

Planning DSO contribution to EUREF densification project.

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DSO Recent Activity

Dionysos Satellite Observatory (DSO) and Higher Geodesy Laboratory of the National Technical University of Athens, have developed an automated processing scheme to accommodate the routine analysis of all available continuous GNSS stations in Greece.

This daily analysis process, is implemented for the last two years, yielding results which help us further understand the complicated tectonic setting of Greece and nearby regions.

Important results, include:

- the recent volcanic activity in *Santorini* (e.g. [2]),
- the 2014 *Kefallonia* earthquakes (e.g. [4], [3])

SEISMO Project

In the framework of the SEISMO¹ Project, platform has been upgraded, to include:

- more GNSS stations, divided into sub-networks,
- manipulation, archiving & dissemination of GNSS data files,
- new processing capabilities (e.g. GPS+GLONASS processing),
- automatic archiving and publishing of results (via a dedicated web-site),
- integration with GSAC ([5]) and MySQL databases,
- new results and products

The platform was in practice re-designed & re-implemented.

¹South Aegean Geodynamic And Tsunami Monitoring Platform

Status



Motivation

Via our contribution to EUREF and interaction with its community, we hope to:

- expand & modernize our research activity,
- contribute to the GNSS community,
- take part in ongoing/future projects,
- expand our knowlegdbase,
- improve our academic services (NTUA is a University)



Densification Network Selection

To contribute to the Densification we have to establish a credible dataset (network). This has proven to be rather challenging !

Currently we process whatever we can get our hands on ...

Problems:

- Inhomogenous dataset (RINEX, raw files, etc).
- Various maintainers, different mentalities.
- Different acquisition methods/rates.
- Hardly any log files.
- Wide variety of equipment (not always included in atx files).

COMET/NTUA Network

- established along the Aegean Arc
- homogenous (geodetic type) equipment
- credible time-span (early 2004 - late 2011)
- data acquisition stopped at late 2011
- equipment is old & GPS-only
- needs repairing

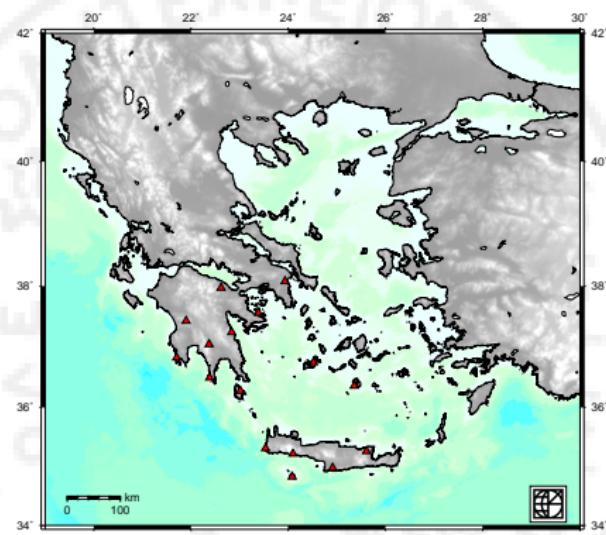


Figure: COMET/NTUA network.

Can be used for EUREF densification “as is”.

NOA/GEIN and others

- covers (sparsely) all of Greece
- credible time-span (newest stations at 2012)
- inconsistent providers (for some stations)
- no log files

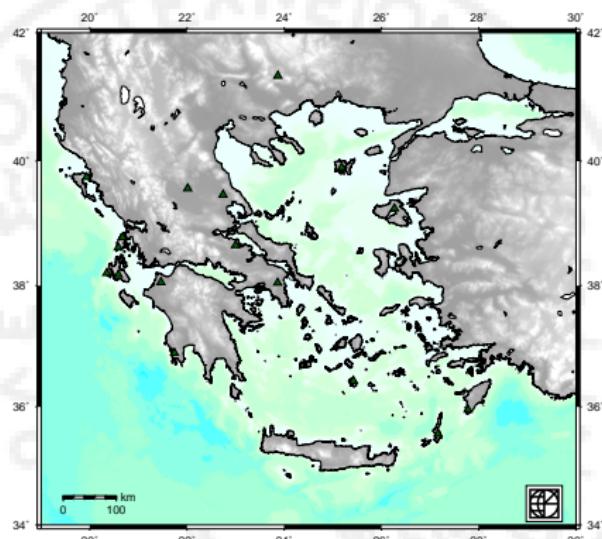


Figure: NOA/GEIN network.

Unusable sites: atal, stef, ?? (no calibration).

Tree-Company / URANUS

- dense network, covers all of Greece
- homogenous (geodetic type) equipment
- limited time-span (late 2013 onwards)
- no log files
- commercial usage oriented
- ~ 2 years of data lost !

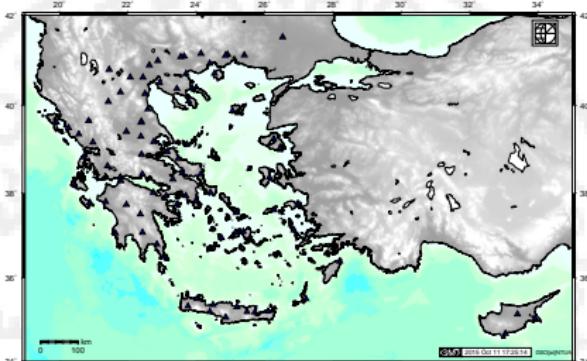


Figure: Tree-Company URANUS network.

Can only use ones with time-span > 2 years (~ ??).

HEPOS

- dense network, covers all of Greece
- homogenous (geodetic type) equipment
- credible time-span (late 2007 onwards)
- limited access (~ 5 stations)!!

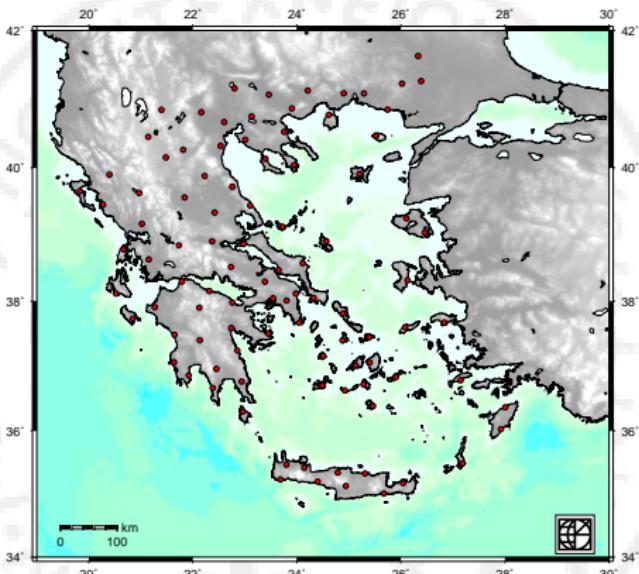


Figure: HEPOS network.

Can only use somewhere between 5 and 10 sites for a time-span of ~ 4 years.



Localised Networks

- credible time-span
- only covers the Corinth Rift
- inconsistent providers
- no log files & equipment changes

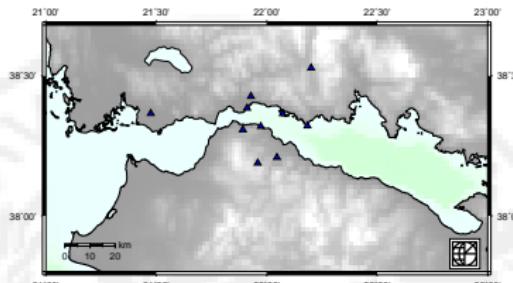


Figure: CRLab network.

Santorini Network.

- localized
- limited time-span



Figure: Santorini network.

Densification Network

The network to be used for the Densification, will look something like this ...

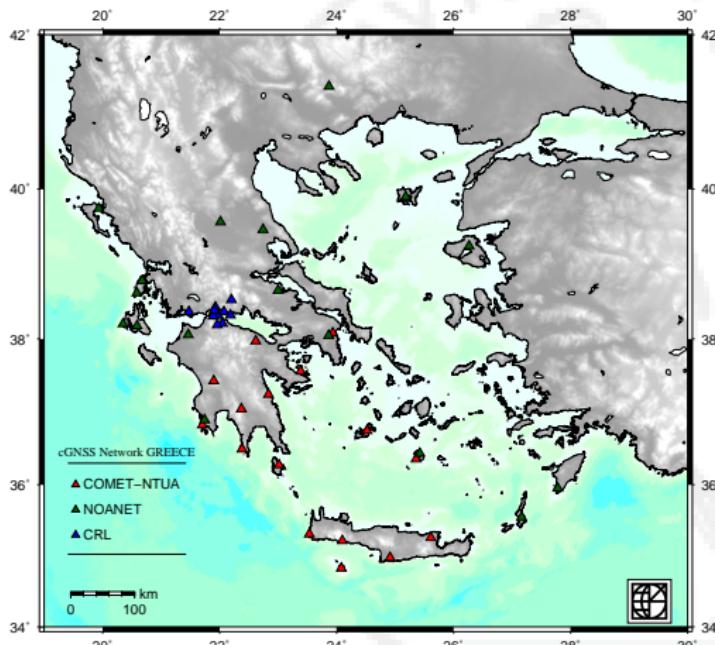


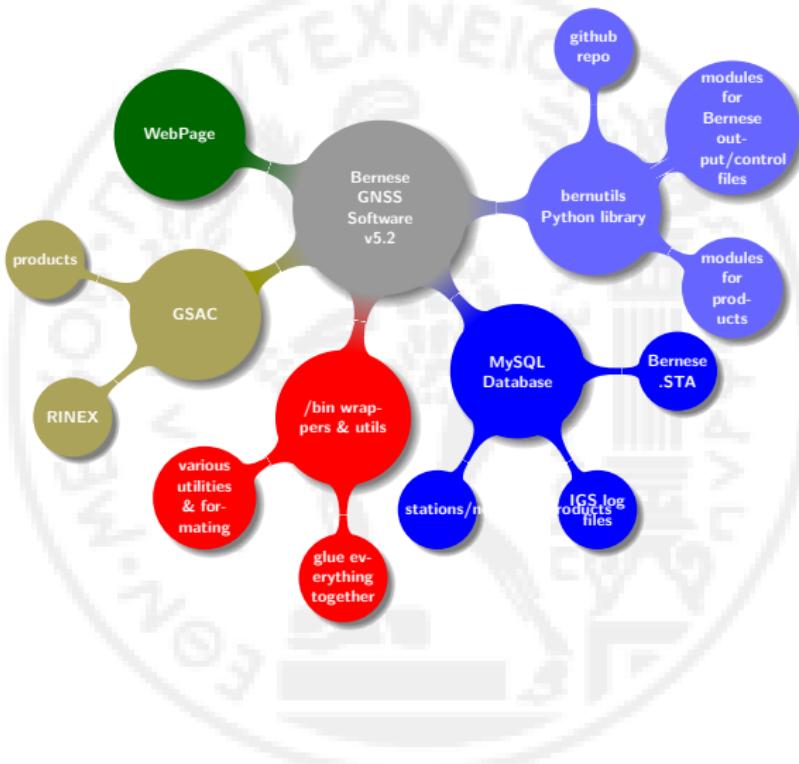
Figure: Densification network (preliminary).

The Scheme

The core
tool/software is
Bernese GNSS
Software
v5.2[?].

Integration with

- MySQL database,
- Python library
- GSAC
- wrappers (shell)





Outlook

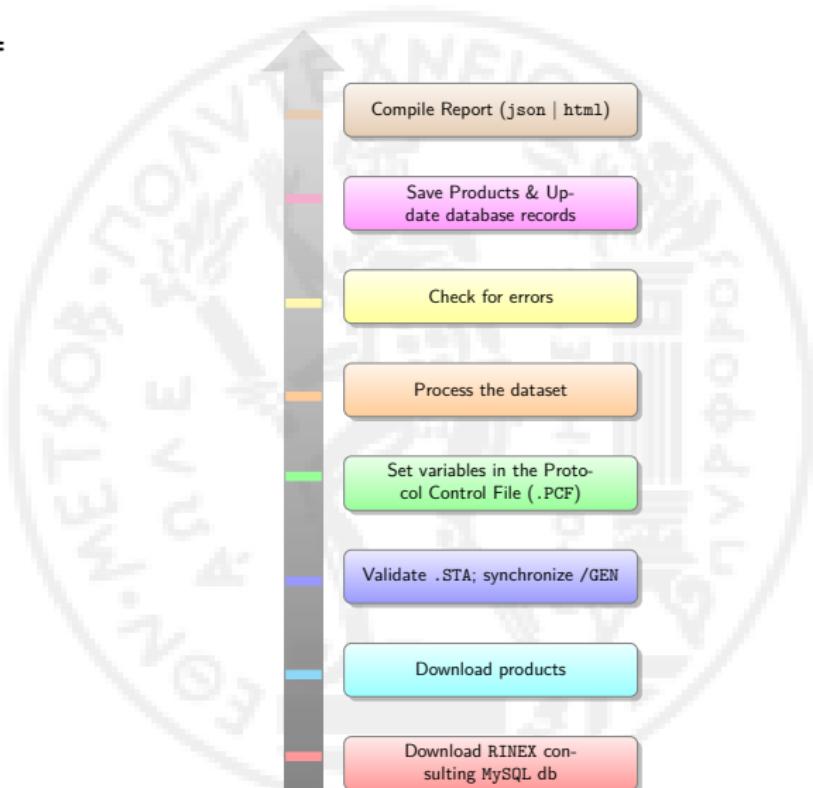
Processing is consistent with EUREFF standards (Guidelines for Analysis Centres).

- SINEX with required info/blocks,
- Reference frame IGb08,
- IERS Conventions 2010,
- IGS/CODE products,
- ocean loading corrections (FES2004),
- atmospheric tidal loading corrections,
- 3° elevation cut-off angle; elevation dependent weighting,
- GMF and/or VMF1; Chen-Herring gradient parameter,
- ambiguities fixed (length-dependent algorithm),
- use GLONASS obs (when available)



Workflow

```
$>ddproces.sh --year=
--doy= --session=
--bern-loadgps=
--campaign=
--satellite-system=
--solution-id=
--save-dir=
--analysis-center=
--use-ntua-products=
--append-suffix=
--elevation-angle=
--update= --pcv=
--apply-exclude-list
```



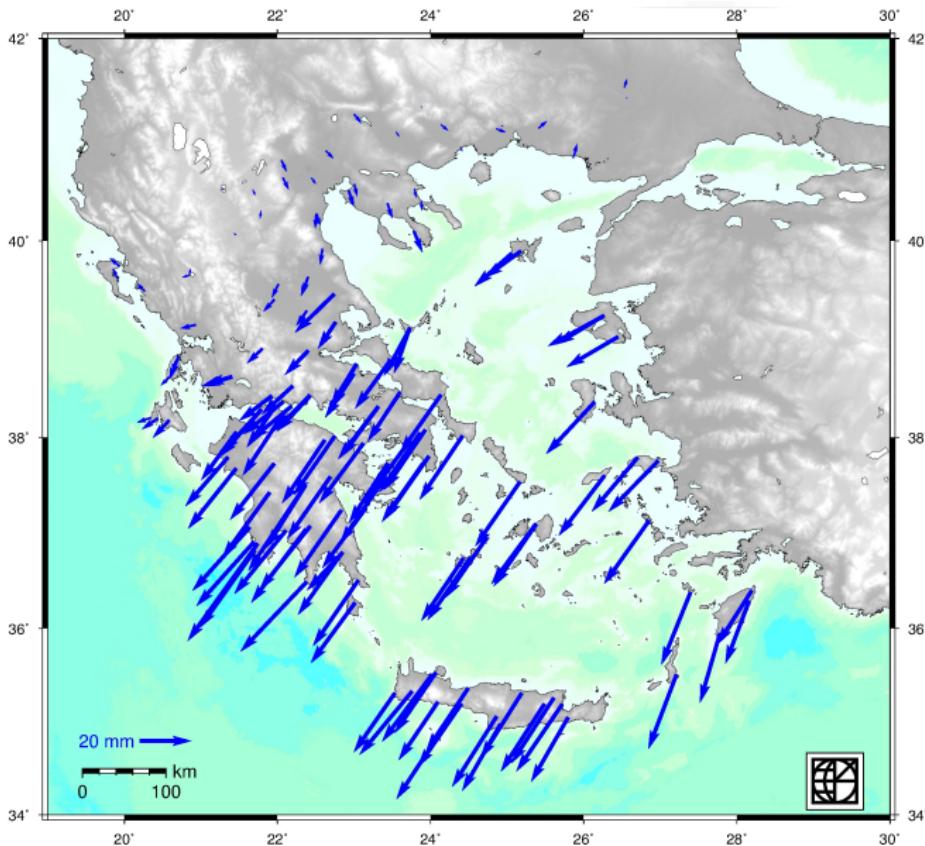
Results & Output

JSON output



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Velocity Field



Web Resources

Visit, Browse, Interact, Comment

- **Dionysos Satellite Observatory**
<http://dionysos.survey.ntua.gr/>
- **GSAC repository** http://dionysos.survey.ntua.gr/dsoportal/_datacenter/gsacrepos.html
- **Ftp site** http://dionysos.survey.ntua.gr/dsoportal/_datacenter/ftpdata.html
- **Kefallonia earthquake** http://dionysos.survey.ntua.gr/dsoportal/_projects/supersites/cephalonia/
- **Ionospheric Remote Sensing** http://dionysos.survey.ntua.gr/dsoportal/_projects/IonoRemSens/

Thank you very much for your attention !



References |

-  **Dach R., Hugentobler U., Fridez P., Meindl M.**
Bernese GPS Software Version 5.0
Astronomical Institute, University of Bern, 2007.
-  **Papoutsis I., Papanikolaou X., Floyd M., Ji K. H., Kontoes C., Paradissis D., Zacharis V.**
Mapping inflation at Santorini volcano, Greece, using GPS and InSAR
Geophysical Research Letters, 40(2):267-272, 2013
-  **Sakkas V., Lagios E.**
Fault modelling of the early-2014 ~ M6 Earthquakes in Cephalonia Island (W. Greece) based on GPS measurements
Tectonophysics, Volumes 644–645, 184–196, 2015, Pages 184–196

References II



Merryman Boncori J.P., Papoutsis I., Pezzo G., Tolomei C., Atzori S., Ganias A., Karastathis V., Salvi S., Kontoes C., Antonioli A.

The February 2014 Cephalonia Earthquake (Greece): 3D Deformation Field and Source Modeling from Multiple SAR Techniques

Seismological Research Letters, Vol.86(1), 2015



UNAVCO

GSAC – Geodetic Seamless Archive Centers: Open-source Software for Geodesy Data Repositories

*available at [https://www.unavco.org/software/
data-management/gsac/gsac.html](https://www.unavco.org/software/data-management/gsac/gsac.html)*

References III

-  **P. Rebischung**
IGb08: an update on IGS08
IGSMAIL [6663] <http://igscb.jpl.nasa.gov/pipermail/igsmail/2012/007853.html>, 2012
-  **Boehm J., B. Werl, and H. Schuh (2006)**
Troposphere mapping functions for GPS and very long baseline interferometry from European Centre for Medium-Range Weather Forecasts operational analysis data
Journal of Geophysical Research, vol. 111, B02406, 2006