KTIMATOLOGIO S.A.

HEPOS
HEllenic POsitioning System

Dealing with significant differential tectonic plate velocities within an RTK-network: The case of HEPOS

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Outline

1. Eurasian intraplate velocities
2. Differential tectonic plate velocities in Greece
3. Approach currently followed
4. First results - evaluation
5. Concluding remarks

1. Eurasian intraplate velocities

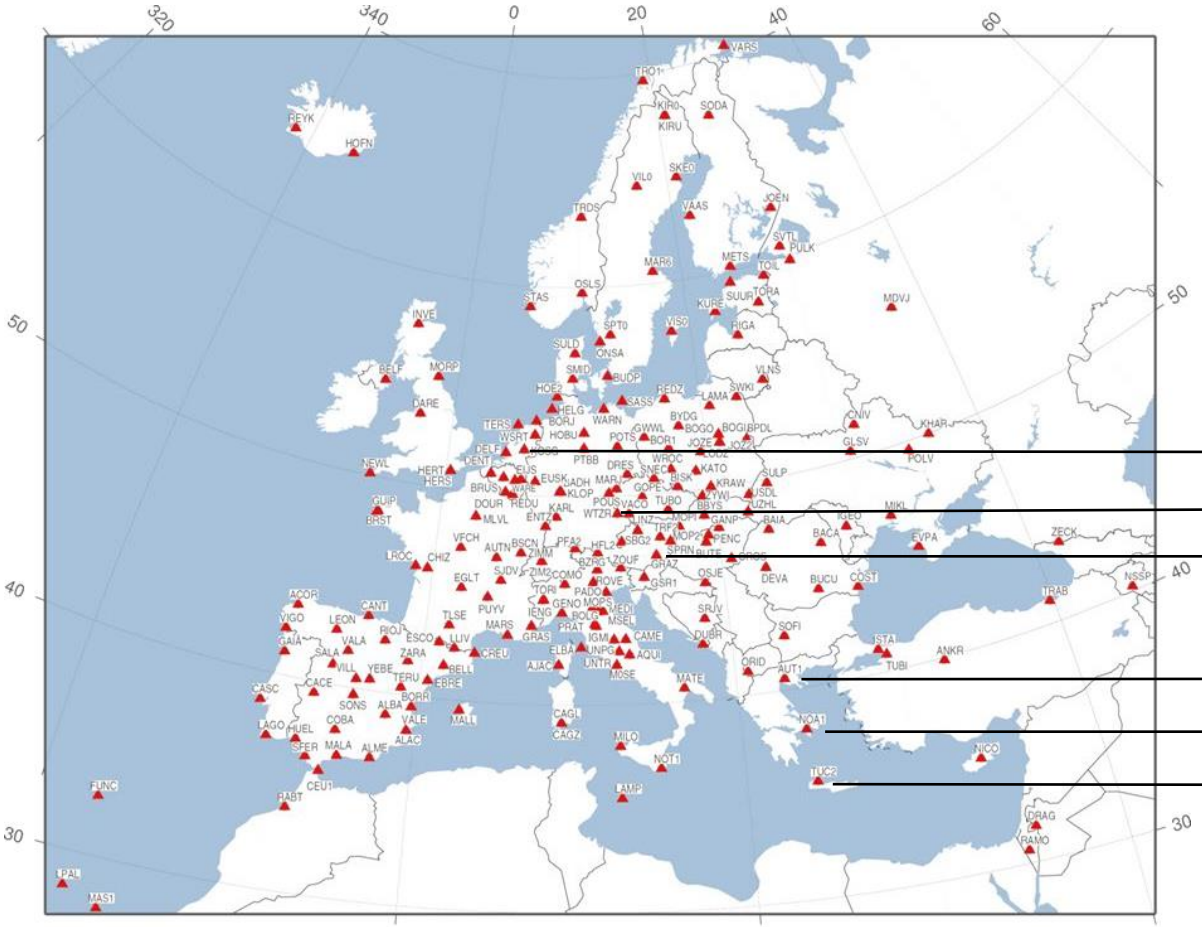
Introduction

- Eurasia, like the other continents, is characterized by an particular plate motion due to the continental drift.
- It is well known that within Eurasia the tectonic velocities are not everywhere the same.
- For the maintenance of a national geodetic reference frame the following characteristics of the velocities are critical:
  - magnitude
  - homogeneity
  - stability in time
- The presentation describes the experience gained from operating a national RTK-network in the most seismotectonically active area of Europe, i.e. Greece.

1. Eurasian intraplate velocities

EPN stations Velocities

3D velocity vectors computed in ETRF2000 using solution C1570



KOSG: 0.0007 mm/y

WTZR: 0.0008 mm/y

GRAZ: 0.0011 mm/y

AUT1: 0.0090 mm/y

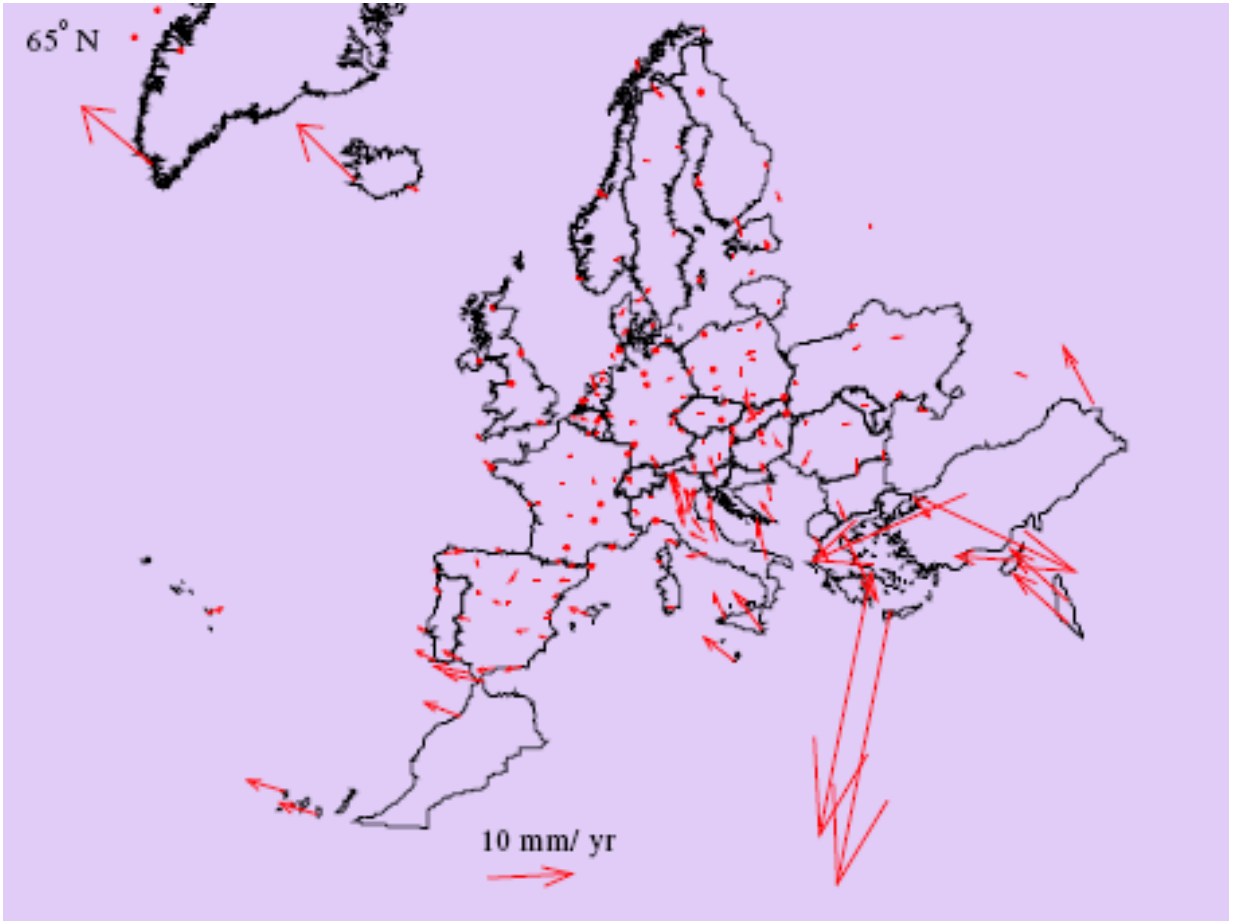
NOA1: 0.0307 mm/y

TUC2: 0.0312 mm/y

1. Eurasian intraplate velocities

EPN stations Velocities

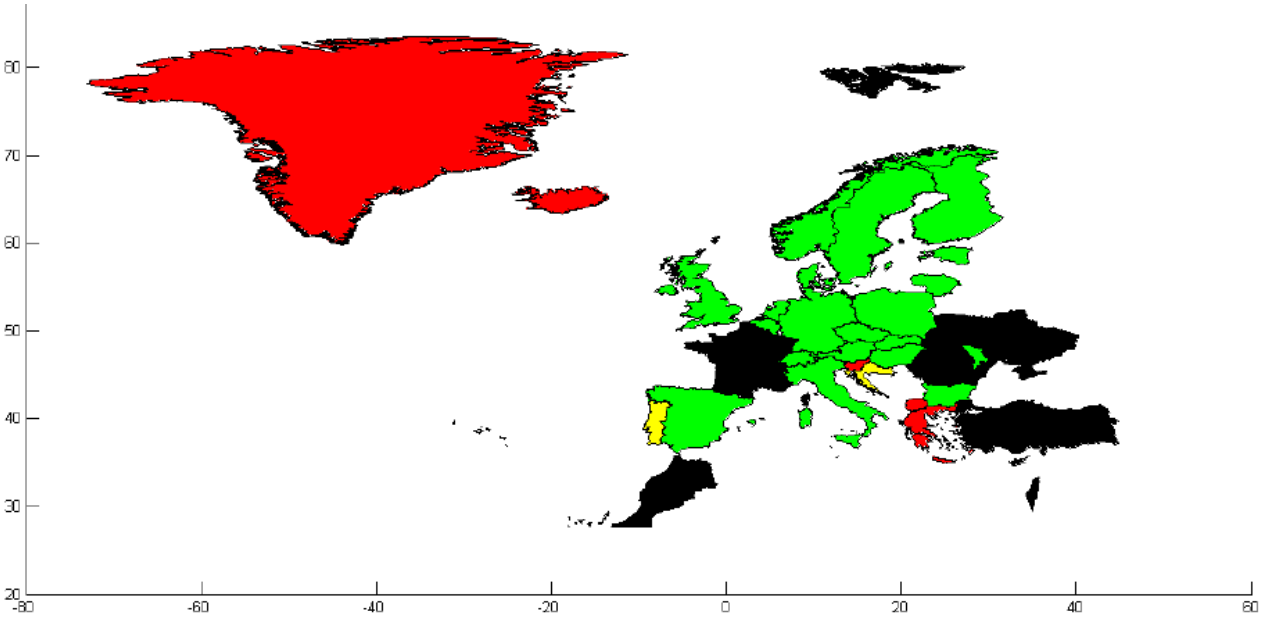
Horizontal velocities of Class A EPN stations *(Lidberg et al., 2011)*



1. Eurasian intraplate velocities

Lifetime of ETRS89 coordinates

Predict when local Hz velocities
generate discrepancies from frame >3 *(Caporali et al., 2011)*

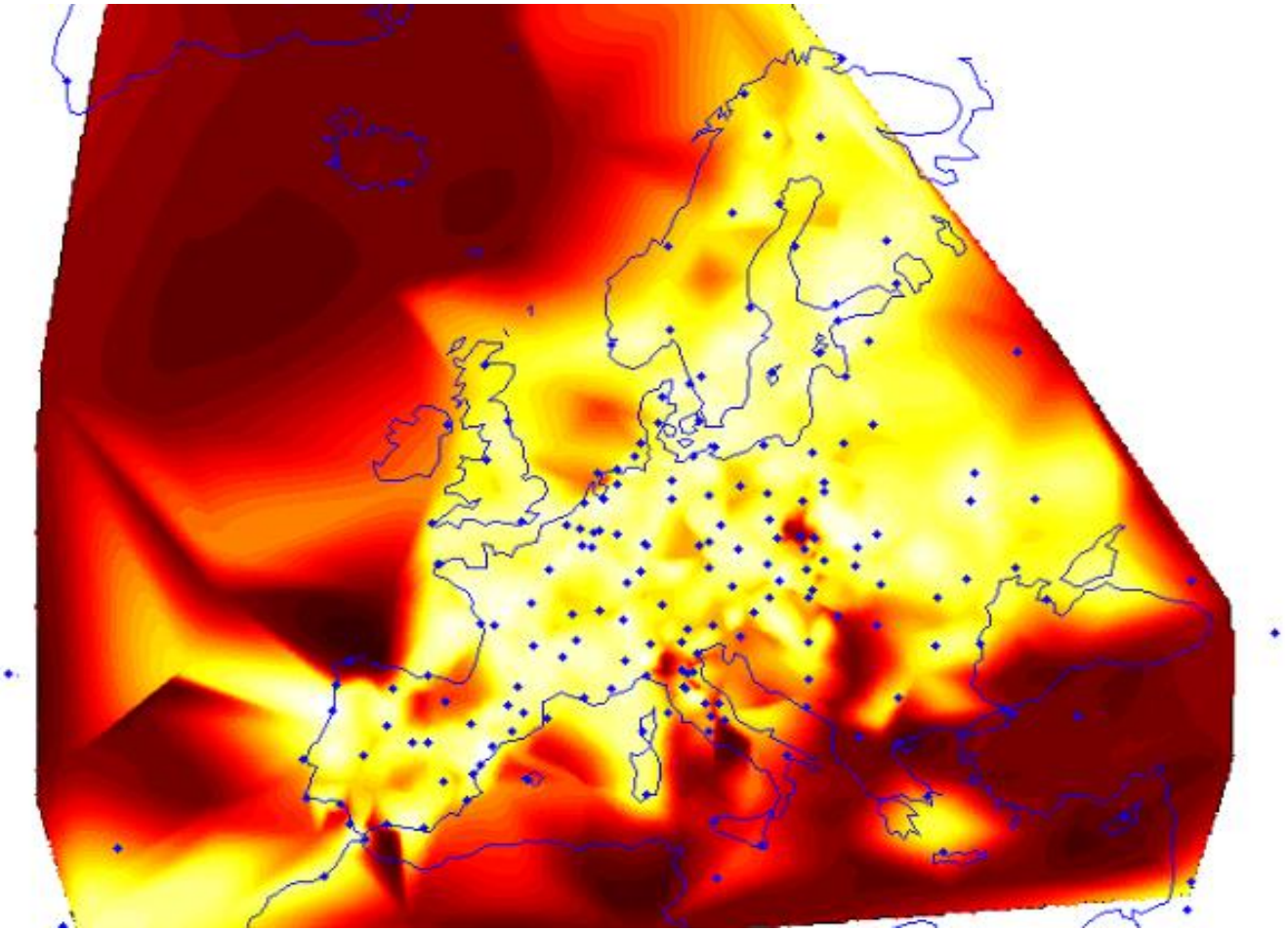


No realization	<2012	>2012 <2020	>2020

1. Eurasian intraplate velocities

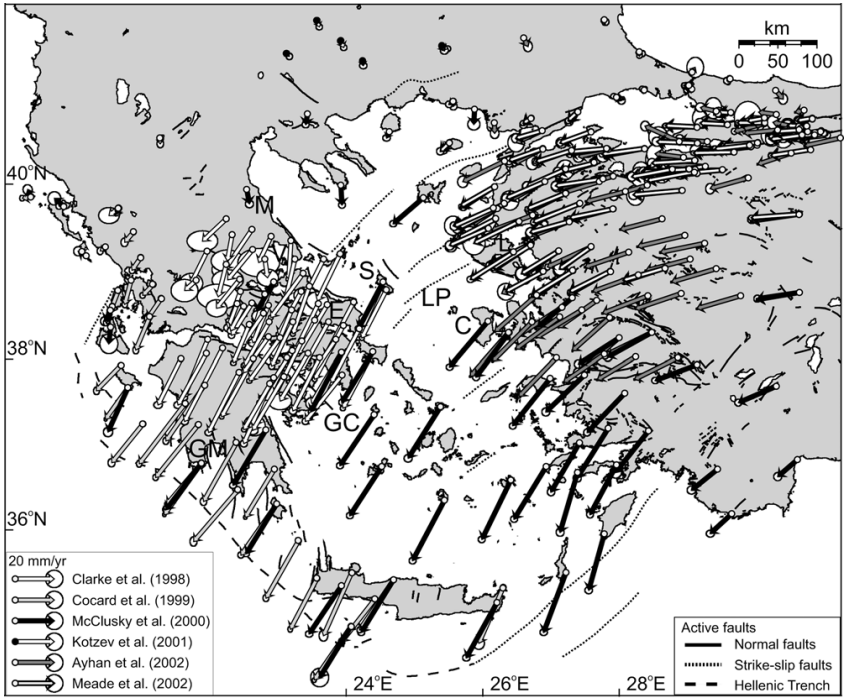
Homogeneity of Velocity field of adjacent points

Differential residuals in horizontal component *(Lidberg et al., 2011)*



2. Differential tectonic plate velocities in Greece

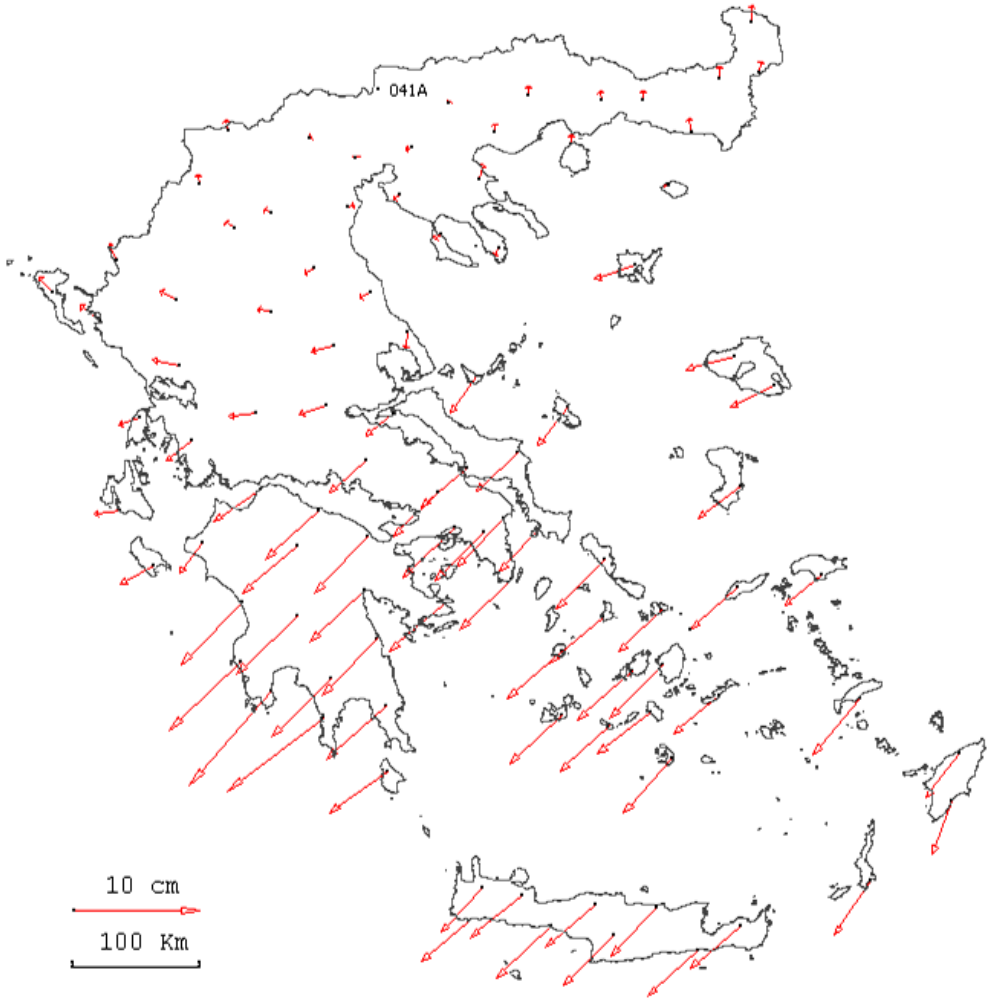
The role of the Aegean Plate



Geodetically derived velocities relative to Eurasia (Nyst and Thatcher, 2004)

2. Differential tectonic plate velocities in Greece

Deformation field resulted from HEPOS



Differential displacements of the HEPOS stations over two years
(w.r.t. station 041A, 11/2007 - 11/2009)
(Gianniou, 2010)

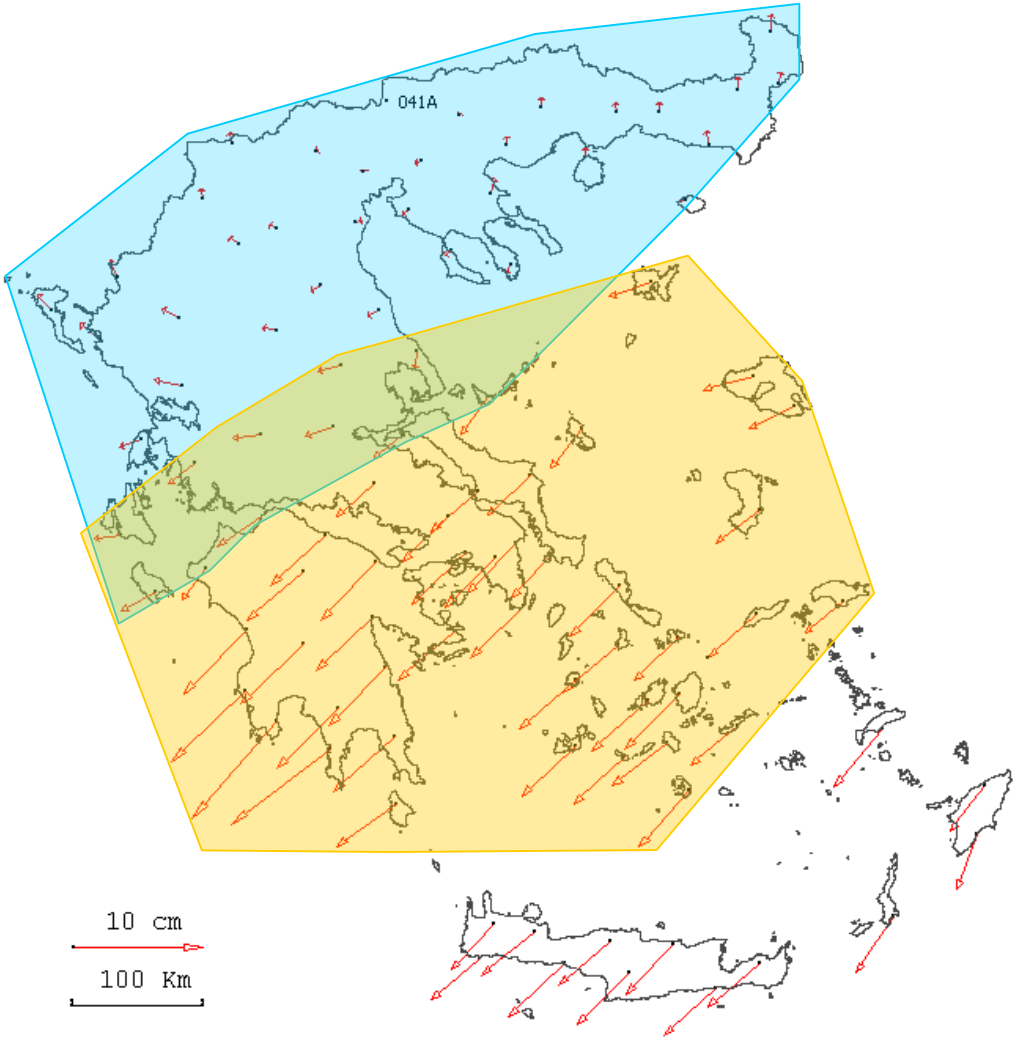
3. Approach currently followed

Consideration of two sub-networks

- The tectonic velocity field in Greece is strongly inhomogeneous. Two main zones are distinguished.
- Due to the considerable difference between the velocities of the two zones, they cannot be treated as a single network over a long period of time.
- From a strictly scientific point of view, the solution would be the regular update (e.g. every 1-2 years) of the stations coordinates, leading to a dynamic or semi-dynamic geodetic datum.
- However, this approach is inconvenient. Thus, a different approach is currently followed in HEPOS, i.e. the consideration of two sub-networks.

3. Approach currently followed

The two sub-networks considered in HEPOS

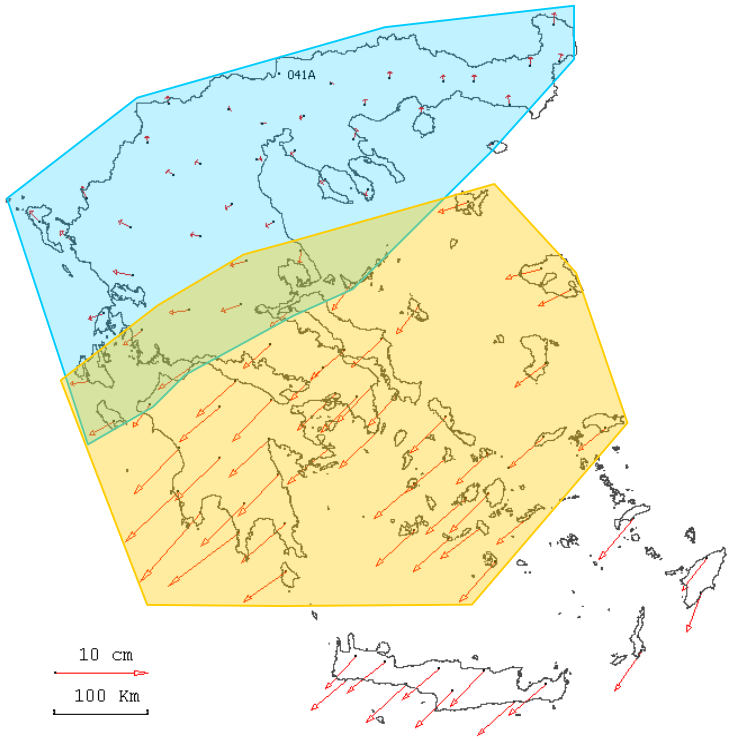


Based on the tectonic characteristics of the stations, two sub-networks* (with an overlap zone) have been formed.

* Crete has always been treated as a separate network.

3. Approach currently followed

Discussion



The overlap zone is desired in order to guarantee a smooth transition from one sub-network to the other.

Users in the transition zone, are served by the sub-network with the lowest residuals.

Consistency between precise orbits and stations coordinates is ensured for each sub-network, following an approach that is absolutely transparent to the users.

* Crete has always been treated as a separate network.

4. First results - evaluation

First results: 8 months of operation

- The two sub-networks perform quite well, ensuring:
  - Short initialization time (resolution of carrier-phase ambiguities at the stations)
  - Robust error modeling, i.e small:
    - geometric and
    - ionospheric remaining errors
  - Production of high quality VRS solutions in terms of:
    - Precision
    - Stability in time

4. First results - evaluation

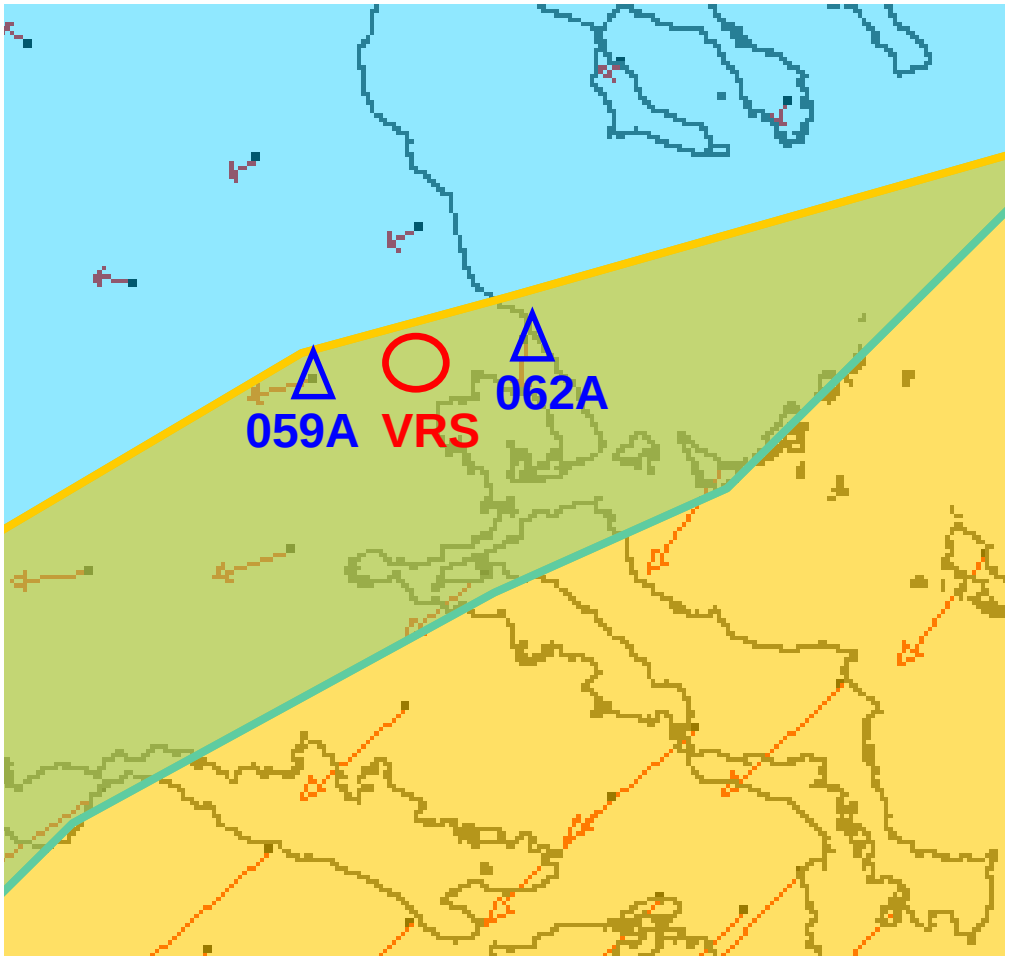
Evaluation of VRS solutions

- The quality of our HEPOS VRS solutions is being evaluated on a regular basis.
- VRS data are periodically being created at different locations throughout the country.
- The data are being processed and the obtained time-series are analyzed.

In the following a characteristic example is given, for a VRS in the overlap zone

4. First results - evaluation

Evaluation of VRS solutions



VRS position (HTRS07):
φ: 39° 22’ 00.0”
λ: 22° 44’, 00.0”
h: 200m

VRINEX files created for every day

Each VRINEX file is processed from station 059A (distance to VRS: 27.6 km).

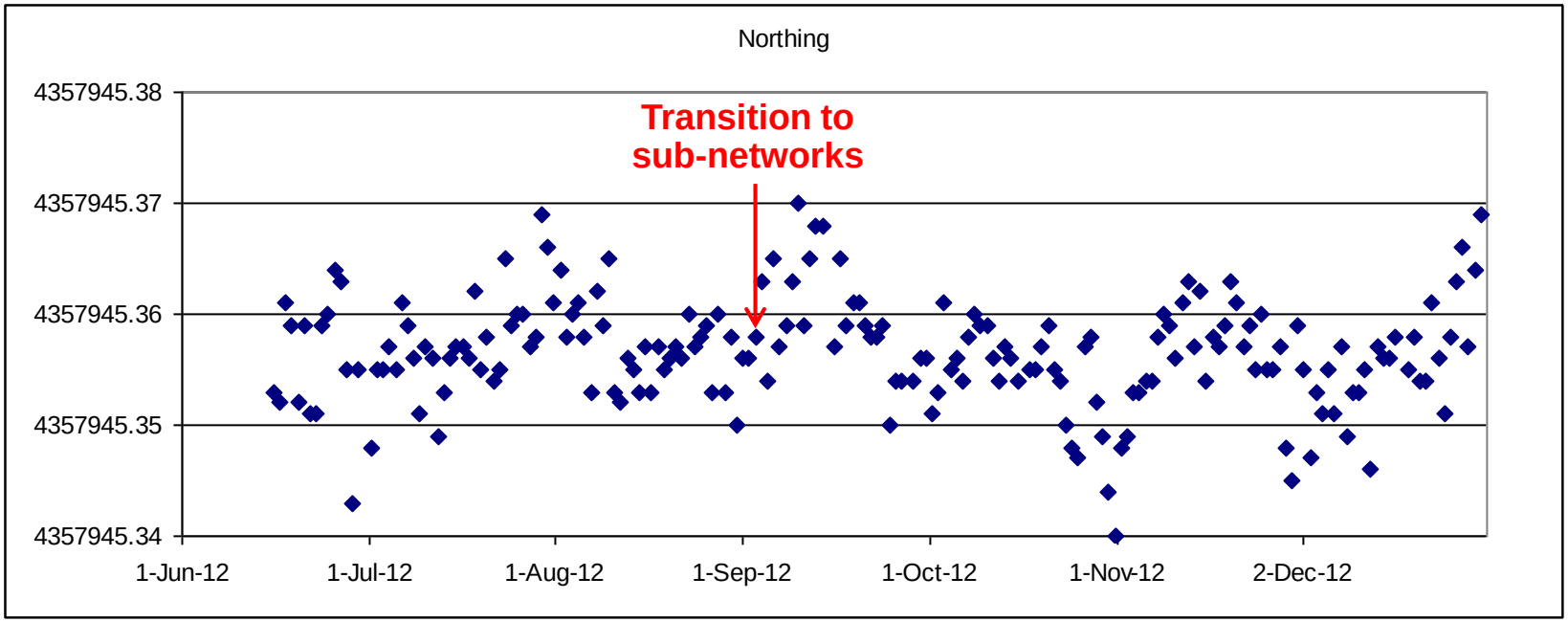
4. First results - evaluation

Evaluation of VRS solutions

Baseline 059A-VRS

Time-series of estimated VRS coordinates: Northing

σ = 0.0048 m



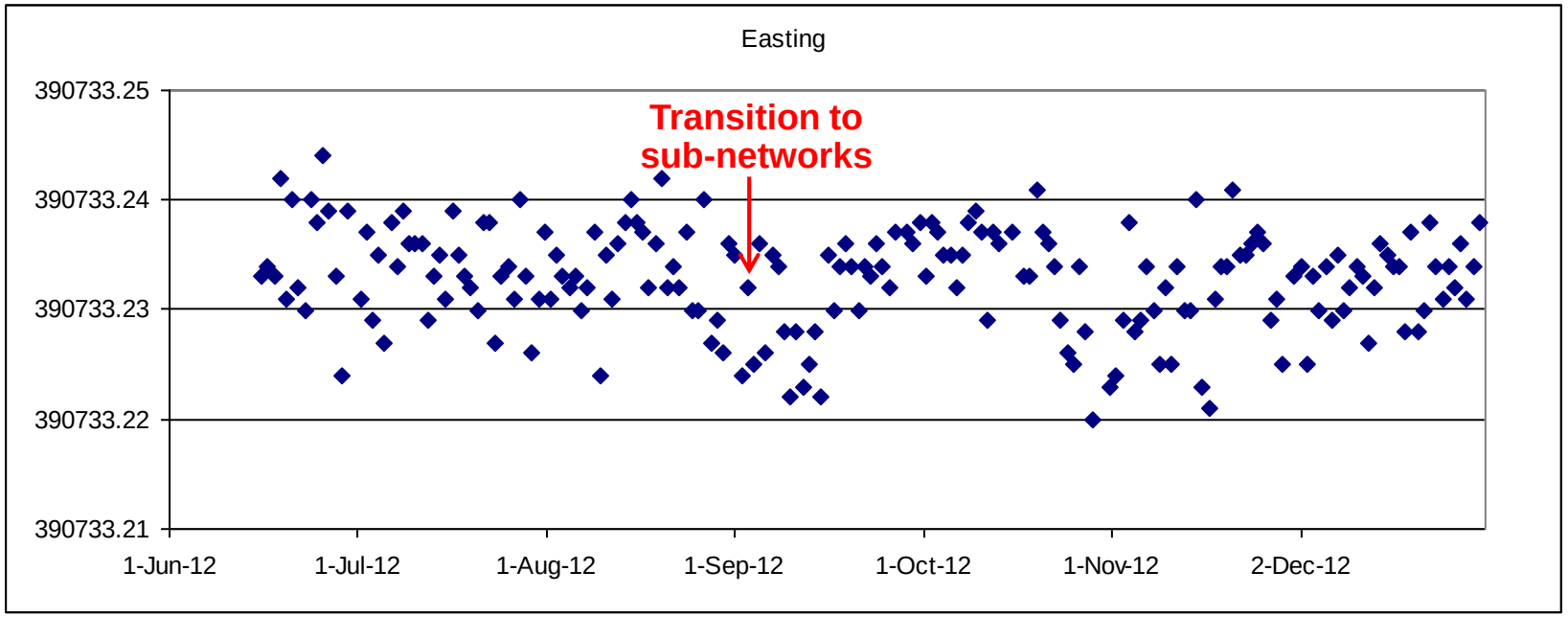
4. First results - evaluation

Evaluation of VRS solutions

Baseline 059A-VRS

Time-series of estimated VRS coordinates: Easting

σ = 0.0046 m



5. Concluding remarks

- Intense differential tectonic plate velocities exist in Greece.
- A way to face it is being tested in HEPOS, by considering two sub-networks
- So far, the results are satisfactory:
  - The networks run smoothly
  - Coordinate update has been avoided for the moment.
- The differential velocities within each sub-network are relatively small, but will accumulate displacements over time. Special attention is being paid on that.

Acknowledgments

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