NATIONAL TECHNICAL UNIVERSITY OF ATHENS
DIONYSOS SATELLITE OBSERVATORY
HIGHER GEODESY LABORATORY

Preliminary data analysis for GNSS stations at Lefkada region (29/11/2015)

Demitris Anastasiou, Xanthos Papanikolaou, Iordanis Galanis
Demitris Paradissis, Vangelis Zacharis, Aggeliki Marinou, Costas Raptakis

This technical report presents preliminary results from analysis of the GNSS stations available in the region of central Ionian Sea.

The earthquake sequence in Lefkada Island starts with a huge earthquake (Mw=6.4) at 17/11/2015, 07:10:07 (UTC) [1].

30s GNSS data analysis

An automated processing scheme for 30s data of 15 permanent GNSS stations in the central Ionian Sea region established using Bernese GNSS Software v5.2 [2] to monitor the evolution of the phenomenon as closely as possible. These stations are part of three different networks. 6 stations are part of NOANET, established from GI-NOA [3], 8 stations are part of URANUS private network that established and maintained from Tree Company[8], and one station is part of CRL Network[9]
The depicted time series plots, present the time period from 3/11/15 up today.

The permanent displacements observed, are presented in the following table.

Station	Region	dN(cm)	dE(cm)	dU(cm)
PONT	Ponti, Lefkada	-37.66	-19.66	-5.33
SPAN	Spanochori, Lefkada	-5.89	-6.8	-0.16
LEUK	Lefkada city, Lefkada	-3.19	-3.34	-0.56
VLSM	Valsamata, Kefalonia	-2.05	0.57	0.83
KEFA	Lixouri, Kefalonia	-1.25	0.62	-4.2

1Hz GNSS data analysis

1Hz data for stations PONT and SPAN were processed using the Precise Point Positioning approach [6] to detect possible co-seismic displacements induced by the earthquake sequence. The analysis was performed via the BKG Ntrip Client (BNC) software package [7]. For this approach, the undifferenced 1Hz carrier phase data were analysed, using broadcast corrections both for satellite orbits and satellite clocks. Permanent displacements observed from 1Hz data analysis are in good agreement with 30-s data analysis.

A dedicated web page is created, within DSO's main website, to monitor the evolution of the phenomenon as closely as possible, using all GPS/GNSS data that are made available.

http://dionysos.survey.ntua.gr/dsoportal/_projects/supersites/lefkada/
(*Hint: use the panel at the right (**Data and Results**) to navigate*)

References

[1] http://bbnet.gein.noa.gr/HL/

[2] Dach, R., U. Hugentobler, P. Fridez, and M. Meindl (2007), Bernese gps software, version 5.0, Jet. Propul. Lab., Astronomical Institute, University of Bern.

[3] Ganas A,. K. Chousianitis, G. Drakatos, M. Papanikolaou, P. Argyrakis, M. Kolligri, P. Petrou, E. Batsi, and Ch. Tsimi, 2011. NOANET: High-rate GPS Network for Seismology and Geodynamics in Greece. Geophysical Research Abstracts, Vol. 13, EGU2011-4840, 2011, EGU General Assembly 2011

[4] Ganas, A., A. Marinou, D. Anastasiou, D. Paradissis, K. Papazissi, P. Tzavaras, and G. Drakatos (2013), Gps-derived estimates of crustal deformation in the central and north ionian sea, greece: 3-yr results from noanet continuous network data., Journal of Geodynamics, 67, 62–71, doi:10.1016/j.jog.2012.05.010.

[5] Mitsakaki, C.; Rondoyannie, T.; Anastasiou, D.; Papazissi, K.; Marinou, A. & Sakellariou, M. Static stress changes and fault interactions in Lefkada Island, Western Greece Journal of Geodynamics, 2013, 67, 53-61, doi:10.1016/j.jog.2012.04.007

[6] Weber, G., and L. Mervart (2009), The bkg ntrip client (bnc), Report on euref symposium 2007 in london, Mitteilungen des Bundesamtes fuer Kartographie und Geodaesie, Band 42, Frankfurt.

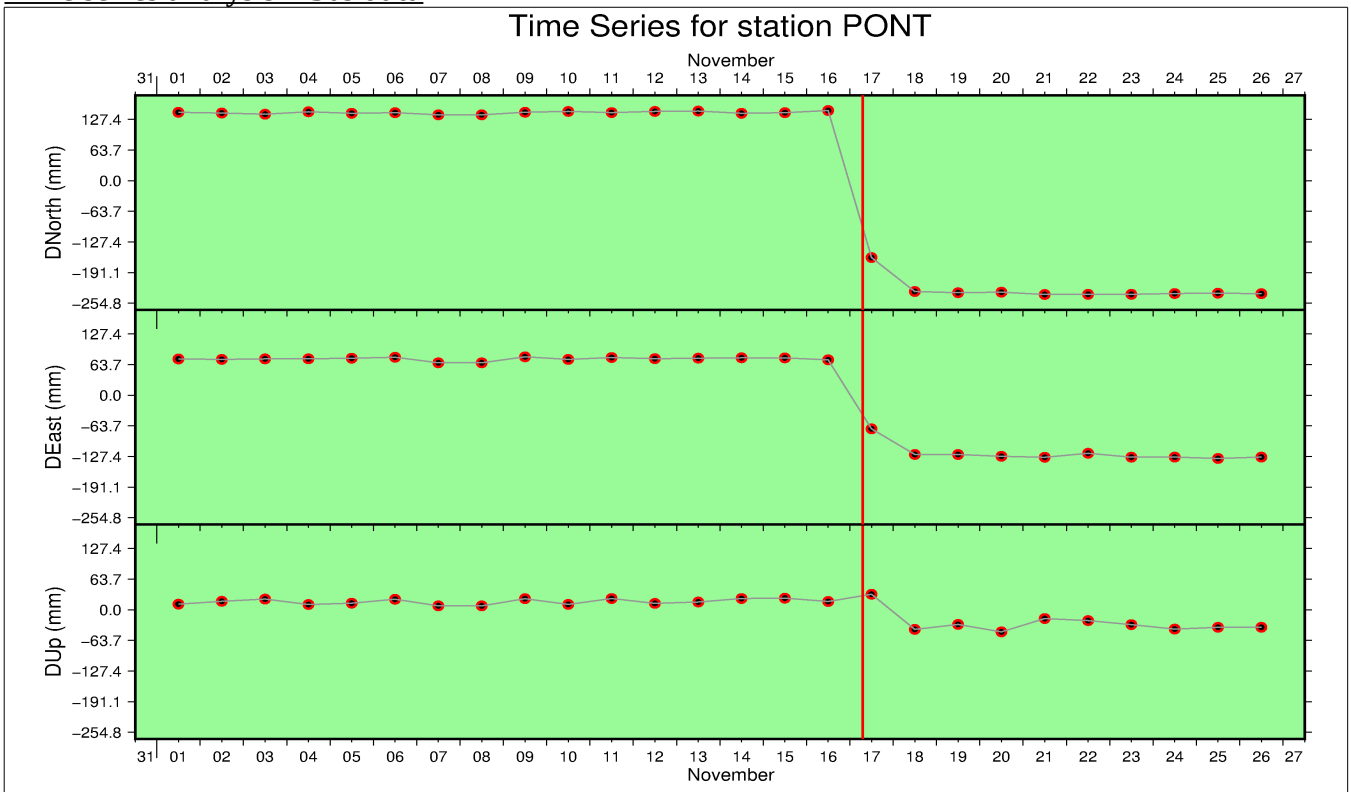
[7] Zumberge, J., M. Heflin, D. Jefferson, M. Watkins, and F. Webb (1997), Precise point positioning for the efficient and robust analysis of gps data from large networks, Journal Geophysical Research, 102(B3), 50055017, doi:10.1029/96JB03860.

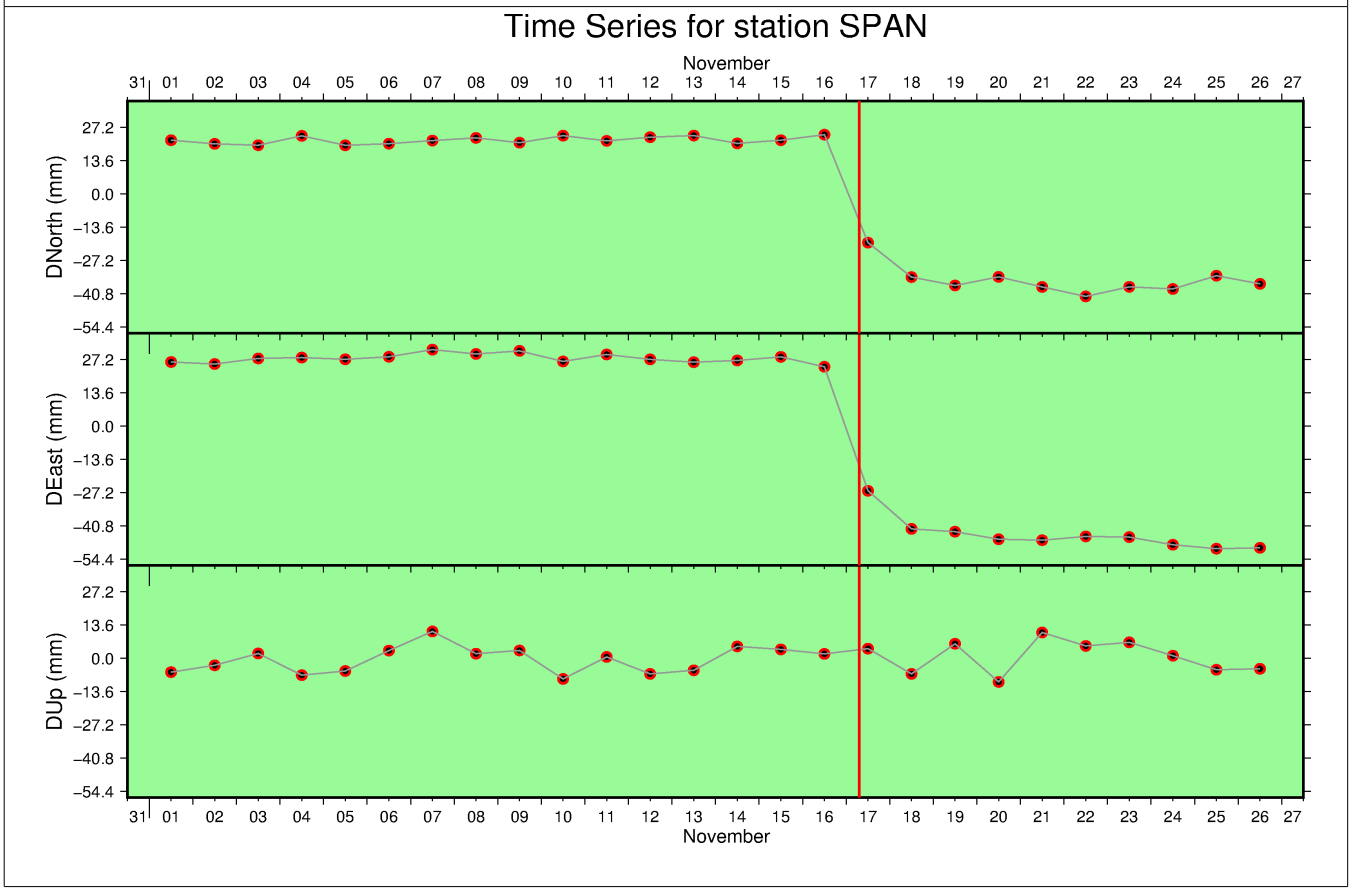
[8] URANUS - Tree Company

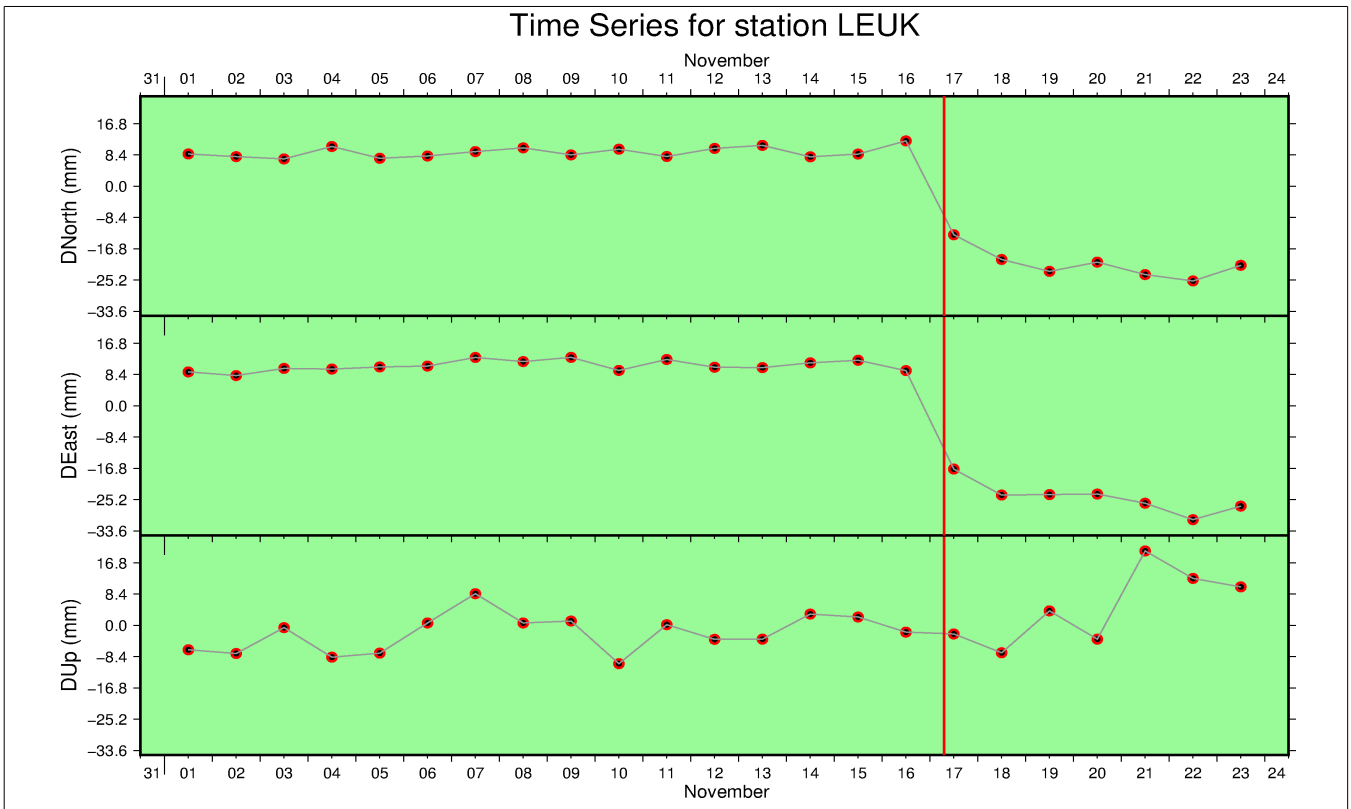
[9] CRL – permanent stations

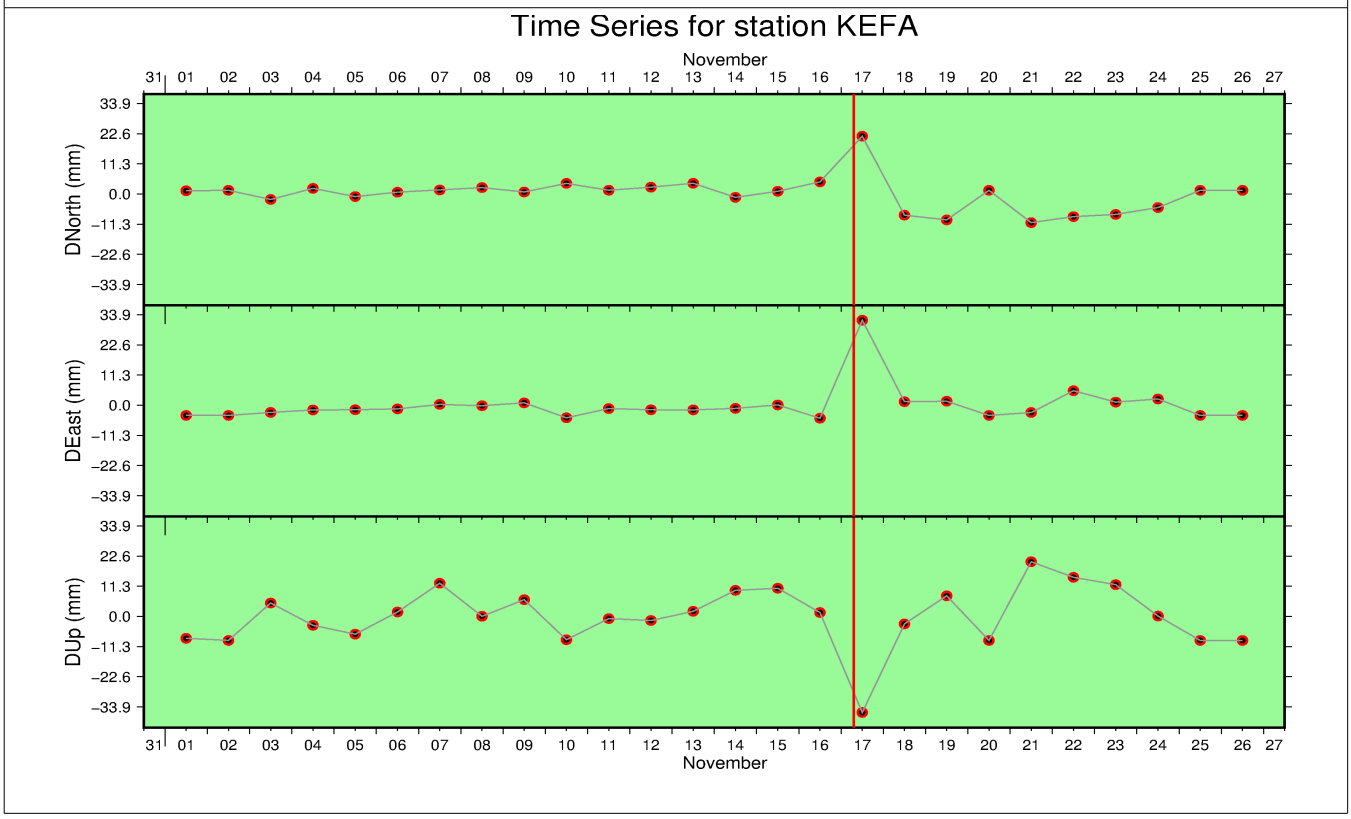
Note: This document will be under constant updating; the most recent version should be available at: http://dionysos.survey.ntua.gr/dsoportal/_projects/supersites/lefkada/docu/dso-lefkada-1511.pdf

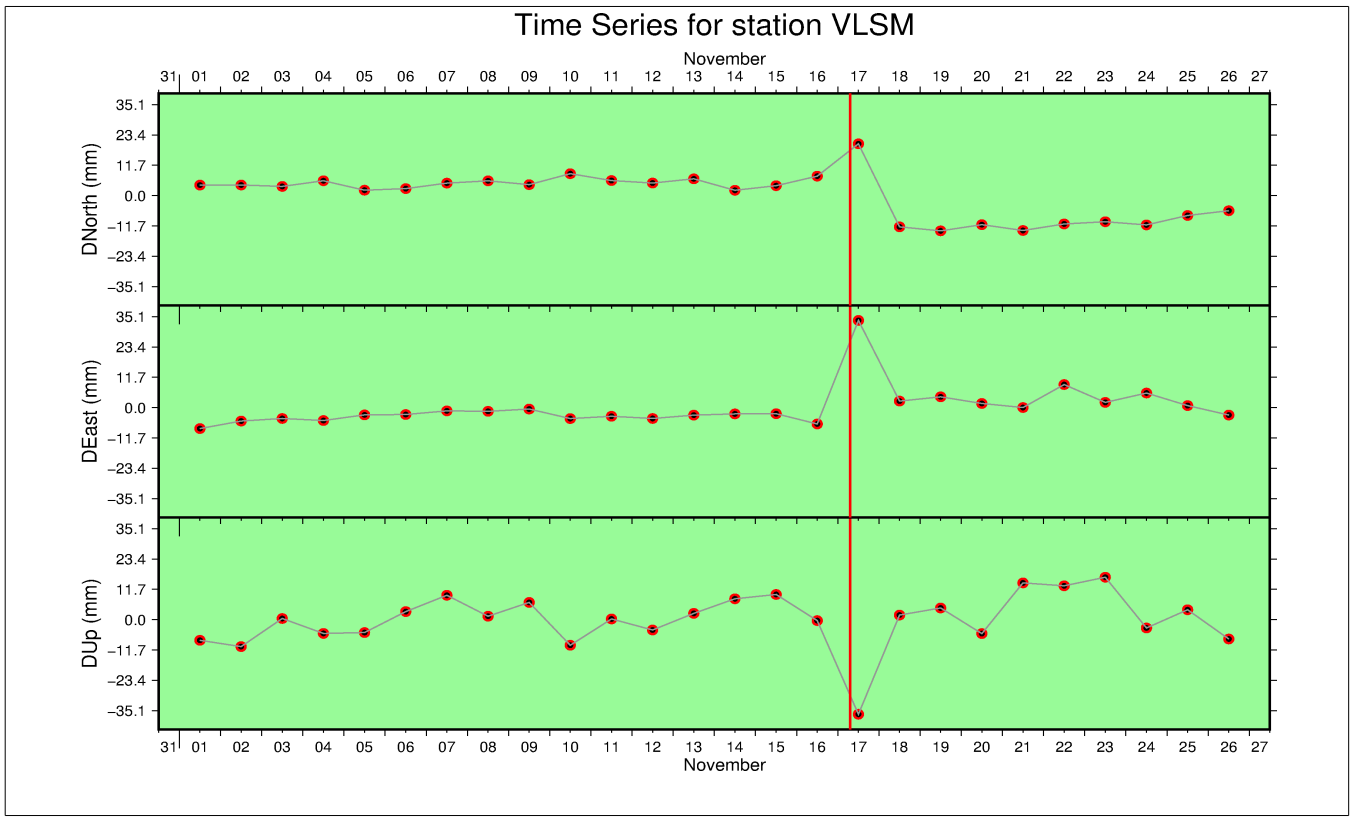
Time series analysis - 30s data





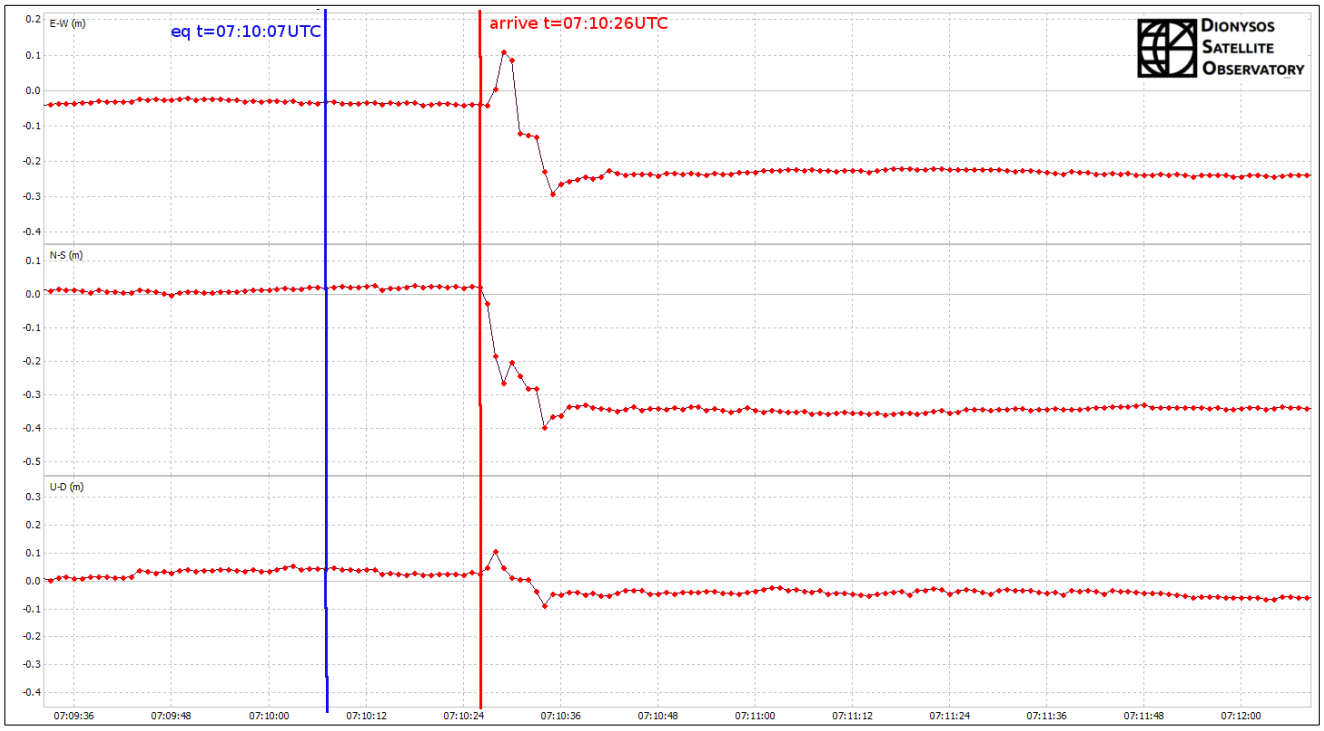

Time Series for station LEUK
November
31 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
DNorth (mm)
DEast (mm)
DUp (mm)
16.8
8.4
0.0
−8.4
−16.8
−25.2
−33.6
November


Time Series for station KEFA
November
31 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
DNorth (mm)
DEast (mm)
DUp (mm)
33.9
22.6
11.3
0.0
−11.3
−22.6
−33.9
November

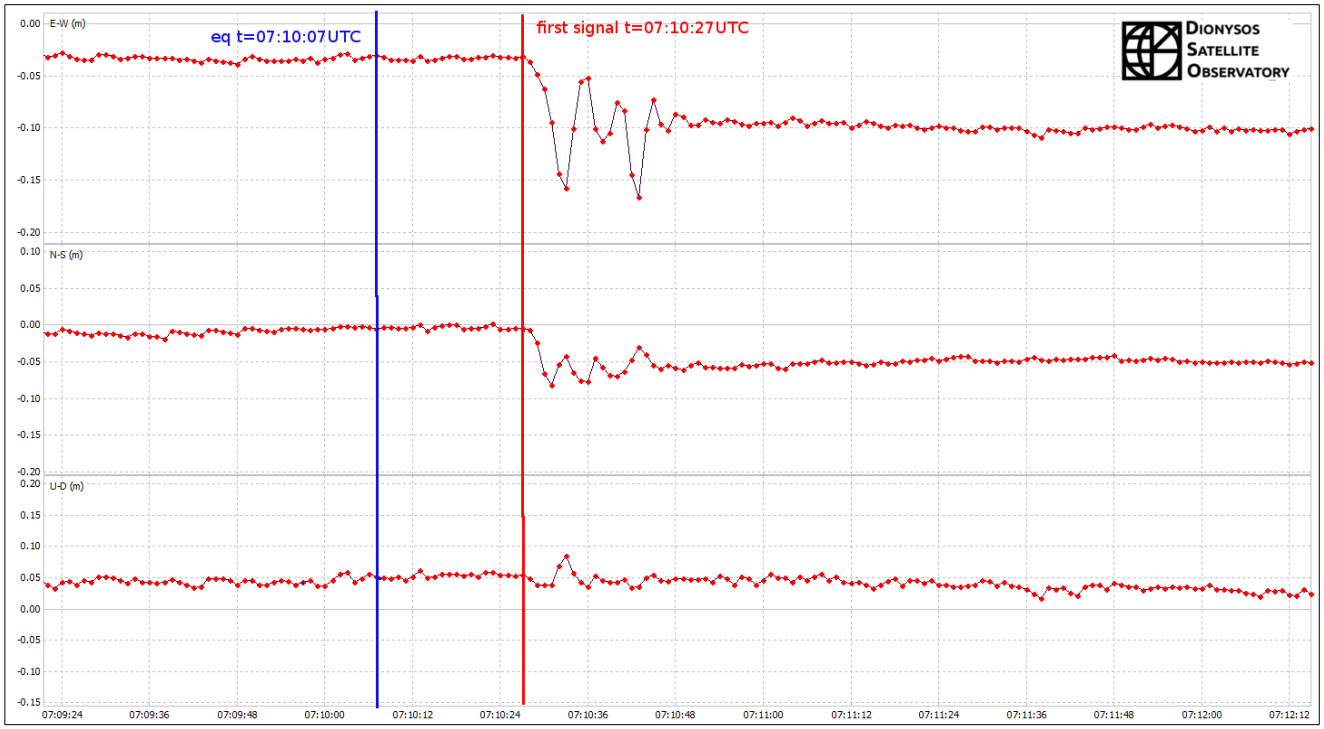

Time Series for station VLSM
November
31 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
DNorth (mm)
DEast (mm)
DUp (mm)
35.1
23.4
11.7
0.0
−11.7
−23.4
−35.1
November

1Hz data analysis

Blue line indicates the time that the earthquake happened. Red line indicates the first signal arrived at the station



Data analysis for station PONT



Data analysis for station SPAN

Map of displacements