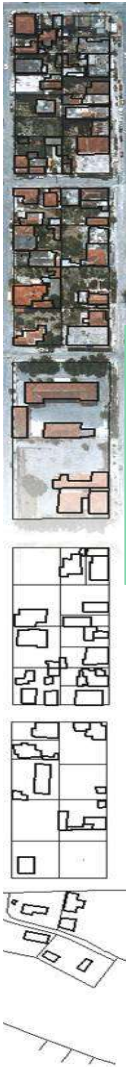


HELLENIC REPUBLIC
MINISTRY OF DIGITAL GOVERNANCE



HELLENIC CADASTRE



National Report of Greece

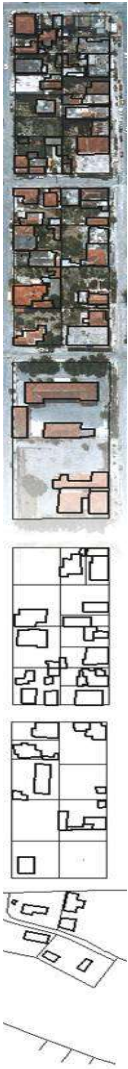
M. Gianniu, D. Mastoris, E. Mitropoulou
Geodetic Department
Hellenic Cadastre

e-mail: mgianniu@ktimatologio.gr



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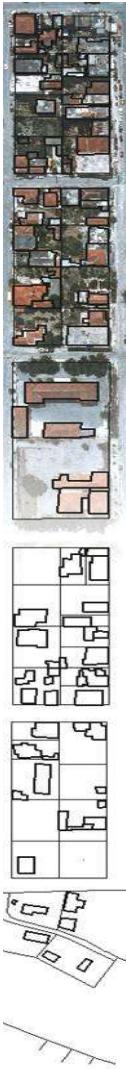
ZAGREB 1 - 3 June 2022



Outline

- 1. Evaluation of HEPOS full GNSS services**
- 2. Monitoring of ionospheric activity**





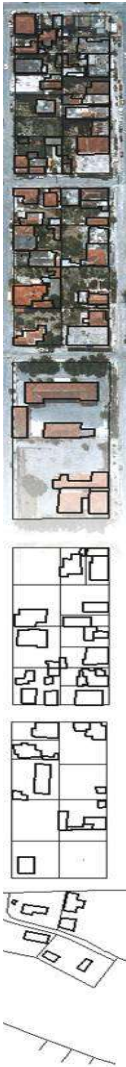
Evaluation of HEPOS full GNSS services

Timeline



- 2007: Established (*co-funded by the EU*)
- 2008: Initial operation
- 2009: Available to all users
- **2020: Upgrade to full GNSS** (*national funds*)





Evaluation of HEPOS full GNSS services

Summary of upgrade

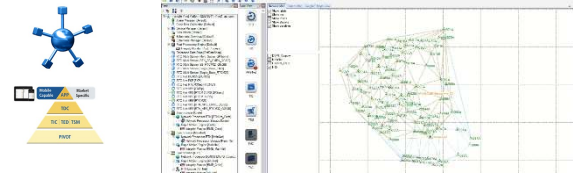
CORS



Full GNSS receivers:

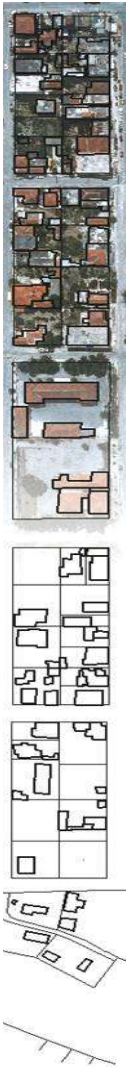
- **GPS:** L1, L2, L2C, L5, L1C
- **GLONASS:** G1, G2, G3
- **Galileo:** E1, E5a, E5b, E5alt-BOC, E6
- **BEIDOU:** B1, B2, B3
- **SBAS:** EGNOS-WAAS-GAGAN: L1C/A, L5

Control Center



Selected features of upgraded software:

- Full GNSS (RTCM 3.2, MSM 3-7)
- Individual station velocities
- Customizable user subscriptions
- GDPR compliant
- Full server redundancy

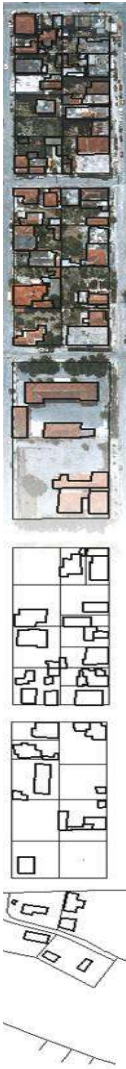


Evaluation of HEPOS full GNSS services

Upgrade of Mount-points

	Mount-point	RTK service	Until 2020	After 2020
L e g a c y	<u>Single Base RTK</u>	Single-base	G	GG
	<u>CMRp</u>	VRS	G	GG
	FKP	FKP	G	GG
	RTCM23	VRS	G	GG
	RTCM30	VRS	G	GG
	RTCM31	MAC	G	GG
N E W	Single_Base_RTK_GPSONly	Single-base	-	G
	RTCM30_GPSONly	VRS	-	G
	Single_Base_RTK_CMRp	Single-base	-	GG
	RTK_VRS_RTCM32_GGGB	VRS	-	GGGB
	RTK_Single_Base_RTCM32_GGGB	Single-base	-	GGGB

G: GPS, GG: GPS-GLN, GGGB: GPS-GLN-GAL-BDS



Evaluation of HEPOS full GNSS services

RTK: fixed solution in challenging environments

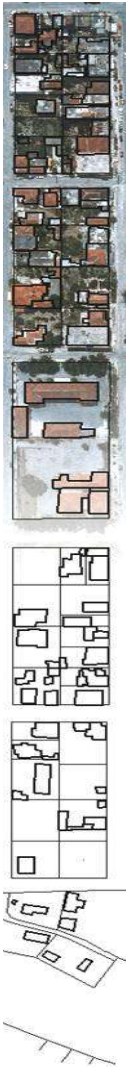


GPS
float

GPS+GLN
float

GPS+GLN+GAL+BDS
fixed





Evaluation of HEPOS full GNSS services

RTK: fixed solution in challenging environments

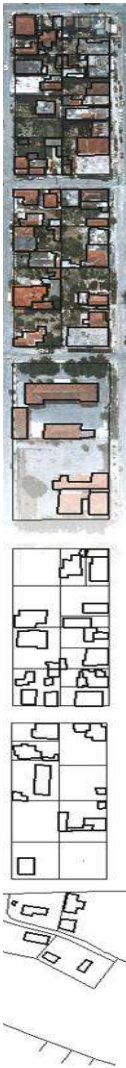


GPS: float

GPS+GLN: float

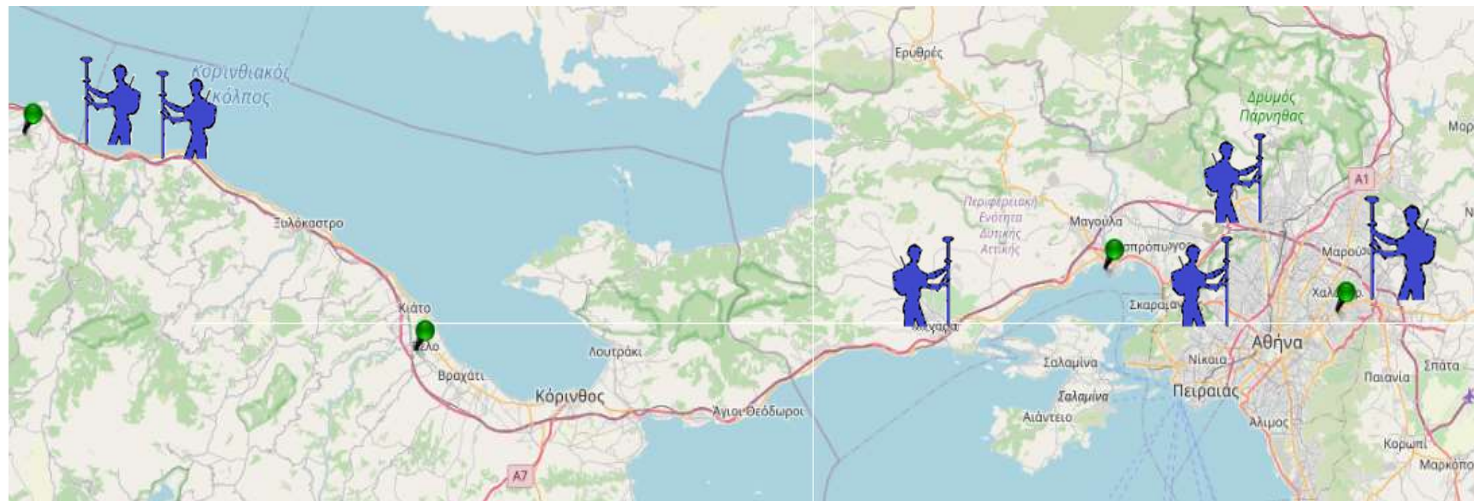
GPS+GLN+GAL+BDS: fixed

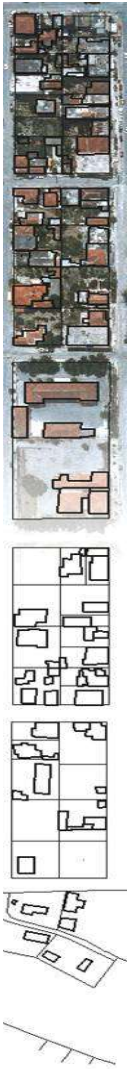
Note: Such points are not suitable for GNSS measurements. The tests were made just to demonstrate the high potential of full GNSS.



Evaluation of HEPOS full GNSS services

Comparison of RTK techniques: locations of measurements



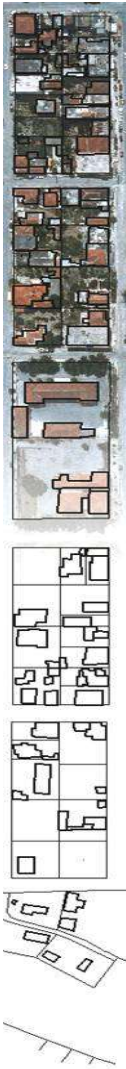


Evaluation of HEPOS full GNSS services

Comparison of RTK techniques: Procedure

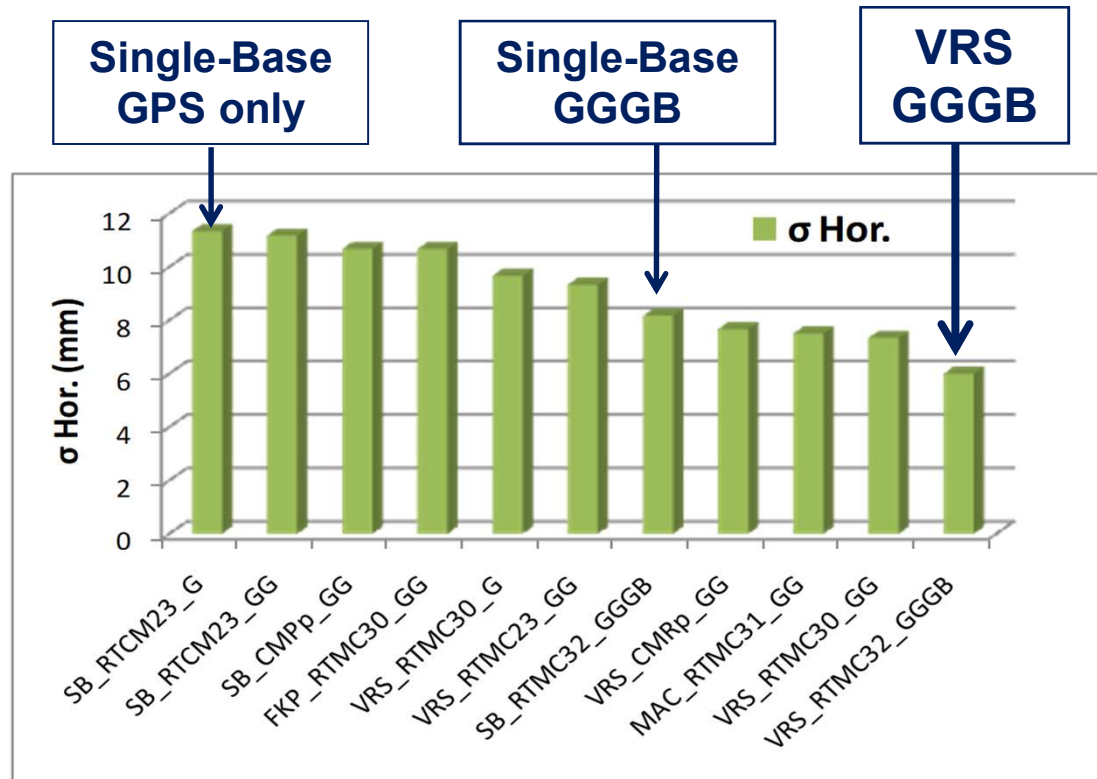
Measurement procedure

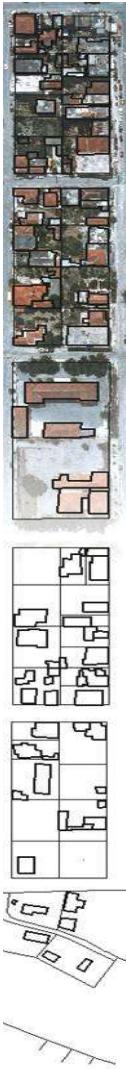
- Rover on tripod, pillar etc. (not on RTK pole)
- Measure with each one of the mount-points (techniques) of HEPOS
- Measurement duration for each mount-point: 4 sec
- Total stay on each point: ~ 15min
- Time period of measurements: May 2021
- Rover: Trimble R8s



Evaluation of HEPOS full GNSS services

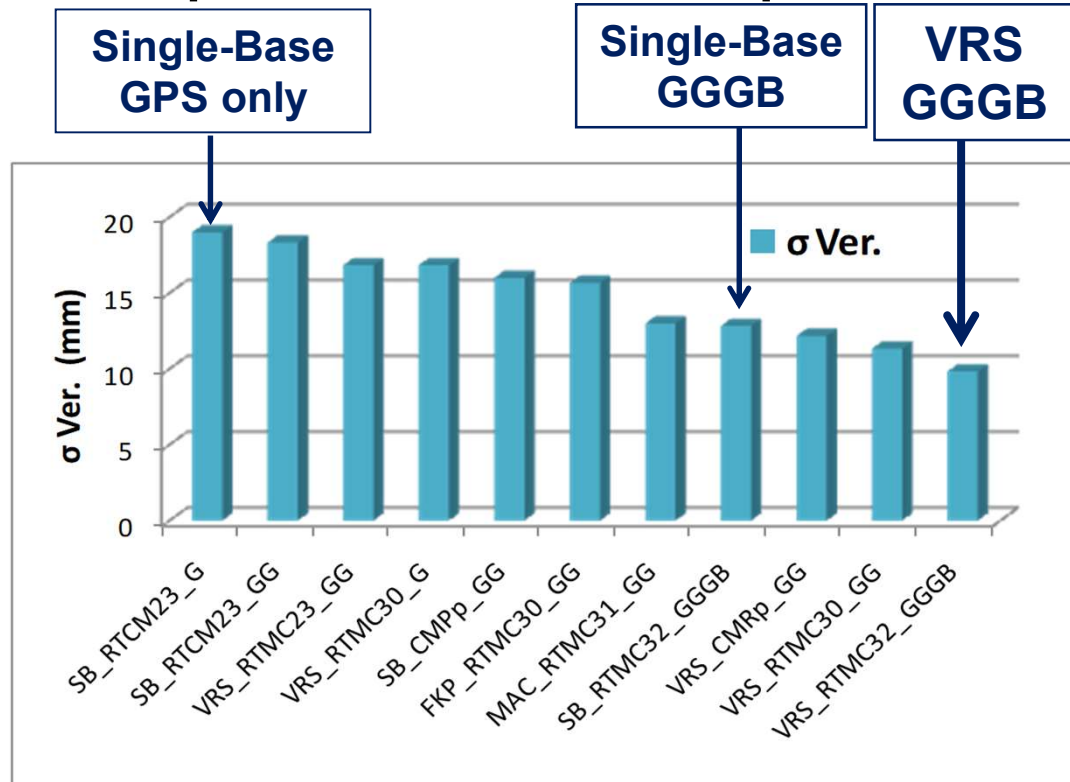
Comparison of RTK techniques: Mean $\sigma_{\text{Horizontal}}$

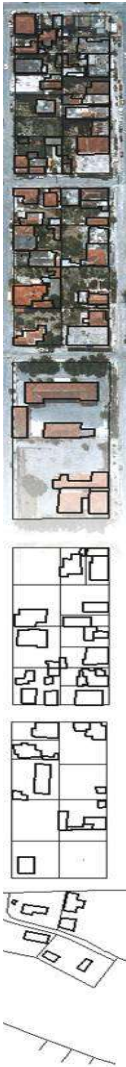




Evaluation of HEPOS full GNSS services

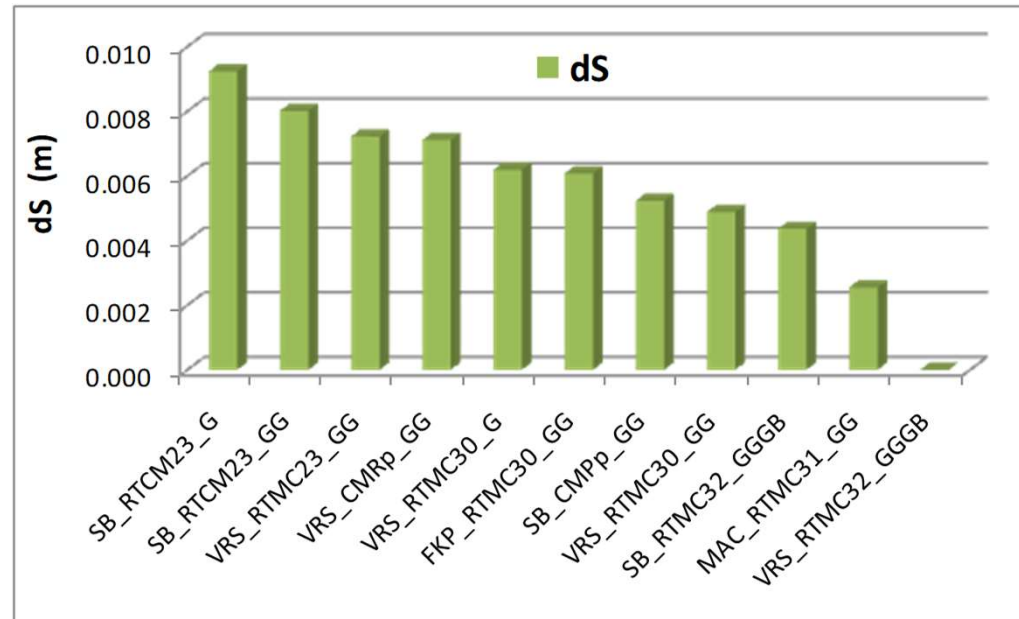
Comparison of RTK techniques: Mean $\sigma_{\text{Vert.}}$





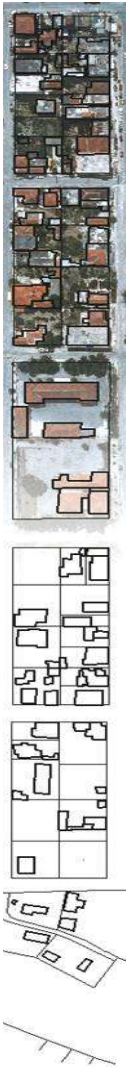
Evaluation of HEPOS full GNSS services

Comparison of RTK techniques: Mean horizontal difference*



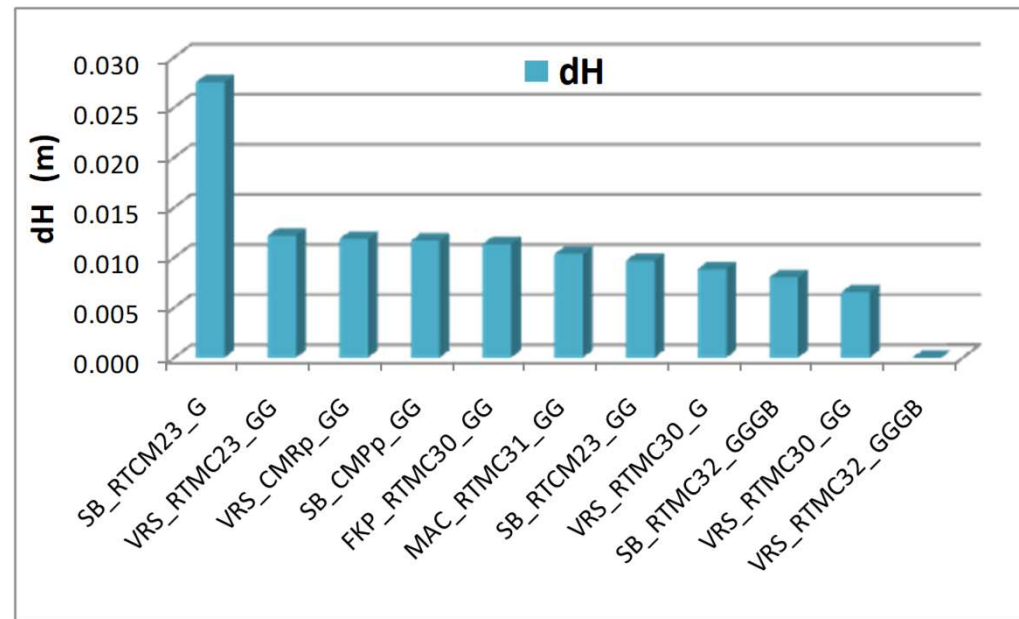
Horizontal positions are better than 1 cm!

(*) w.r.t. VRS_RTCM_GGGB.



Evaluation of HEPOS full GNSS services

Comparison of RTK techniques: Mean vertical difference*



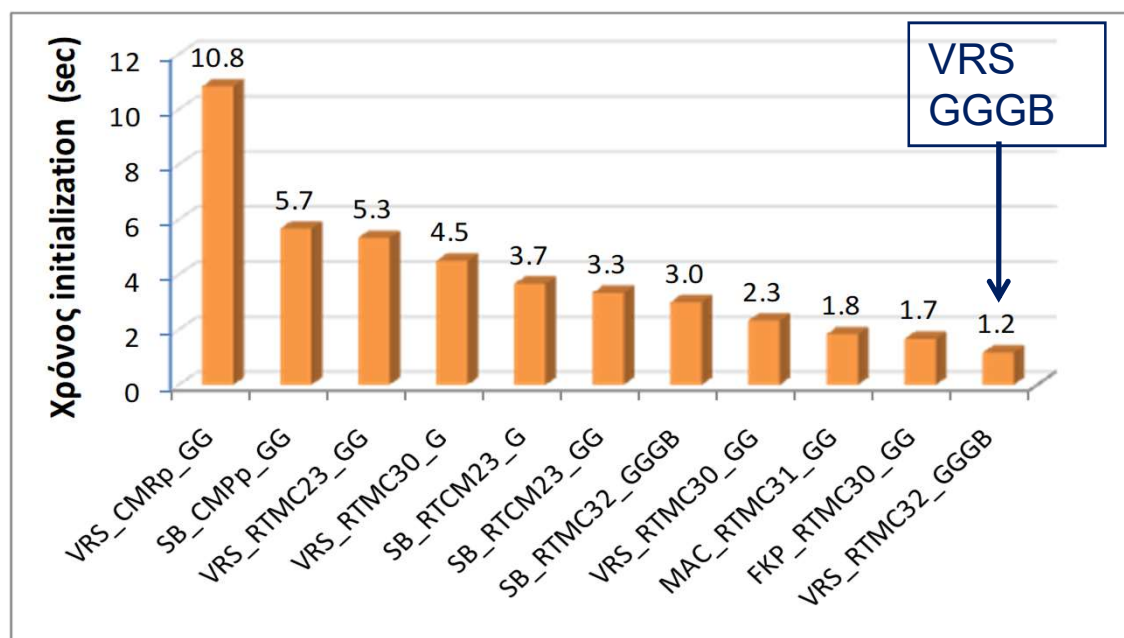
Except for the Single_Base_RTK_GPS_only, **Heights fit better than 1,5 cm!**

(*) w.r.t. VRS_RTCM_GGGB.



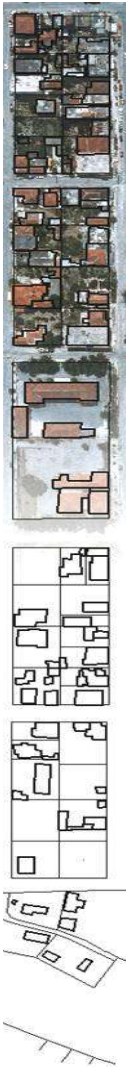
Evaluation of HEPOS full GNSS services

Mean time to fix



Usual 'time to fix' for GGGB: 1-3 sec!

Note: Times may vary depending on the model of the Rover



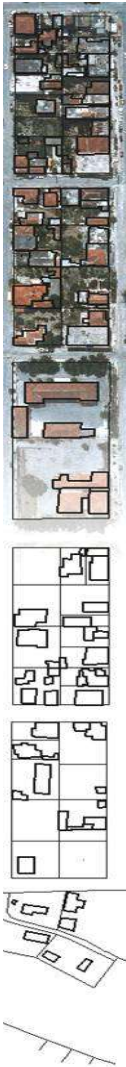
Monitoring of ionospheric activity

Motivation

During the maximum of the 24th Solar Cycle (~2012-2013) intense ionospheric activity seriously affected RTK applications in Greece, mainly in the Southern part of the country.

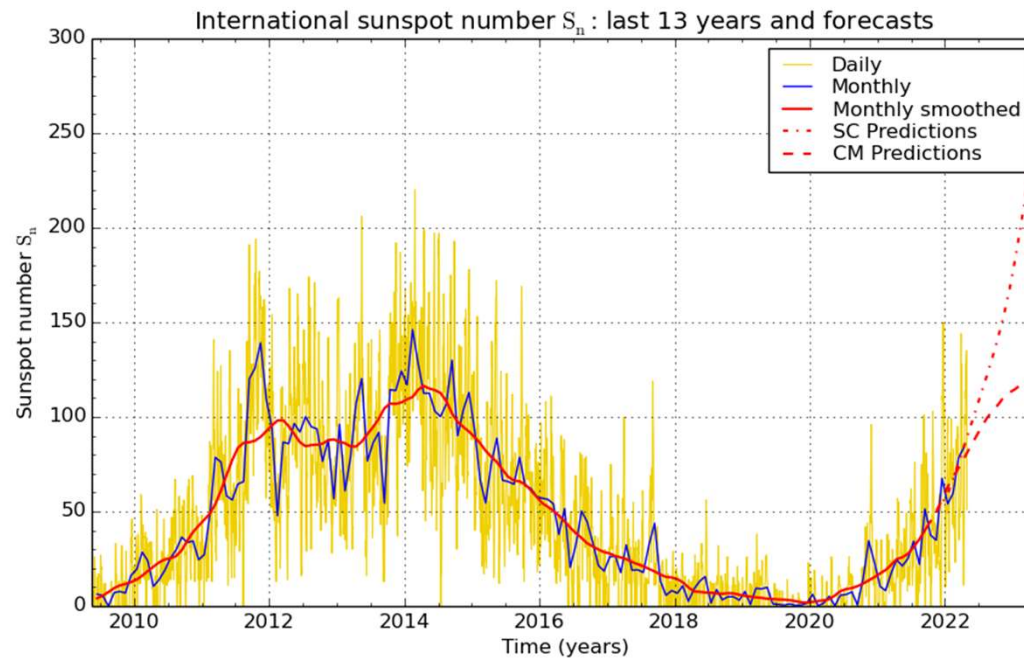
As the maximum of the 25th Solar Cycle is approaching, in HEPOS we monitor the ionospheric activity over Greece.



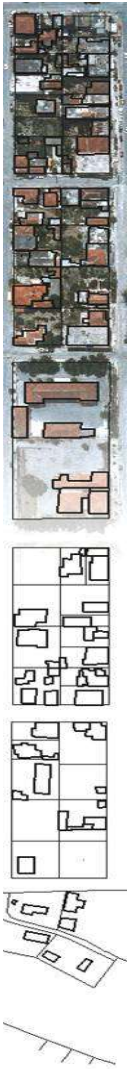


Monitoring of ionospheric activity

Sunspot number



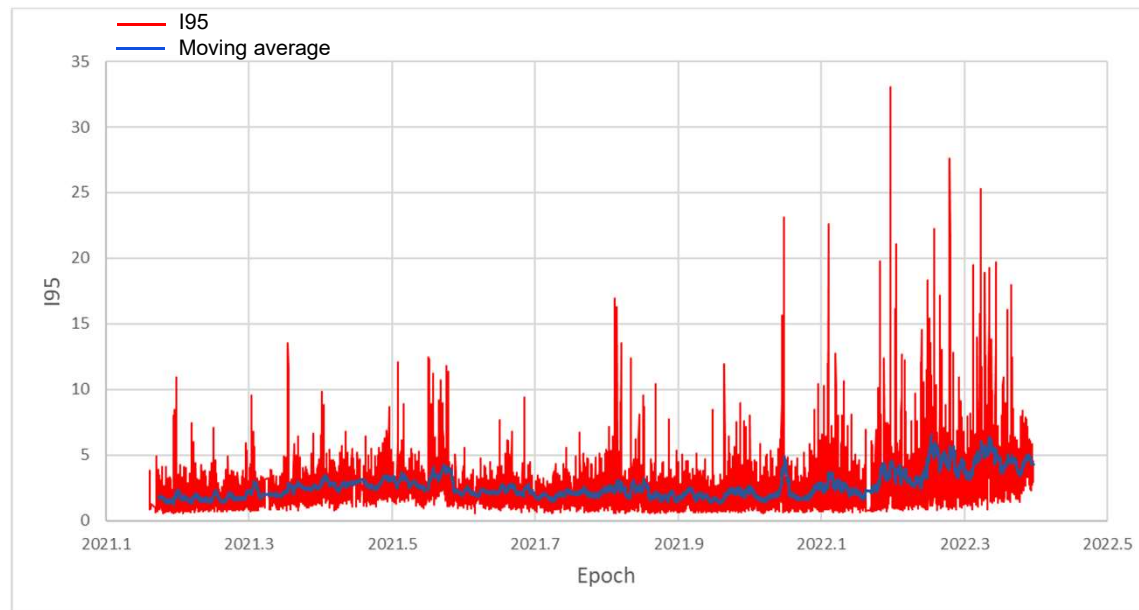
SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium 2022 May 1

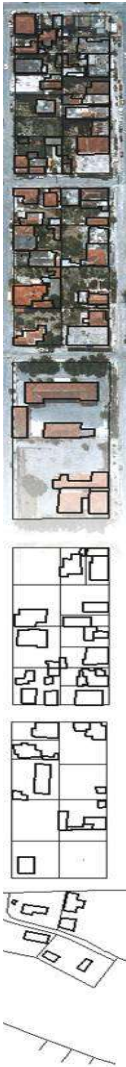


Monitoring of ionospheric activity

HEPOS I95 index

Crete

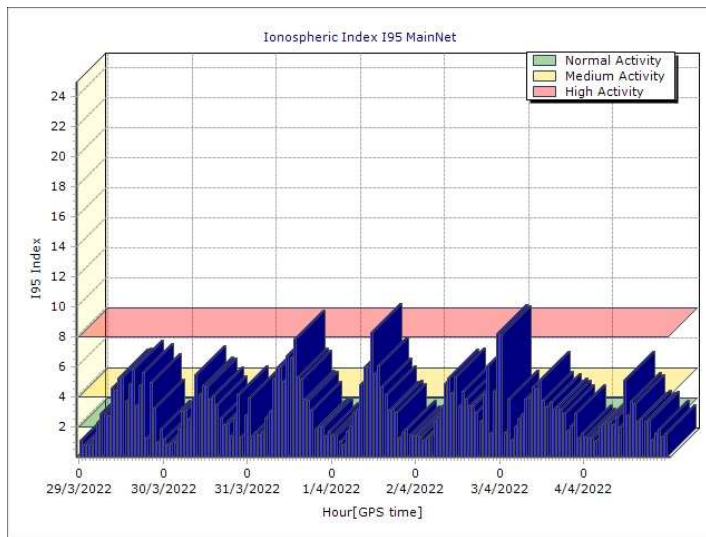




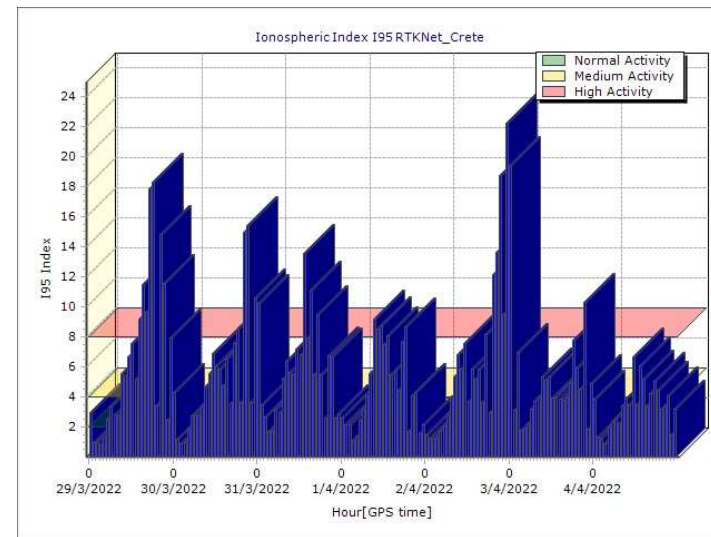
Monitoring of ionospheric activity

HEPOS I95 index

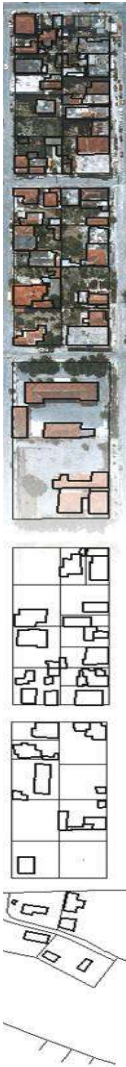
Mainland & Islands



Crete



As we are approaching the max of the 25th Solar Cycle, I95 is increasing over Greece and particularly over Crete.



Acknowledgments

Thank you for your attention!



The establishment of HEPOS was part of the Operational Program “Information Society” and was co-funded by the European Regional Development Fund.



EUREF 2022 SYMPOSIUM
ZAGREB 1 - 3 June 2022