Geodetic activities of GNSS QC research team of AUTh

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Abstract

The laboratory of Geodetic methods and Satellite applications of AUTh has an over 20 years experience on the use of GNSS for Geodetic activities in Greece. This presentation aims to depict the most important research activities of the GNSS Quality Control team. GNSS-QC has a critical mass of good quality research in several areas with more than 80 scientific publications and papers in national and international journals and conferences over the last 10 years. Furthermore, they are involved at the practical training and course teaching of postgraduate and undergraduate students. The scientific laboratory staff has great educational and research experience in Geodesy, Adjustment theory, GNSS/Geoid estimation, GNSS RTK positioning, receiver calibration and GNSS applications for crustal deformations and atmospheric modeling studies (troposphere and ionosphere over Greece). It is equipped with all necessary equipment, workstations / PC, GNSS receivers and software (like Bernese and GAMIT) to solve all the complex problems that called in today. The academic personnel are also the operational managers of three EUREF Permanent Network GNSS stations (AUT1, DUTH, LARM) of Greece. Since 2014 the GNSS-QC is contributing as new Analysis Center of EGVAP project in order to estimate tropospheric over Greece. Extensive studies were applied in the velocity estimation field using permanent station GNSS data and the realization of a new modern reference frame for Greece.

Adjustment and monitoring of SmartNet Greece

Fig 1. Leica SmartNet permanent stations.

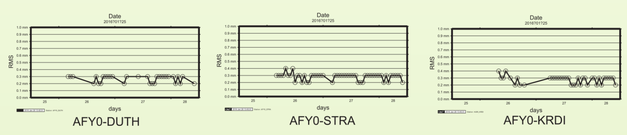


Fig 2a. RMS of baseline estimation.

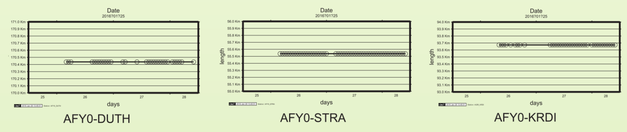


Fig 2b. Baseline length estimation.

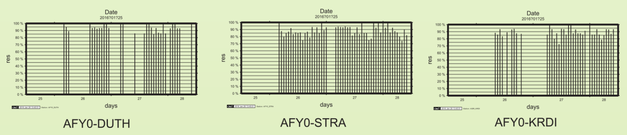


Fig 2c. Percentage (%) of ambiguity resolution of processed baselines.

Daily adjustment and yearly velocity re-estimation with Bernese v5.2

Troposphere and Ionosphere modeling Studies

Through the E-GVAP project provides a unique contribution of tropospheric products across Greece to the meteorological community. The GOP (Geodetic Observatory Pecný) engine was installed together with the appropriate hardware infrastructure. GOP has developed a core system for automated GNSS processing using the Bernese v.5.2 + BPE including data and product flow in order to support various scientific applications. In the processing scheme 36 additional stations from the IGS and EUREF permanent networks are used for datum definition and for a stable absolute tropospheric estimation. The tropospheric products are uploaded to the GOP data center and the UK Met-office. In order to have a continuous quality monitoring of the estimated results and at the same time proper product evaluation, our research team developed various scripts for the automatic derivation of ZTD plots together with coordinates estimates for each GNSS station. Future plans include the assessment of the derived tropospheric products such as the Precipitable Water through their comparison with (regional mesoscale) weather models. TEC values estimation through PPP technique.

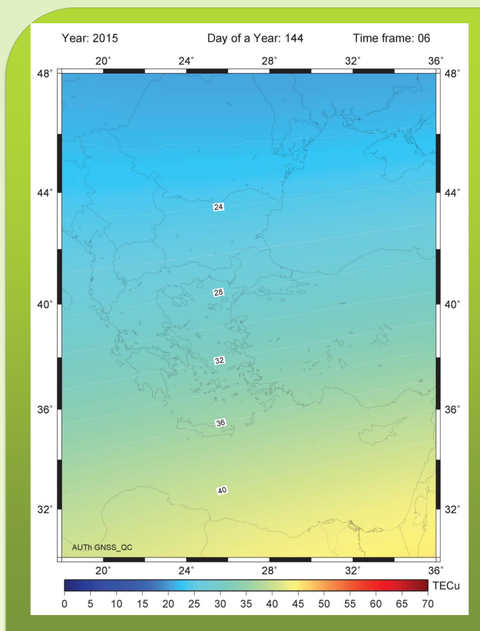


Fig 5. Greek Regional Ionospheric model.

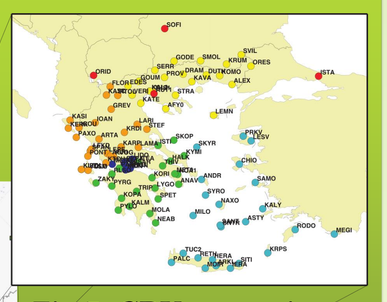


Fig 6. Greek GNSS stations. Project EGVAP

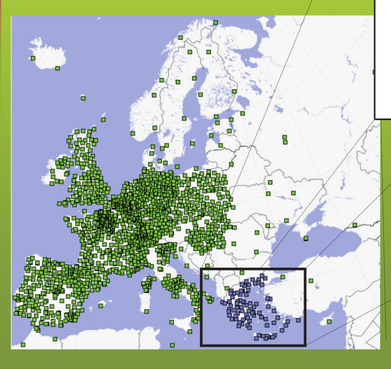


Fig 7. CPU processing Clusters

Greek Velocity Model using seven years GNSS data.

A new horizontal velocity field in Greece.

- 155 stations distributed in the broader Greek territory.
- GPS data processing the GAMIT/GLOBK software package was used for time-series analysis and velocity estimation.
- cell dimension 0.3o x 0.3o (Lat x Lon).
- bi-cubic spline interpolation.
- RMS prediction error, smaller than 0.3 mm/yr, for the horizontal velocities.

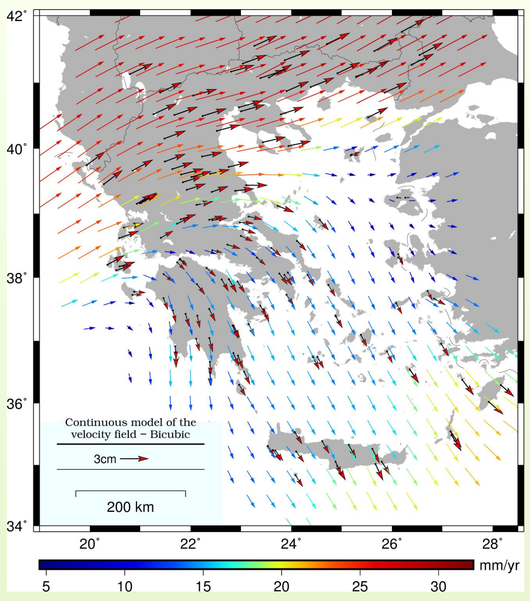


Fig 3. Continuous Greek geodetic velocity model (ITRF2008). The red-black vectors represent the initial velocities on GPS stations whereas the color bar indicates the magnitude of the predicted horizontal velocities.

Model validation with the Global Strain Rate Model GSRM v.2.1 The horizontal vectors differences smaller than 2.5 mm.(Fig 4.)

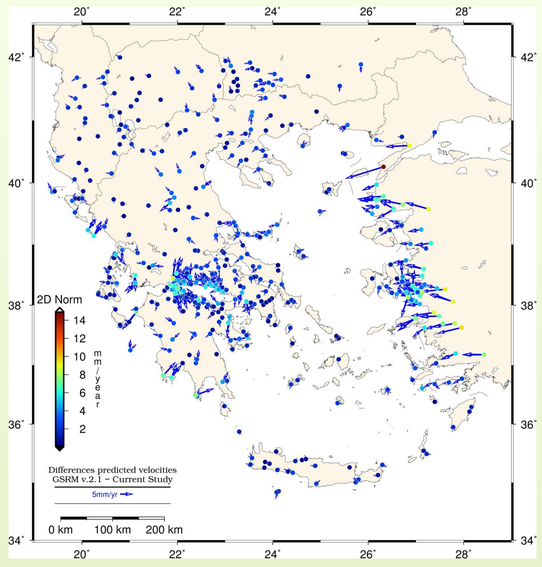


Fig 4.Differences between new Greek Velocity model and GSRM v.2.1.

According to the results the new velocity grid enforce the proper realization of GNSS reference systems in Greece.

GNSS Ntrip Caster (Hermes) over Greece Area

The main goal of this project is to apply this modern technique in geodetic and surveying engineering applications in cluding photogrammetric, cartographic, cadastral and GIS applications as well. Since October 2008 18 permanent GNSS stations transfer their data to the Hermes Caster. Field tests using internet connection via GPRS devices show an excellent and unique opportunity to receive real time GNSS data for the purpose of various positioning mode.

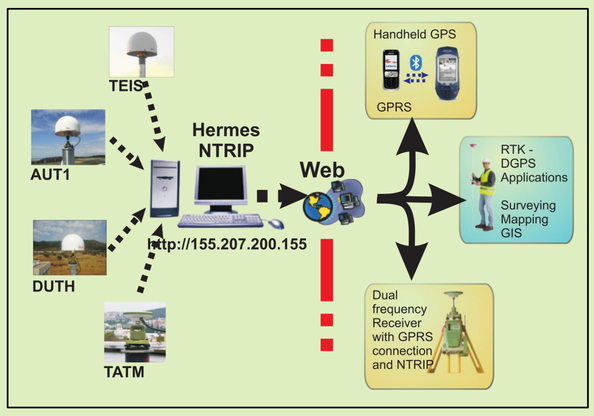


Fig 8. The Hermes NTRIP Caster concept
Caster address : http://155.207.200.155:2101

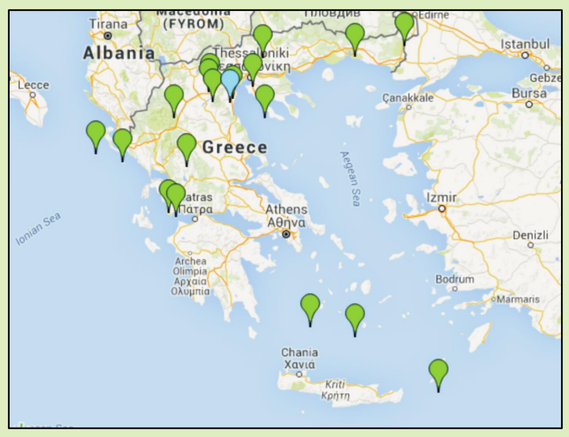
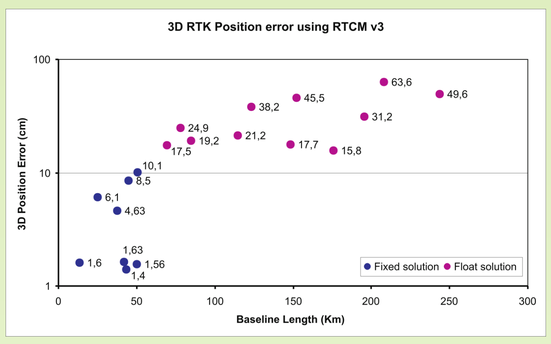


Fig 9. Hermes NTRIP Caster Stations.

The potential accuracy and data communication, several field tests have been carried out for various baseline lengths including static and DGPS-RTK methods. For that reason the rover receiver has occupied points forming baselines distances varying from 5.6Km, to 243Km from the network permanent stations.



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Acknowledgments

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