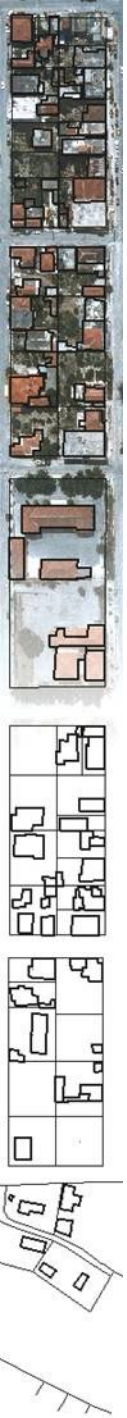

NATIONAL CADASTRE & MAPPING AGENCY S.A.

National Report of Greece

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Outline

1. **Preface**
2. **The 2011-2012 Santorini volcano inflation**
   - Geographic distribution of horizontal displacements
3. **The 2014 North Aegean Sea earthquake**
   - Change of tectonic velocities

1. Preface

In the context of operating HEPOS and maintaining the reference system, geological phenomena that may lead to coordinate changes are being investigated.

This report presents the results obtained from the study of two important geological phenomena:

- **The 2011-2012 Santorini volcano inflation.**
- **The 2014 North Aegean Sea earthquake**

2. The 2011-2012 Santorini volcano inflation

The event

- **Unrest for the first time since 1950**
- **Started: January, 2011**
- **Ended: ~ April, 2012**
- **Associated with microseismicity**
- **No eruption**

  Previous eruptions: 1707, 1866, 1925, 1939, 1950
- **Importance from geodetic point of view:**

  Coordinate changes due to crustal deformations

2. The 2011-2012 Santorini volcano inflation

Data sets used

- **Before inflation**
  GPS measurements[1] made in 2007 on 11 pillars of the national trigonometric network

- **After inflation**
  GPS measurements[2] repeated in 2017 on the same pillars

1. Data from the HEPOS project for the establishment of the transformation model between HTRS07 and GGRS87
2. Measurements conducted by the Geodesy & Surveying Lab of the TEI of Athens

2. The 2011-2012 Santorini volcano inflation

GPS measurements

Same schema of measurements

Baseline starting from CORS 048A

Session Duration

- 2007: 60 min
- 2017: 90 min

GPS receivers

Dual frequency GPS receivers

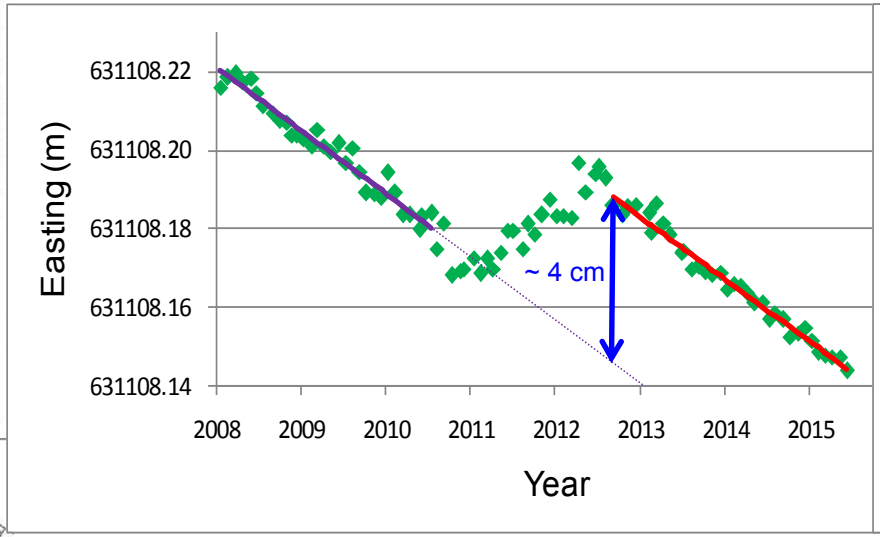
Processing software

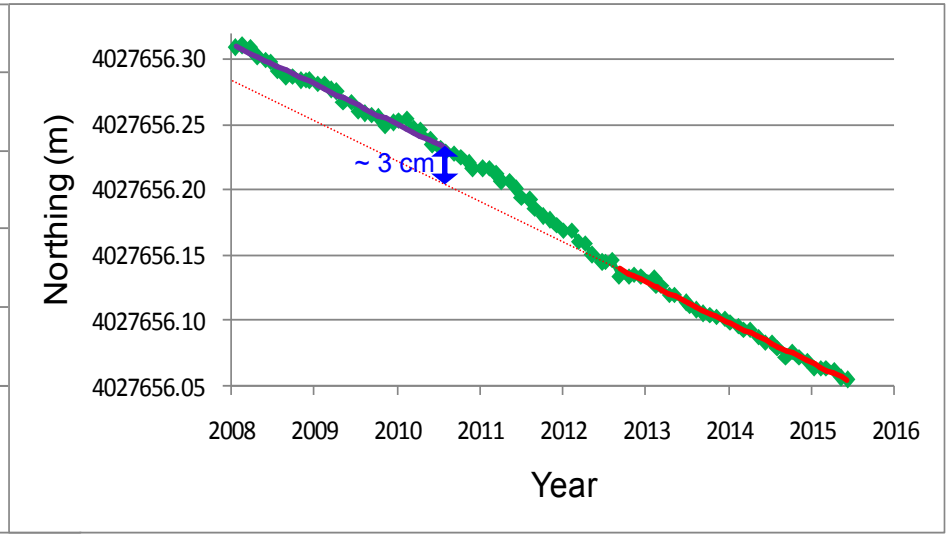
Trimble Business Center ver. 3.81

2. The 2011-2012 Santorini volcano inflation

Estimation of displacement of Ref. Station 048A

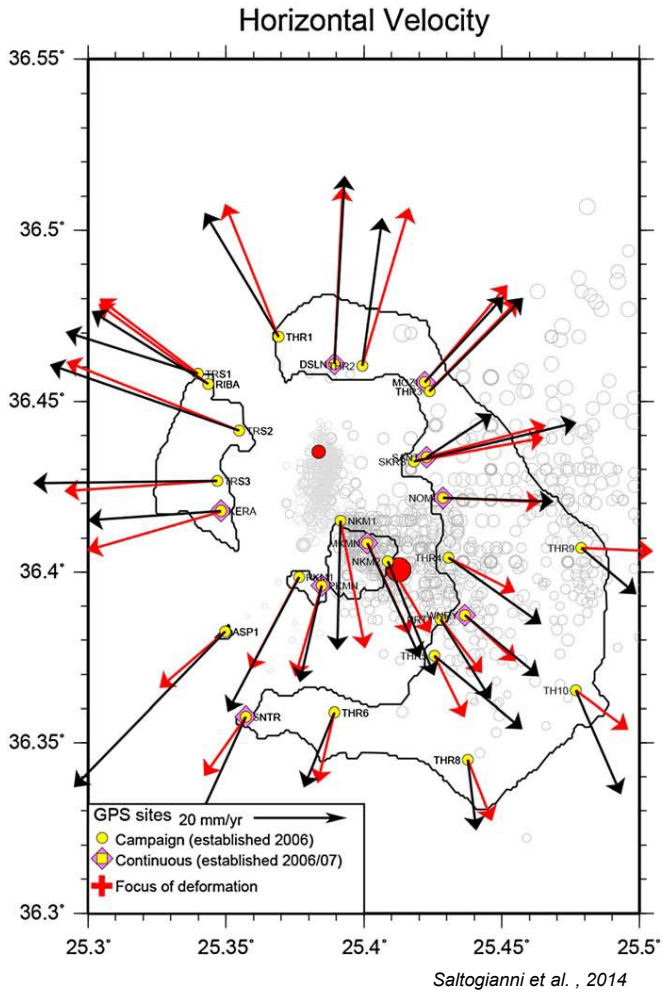
- Necessary in order to convert the relative (w.r.t. 048A) displacements of the other points to absolute displacements.
- Displacement of 048A is estimated based on PPP coordinate time series.





2. The 2011-2012 Santorini volcano inflation

Obtained results and validation



Saltogianni et al. , 2014

2. The 2011-2012 Santorini volcano inflation

Problematic pillars: point 248016

2007

2017

2017

2. The 2011-2012 Santorini volcano inflation

Problematic pillars: point 248010

2007

2017

2. The 2011-2012 Santorini volcano inflation

Final results (problematic points excluded)

Horizontal displacements:

- **Min: 0.040 m**
- **Max: 0.116 m**

2. The 2011-2012 Santorini volcano inflation

Discussion

- Approach presumes that (except the 2011-2012 unrest) no other significant event took place between 2007 and 2017, which is confirmed by geological observations.
- Local phenomena should be carefully detected and isolated.
- Revealed displacements agree well with the geological models.

3. The 2014 North Aegean Sea Earthquake

The event

The 2014 North Aegean Sea EQ

- Day: May 24, 2014
- Mw: 6.9
- Depth: 28 Km

- Stroke along the North Aegean Trough (NAT), near Samothrace Island.

- Significant permanent displacements

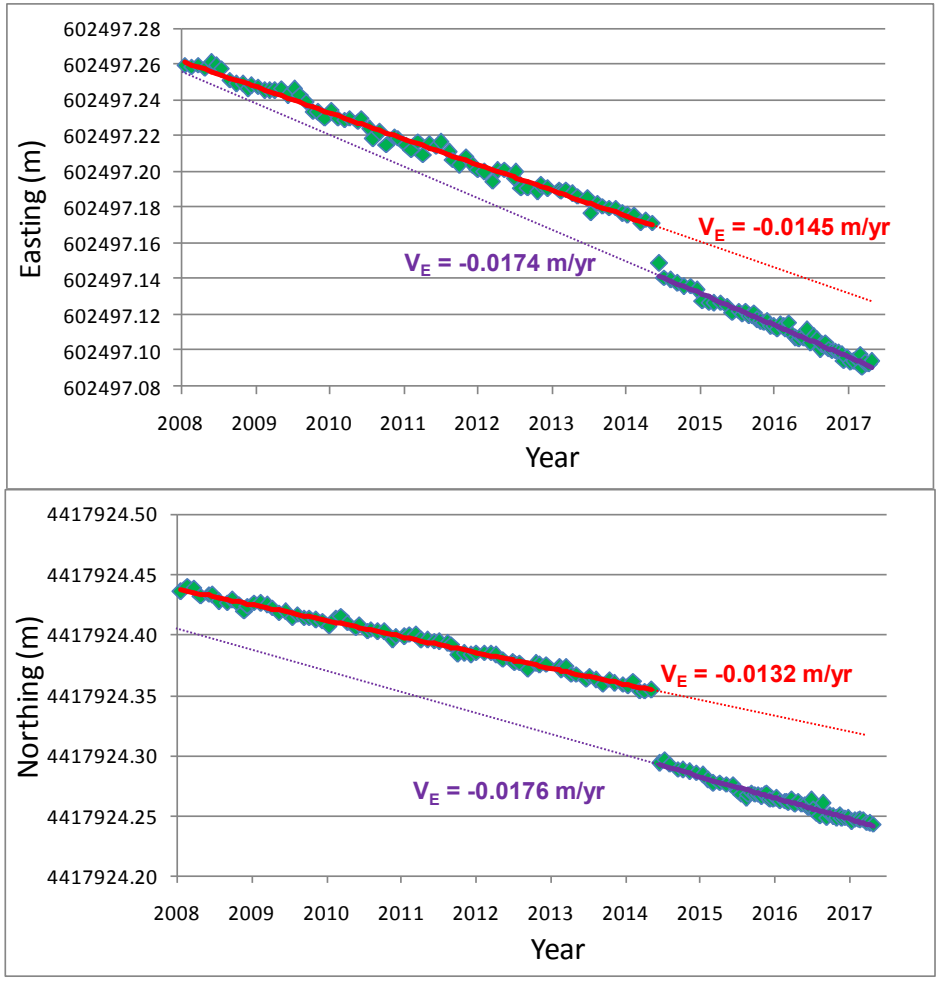
3. The 2014 North Aegean Sea Earthquake

Dataset - data processing

- **Data:** GPS daily files
  from HEPOS station 089A
- **Data span: 2008.0 – 2017.3**
  One daily solution per month
  (two daily solutions/month after 2015.5)
- **Method:** PPP
- **Software:** CSRS-PPP
- **Orbits and Clocks:** IGS
- **Processing interval:** 30 sec
- **Elevation mask:** 10^{o}
- **Reference frame:** ITRF2008(IGb08)

3. The 2014 North Aegean Sea Earthquake

Estimation of (mean) velocities



Tectonic velocity (m/yr) before and after the earthquake

	Before EQ	After EQ	Change
East	-0.0145	-0.0174	+20%
North	-0.0132	-0.0176	+33%

3. The 2014 North Aegean Sea Earthquake

Discussion

- Significant change in the (mean) tectonic velocity after the earthquake.
- Compatible with the local geology (NAT, Aegean microplate).
- Such changes are crucial when:
  - computing velocity fields (e.g. WG ‘Deformation Models’, ‘European Dense Velocities’) and/or
  - using a dynamic or semi-dynamic datum.

Acknowledgments

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