.842
Štandardná odchýlka: 23.51
σ1: 67% inicializačných časov

Experience from analysis
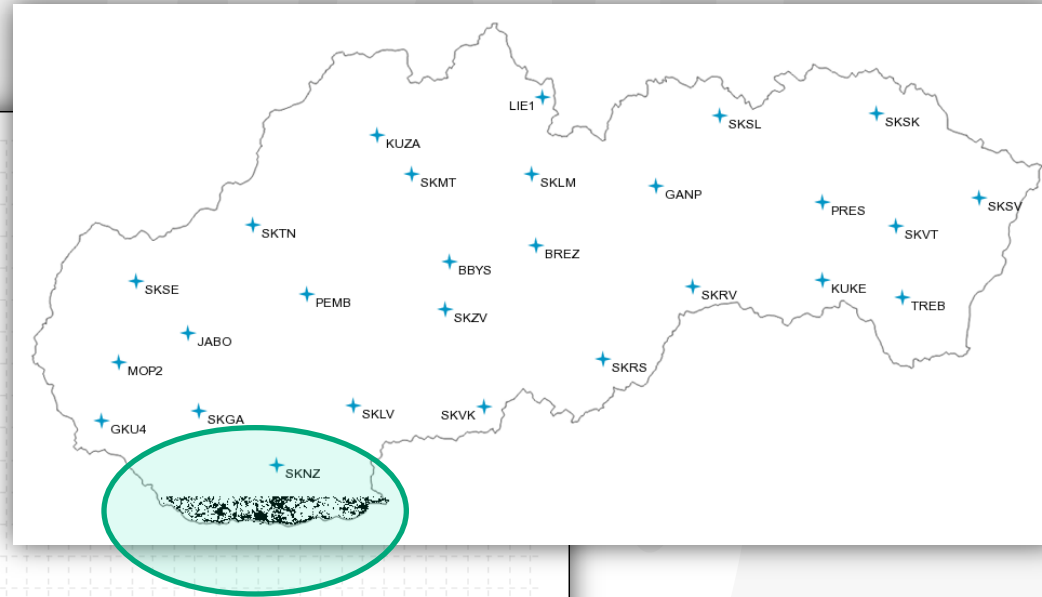# **network densification**

- Summary
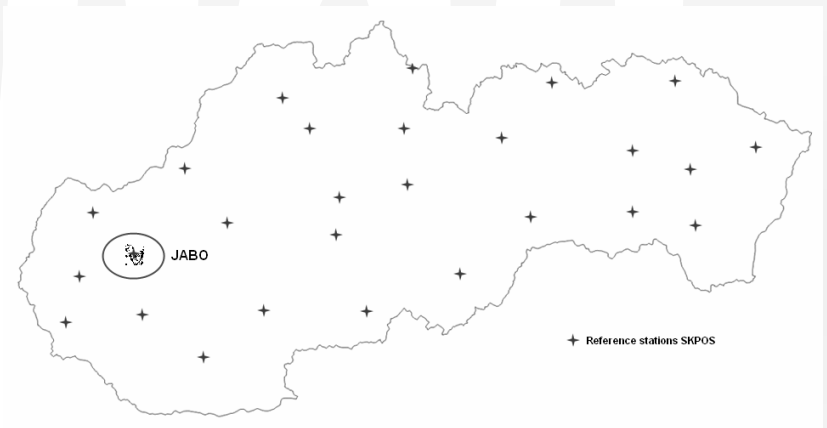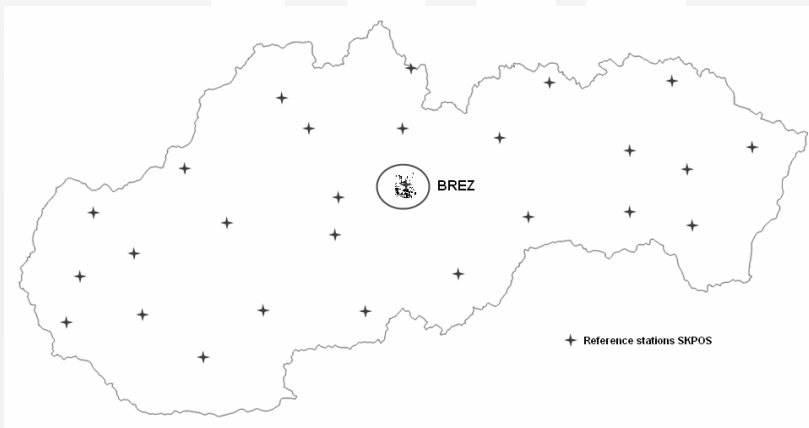
SKPOS station	Number of initialisation times	Average initialisation time [sec]	Number of initialisation times	Average initialisation time [sec]
	before the station's introduction		after the station's introduction	
BREZ	1 114	**46.6**	907	**33.7**
JABO	985	**36.7**	779	**25.4**

Experience from analysis
border zones

- Values: 9,300
- Average value: 48 sec

- Values: 13,000

- Average value: 48 sec

- Summary

Border zone	Number of initialisation times	Average initialisation time [s]
SK-AT	11,038	44.2
SK-HU_1	9,308	48.4
SK-HU_2	10,198	46.3
SK-PL	12,790	47.9
SK-UA	5,899	45.7

- ## RTK rover – brand 1
  - ### Average value: 32 sec
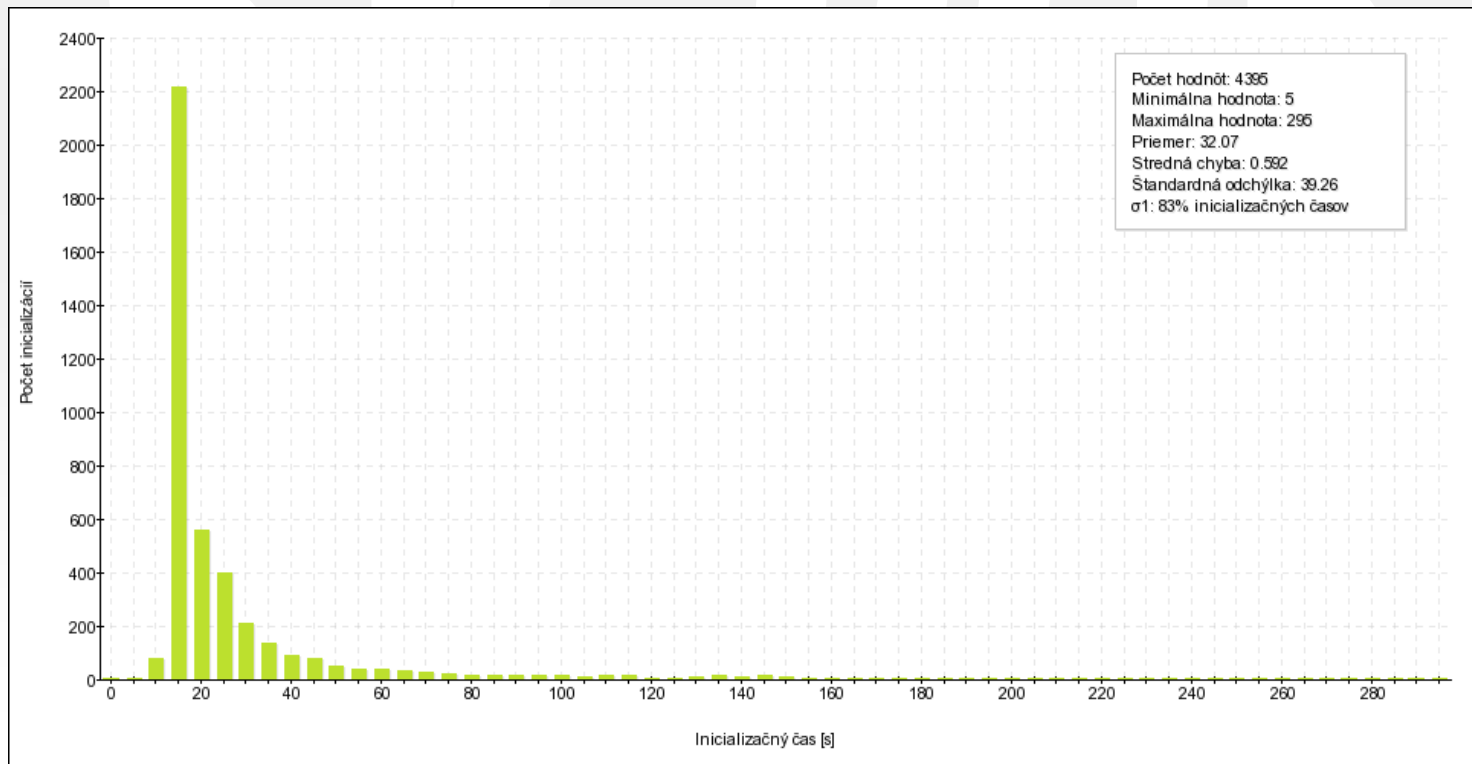
- ## RTK rover – brand 2
  - ### Average value: 37 sec
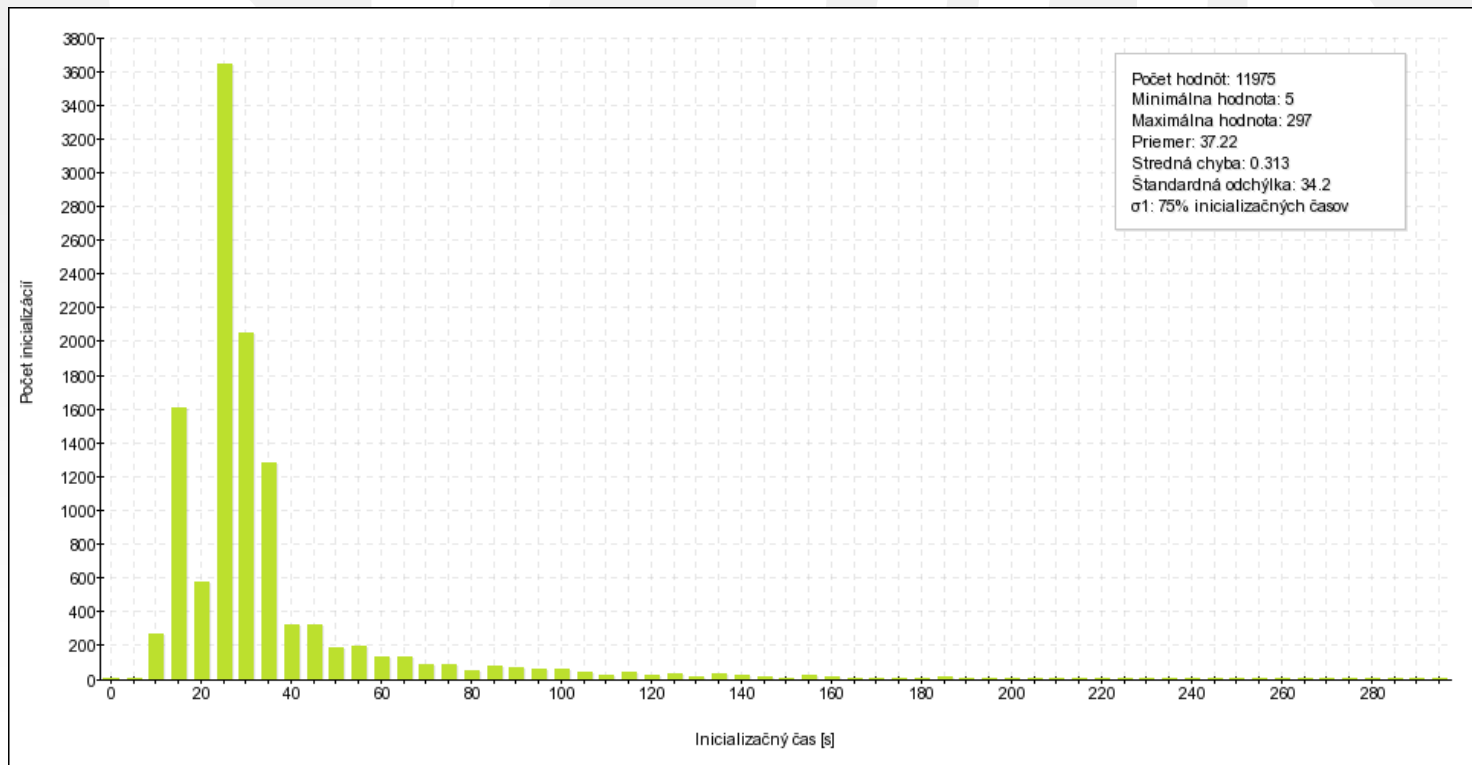
- RTK rover – brand 3
  - Average value: 43 sec

Počet hodnôt: 323
Minimálna hodnota: 8
Maximálna hodnota: 278
Priemer: 43.43
Stredná chyba: 2.526
Štandardná odchýlka: 45.4
σ1: 69% inicializačných časov
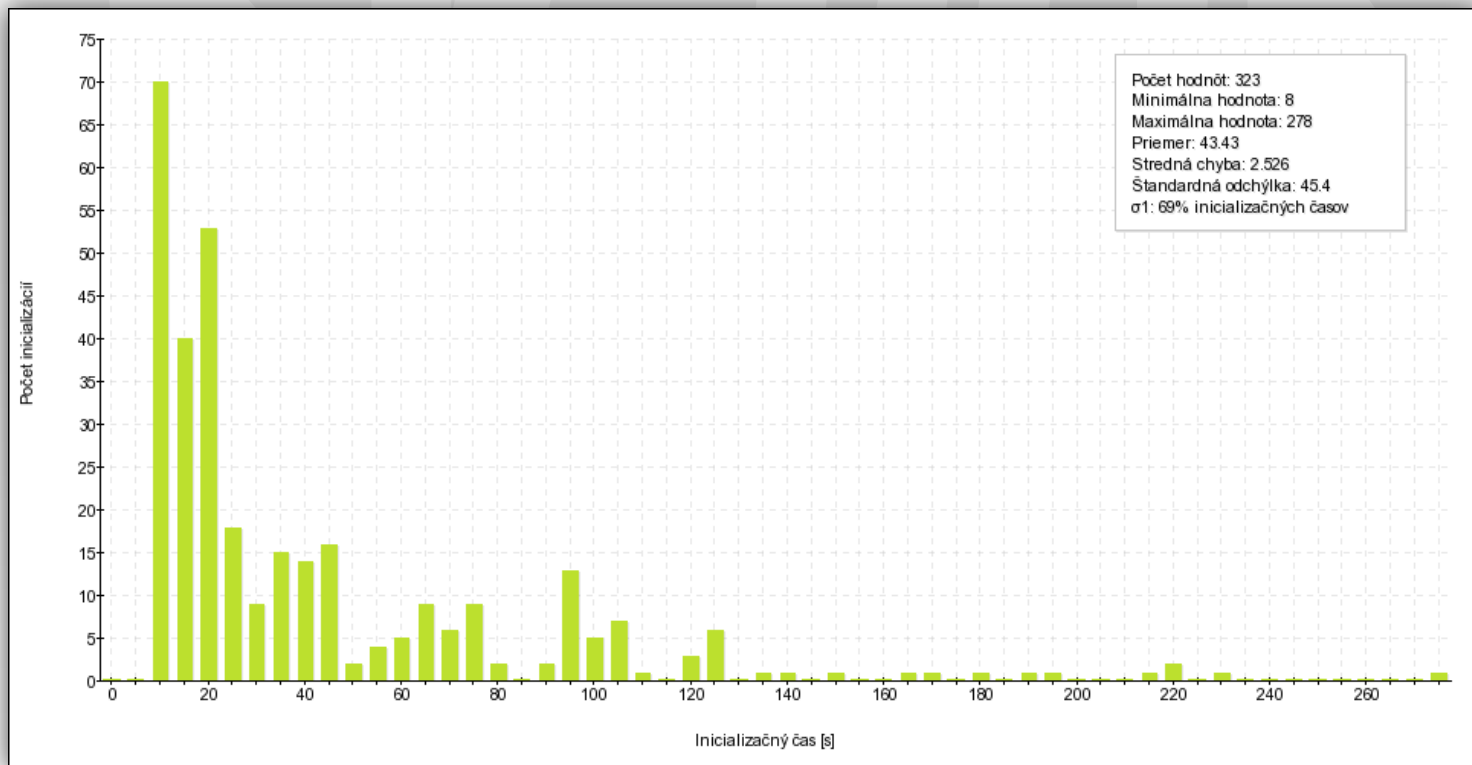
Conclusion

- Results from analysis confirms:

    - the influence of use of different mountpoints on the length of the initialisation times is neglected,

    - the number of satellites used has an influence on the length of initialisation times,

    - the state of the ionosphere has a negative impact on the length of the initialisation time and, in extreme cases, makes it impossible to perform measurements,

    - densification of the network helps to improve the quality of the measurements in the affected areas,

    - a negative influence on RTK measurements in the border regions as a result of the extrapolation of the network solution was confirmed,

    - very small differences in the length of the initialisation times in the different rover brands used can be expected.

Thank you for your attention

branislav.droscak@skgeodesy.sk
karol.smolik@skgeodesy.sk