

# Developments in the Hungarian Active GNSS Network

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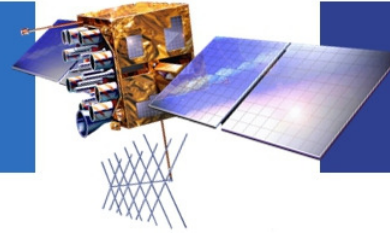
**Péter Braunmüller**

Institution of Geodesy, Cartography and Remote  
Sensing, Satellite Geodetic Observatory

[braunmuller@gnssnet.hu](mailto:braunmuller@gnssnet.hu)

[www.gnssnet.hu](http://www.gnssnet.hu)

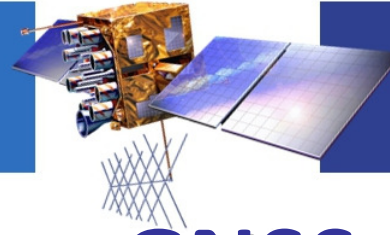




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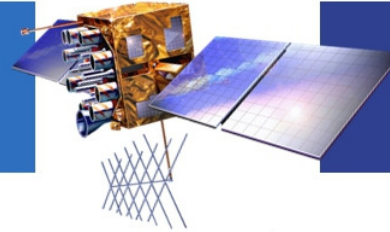
- **Developments of the last few years**
- **Statistics**
  - Users of the Hungarian Active GNSS Network
  - Troposphere
- **Plans for the future**



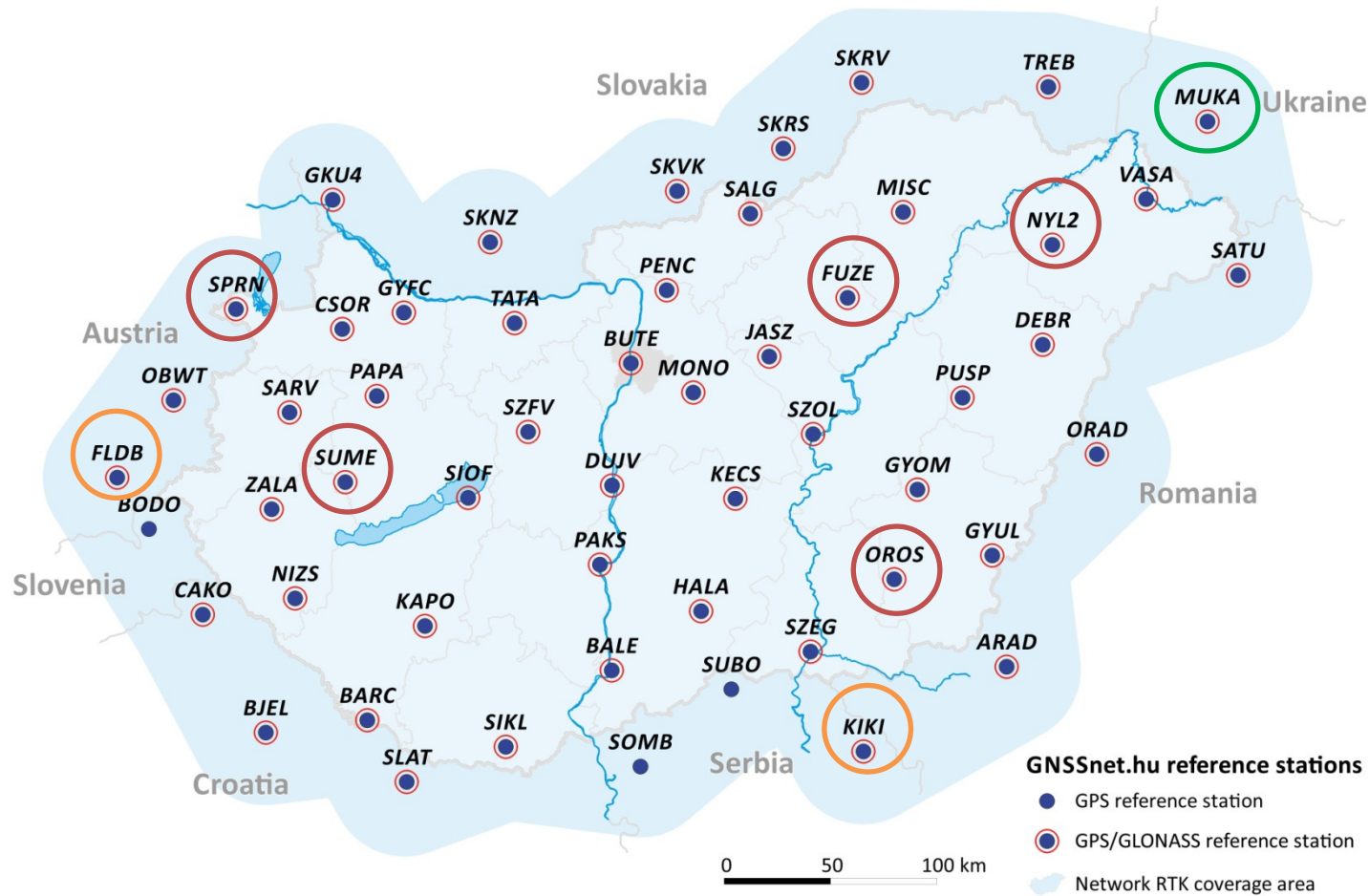
# The Hungarian Active GNSS Network

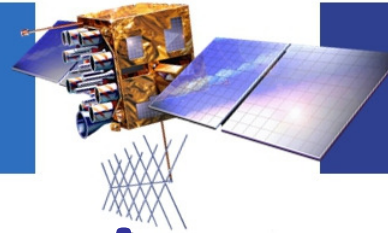
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- Name: GNSSnet.hu
- 54 permanent stations including 19 stations of the neighbouring countries
- DGNSS, RTK and Network RTK solutions (FKP, MAC, VRS)
- More than 1100 registered users
- Users from different fields of usage

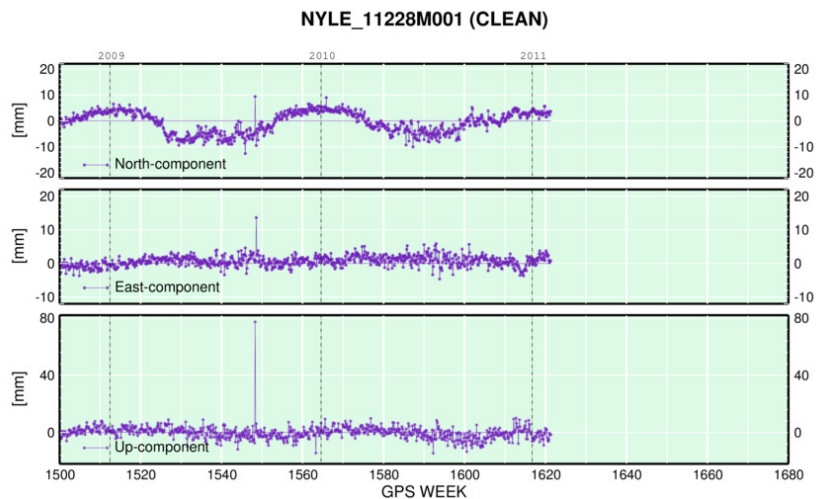
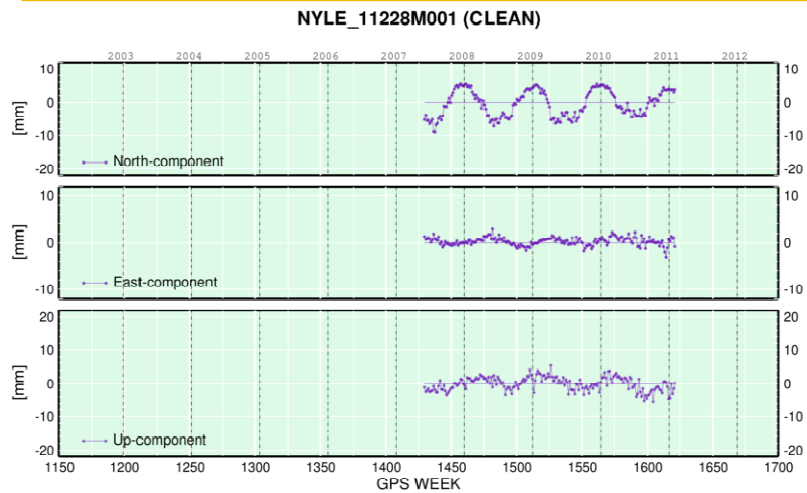


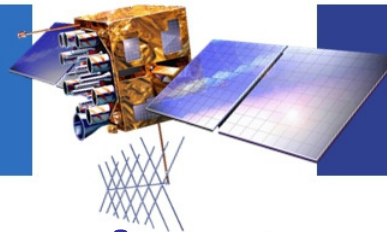
# Developments: permanent stations



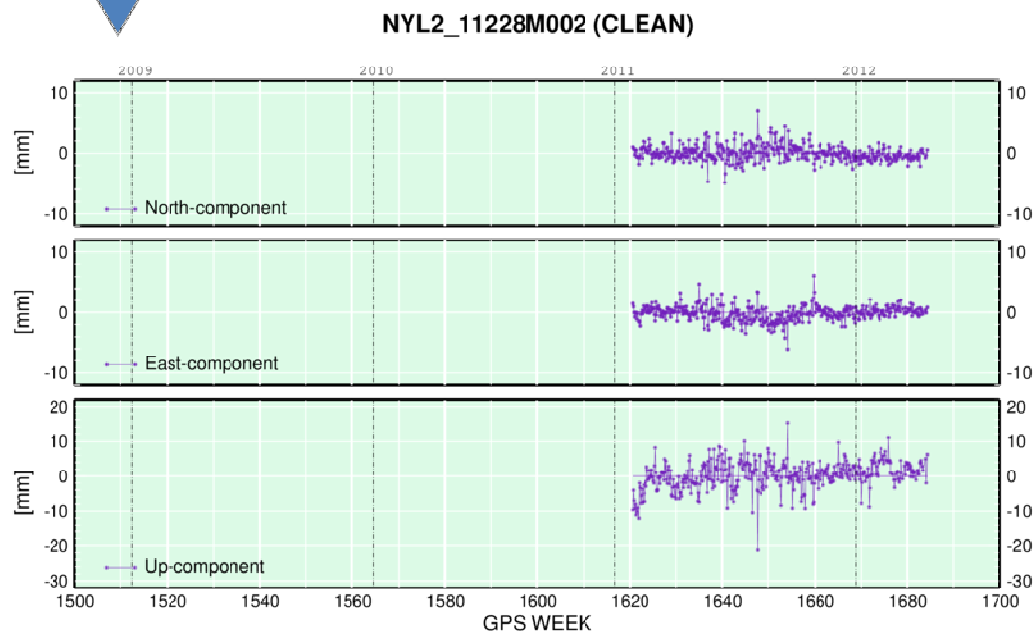
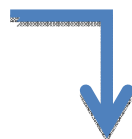
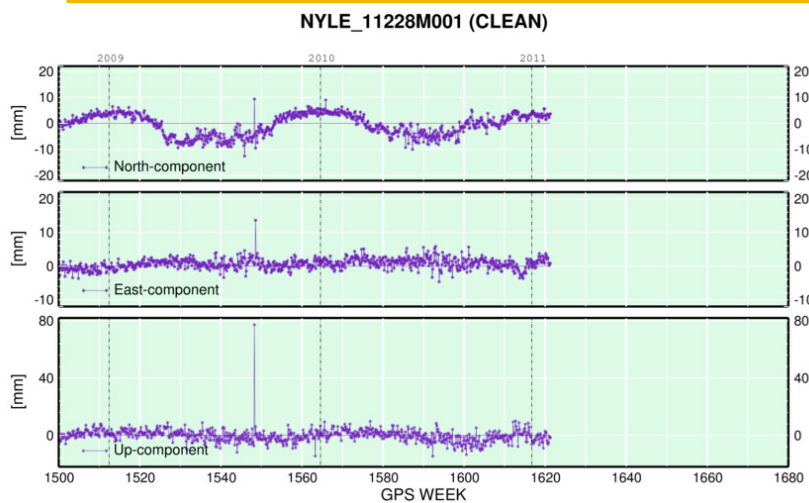


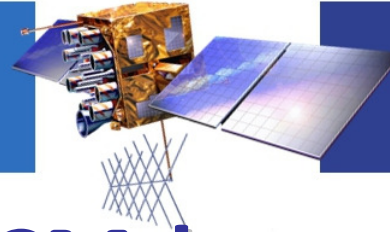
# Development: station transfer





# Development: station transfer

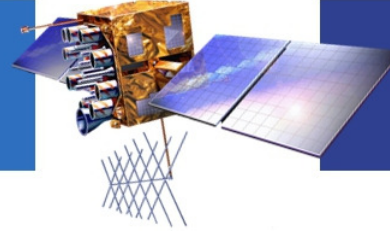




# Development: RTCM-based VITEL

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- VITEL: real-time transformation method from WGS84 to EOVS (Hungarian Projection System)
- The Geo++<sup>®</sup> solution is used
- The users receive „corrected” ETRS89 coordinates and the transformation is done in the rover
- Dedicated mountpoints set up for this solution (coordinate-check before users are allowed to use these)
- ~ 4% of the real-time transformation methods

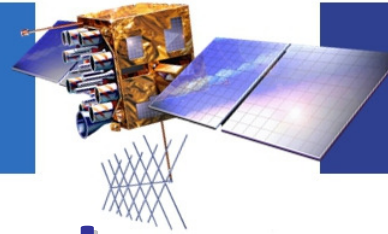


# Development: RTCM message type 1033

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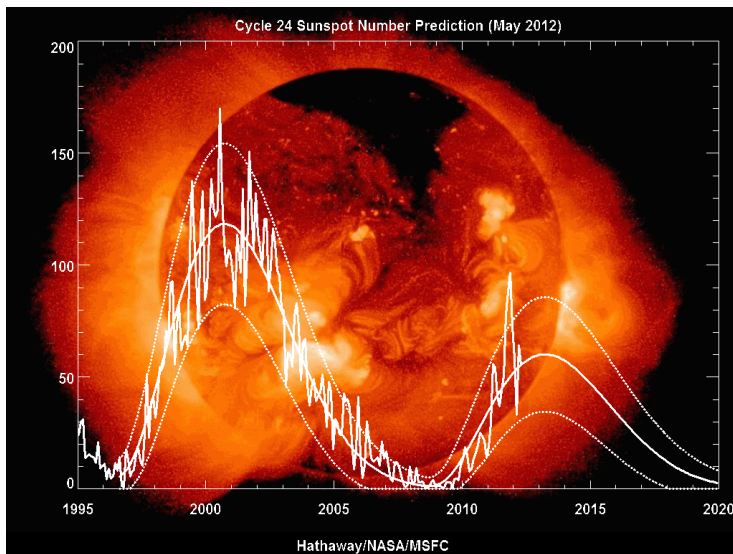
- Mitigation the effect of the GLONASS biases
- 3 dedicated (RTCM 3.1) mountpoints, only for the users with rover supporting m.t. 1033
- Special Geo++ 1033 message
- Supports all rover and correction types



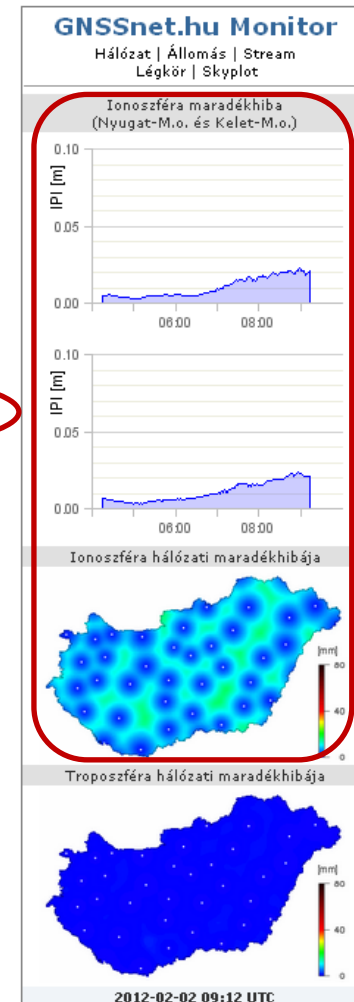


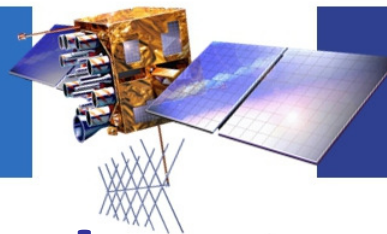
# Development: ionosphere monitoring

- Beside the real-time monitor page (GNSSnet.hu Monitor)



GNSSnet.hu Monitor		
Hálózat   Állomás   Stream Légkör   Skyplot		
Jelenleg aktív állomások:	54 / 54	✓
GPS hálózati/észlelt holdak:	10 / 10	✓
GLO hálózati/észlelt holdak:	7 / 7	✓
Jelenleg elérhető streamek:	22 / 22	✓
Ionoszféra állapota nyugaton:	0.021 m	!
Ionoszféra állapota keleten:	0.021 m	!
2012-02-02 09:12 UTC		

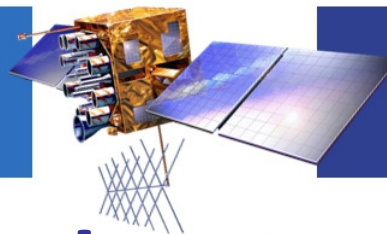




# Development: ionosphere monitoring

- Beside the real-time monitor page (GNSSnet.hu Monitor)
- Posteriorly on our web page
- **Chart**





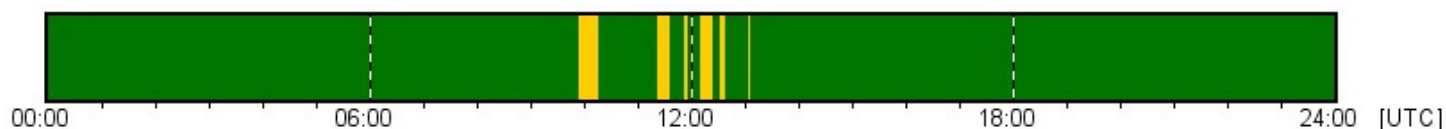
# Development: ionosphere monitoring

- Beside the real-time monitor page (GNSSnet.hu Monitor)
- Posteriorly on our web page
- Chart, **Timeline**

2012-03-05

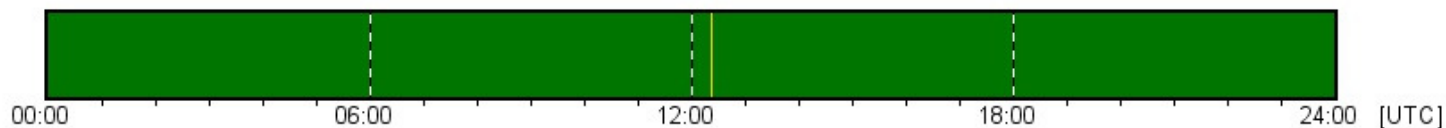
**Maradékhibák nyugaton:**

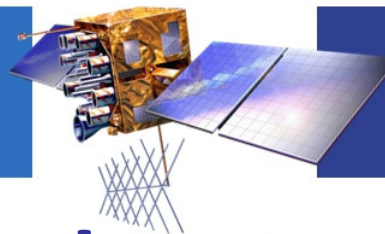
3 cm-nél nagyobb: 0.0%  
2-3 cm között: 4.3%  
2 cm-nél kisebb: 95.7%



**Maradékhibák keleten:**

3 cm-nél nagyobb: 0.0%  
2-3 cm között: 0.1%  
2 cm-nél kisebb: 99.9%

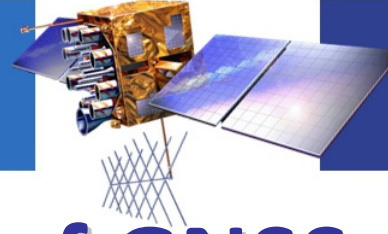




# Development: ionosphere monitoring

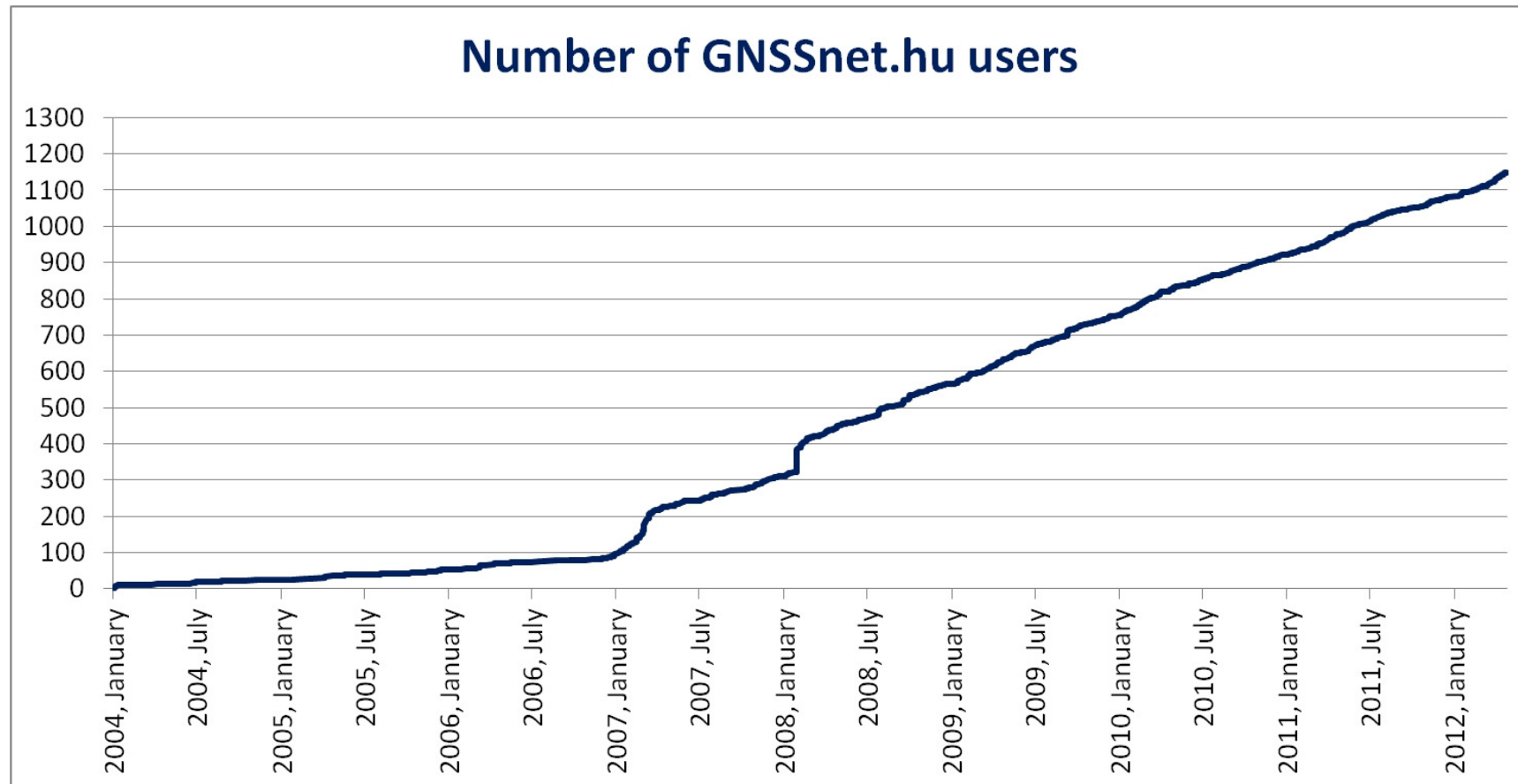
- Beside the real-time monitor page (GNSSnet.hu Monitor)
- Posteriorly on our web page
- Chart, Timeline, **Table**

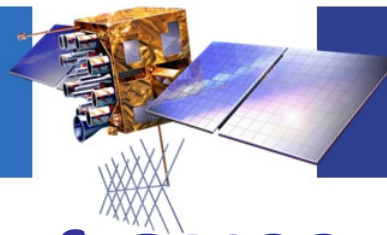
2012-03-08 nap órás bontású ionoszféra maradékhiba táblázata						
Óra [UTC]	2 cm alatt		2 - 3 cm között		3 cm fölött	
	Nyugaton	Keleten	Nyugaton	Keleten	Nyugaton	Keleten
0	86.7%	60.0%	13.3%	40.0%	0.0%	0.0%
1	13.3%	13.3%	80.0%	70.0%	6.7%	16.7%
2	0.0%	70.0%	100.0%	30.0%	0.0%	0.0%
3	76.7%	100.0%	23.3%	0.0%	0.0%	0.0%
4	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
5	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
6	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
7	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
8	60.0%	46.7%	40.0%	53.3%	0.0%	0.0%
9	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
10	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
11	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
12	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
13	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
14	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
15	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
16	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
17	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
18	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
19	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
20	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
21	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
22	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
23	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%



# Statistics: Users of GNSSnet.hu

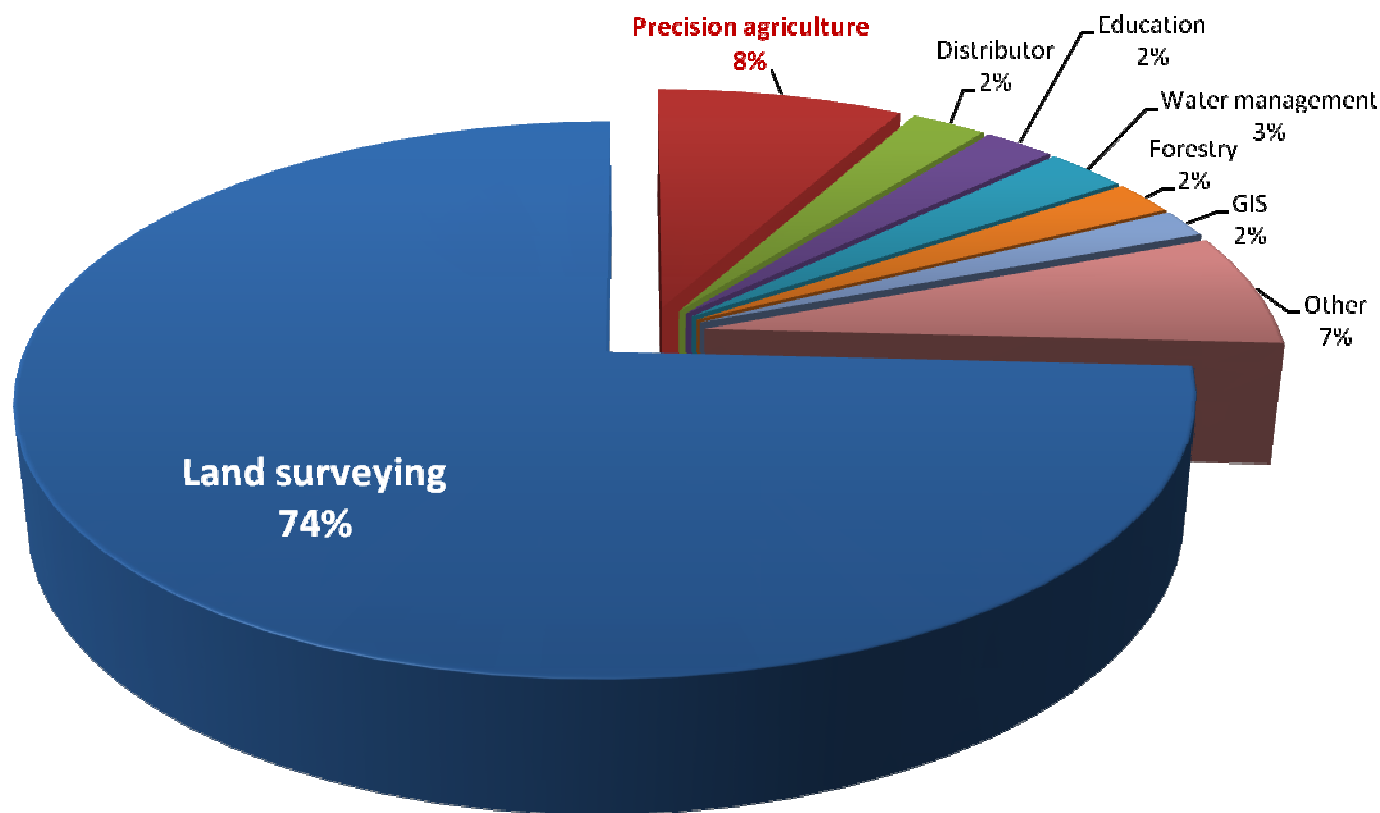
- The number of users increasing continuously

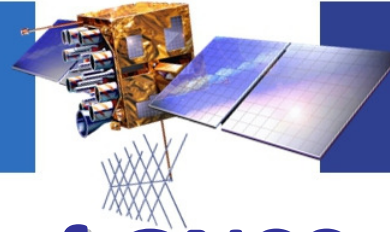




# Statistics: Users of GNSSnet.hu

## Distribution of users of GNSSnet.hu [%]



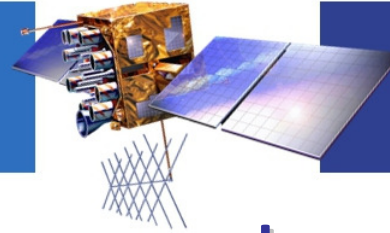


# Statistics: Users of GNSSnet.hu

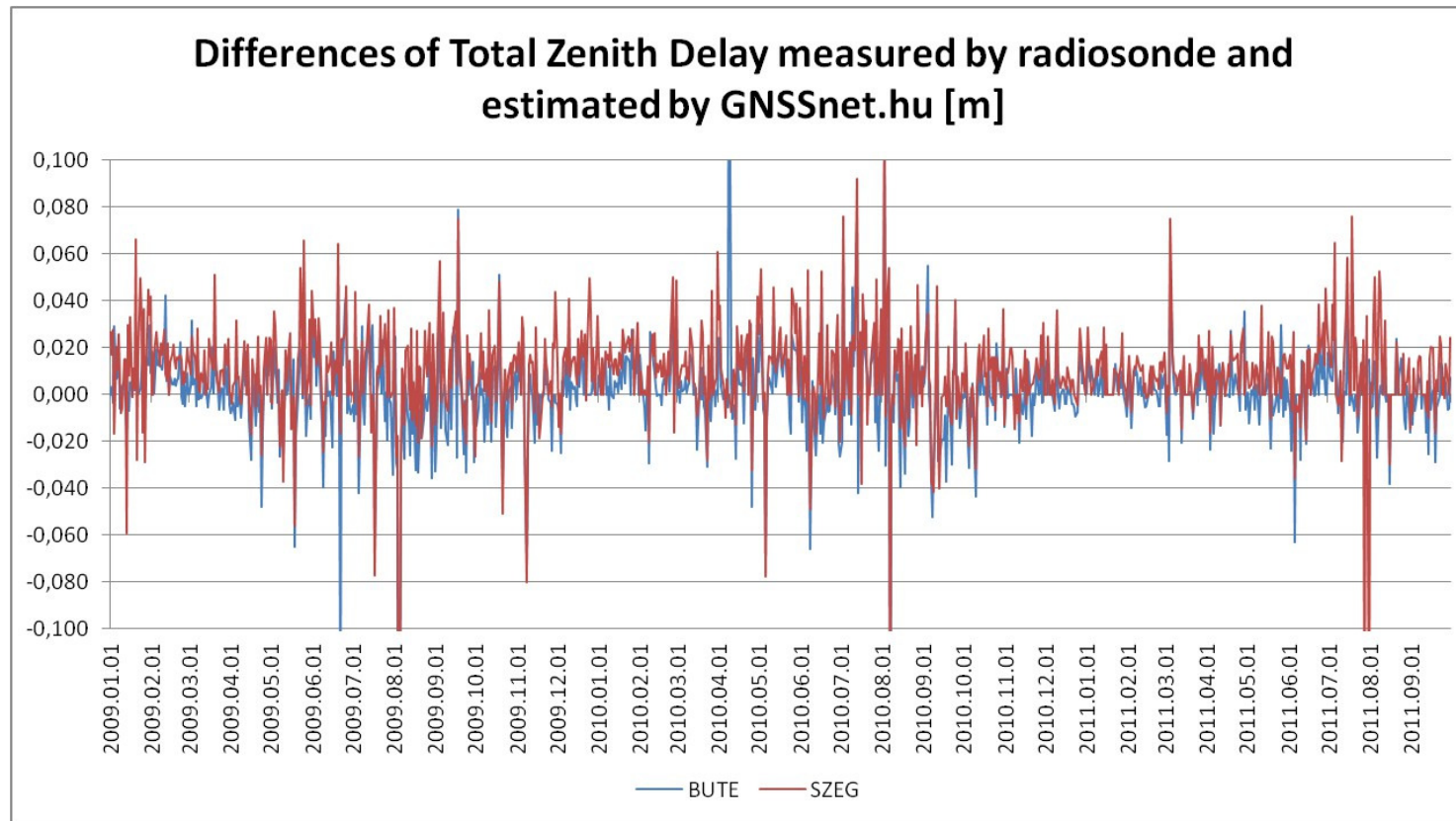
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- New fields of interest in the next few years expected: GIS, mobile mapping, groundworks machine control, etc.
- Rapid growth of precision agriculture is expected



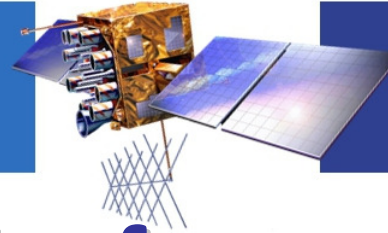


# Statistics: troposphere



	Budapest	Szeged
Average difference [m]	0,013	0,017
Std. dev. Of diff. [m]	0,017	0,019

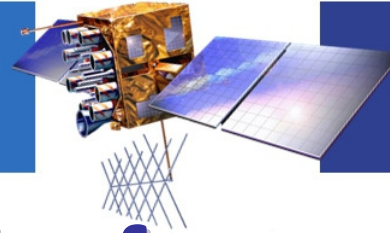




# Plans for the future

- Establishment of a backup central data processing system
  - Automatic reaction for errors
  - Raise the availability to ~100 %
  - Maintenance, updates in working hours
  - Availability in 2011:

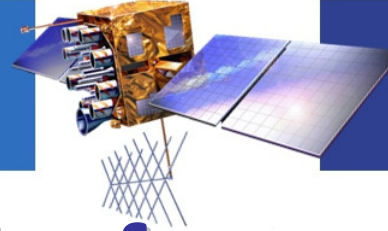
Month	Availability
January	99.88 %
February	99.96 %
March	99.93 %
April	99.94 %
May	99.65 %
June	99.70 %
July	99.86 %
August	99.89 %
September	99.82 %
October	99.92 %
November	100.00 %
December	100.00 %



# Plans for the future

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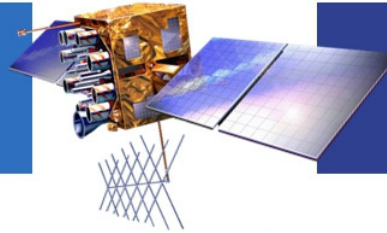
- Automatic central post-processing solution
  - Using the solution of Geo++<sup>®</sup>
  - No need for human interaction
  - Reduce the investment costs and the working hours of the users, raise the profit of the Service Centre
  - Quality ensured



# Plans for the future

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- Upgrade of the Hungarian permanent stations
  - To be able to track the signals of Galileo and Compass satellites
  - Hopefully will be finished in the next 2-3 years
  - Possibly supplemented with a few new stations → smaller distance between the stations, better modelling of the atmosphere
  - In-situ calibration of ~10 permanent stations → better modelling the effect of the multipath



# Thank you for your attention!

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**GNSS SERVICE CENTRE**

[www.gnssnet.hu](http://www.gnssnet.hu)

E-mail: [support@gnssnet.hu](mailto:support@gnssnet.hu)

Phone: +36-27-200-930

Fax: +36-27-374-982