Χαρτογράφηση με InSAR/GNSS της εδαφικής παραμόρφωσης και μοντέλα διάρρηξης των ισχυρών σεισμών στο Δυρράχιο (26/11/2019, Μ=6.4) και στο Ελαζίγικ (24/1/2020, Μ=6.8)

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1. We identify the main source of the M6.4 earthquake that rocked north-central Albania on November 26, 2019 02:54 UTC
2. We identify the main source of the M6.8 earthquake that rocked eastern Turkey / Iran on January 24, 2020 17:55 UTC
3. We use space geodesy observations of ground displacement (GNSS and InSAR)
4. We model the source by inverting the displacement data
Tectonic Setting

Jolivet et al., Tectonophysics, 2013
We use Differential SAR Interferometry to capture the deformation produced by the Durres earthquake. We constructed co-seismic interferograms by combining topographic information with SAR acquisitions from the Sentinel-1 satellites for both ascending track 175 and descending track 153.

The SAR acquisitions were processed with the open-source SNAP v7.0 ESA software. For the ascending track the pre-event acquisition is from 14/11/2019 and the repeat pass is from 26/11/2019.

For the descending track the pre- and post-event acquisitions are from 25/11/2019-01/12/2019 respectively.
The InSAR fringe pattern shows a 40-km long, NW-SE arrangement of three (3) fringes with a maximum LOS displacement of about +8.4 cm near the village Hamallaj (15 km NE of Durres).
INVERSION

Assuming a half-space elastic model with uniform slip along a rectangular fault surface, the source of the ground deformation was inverted using the available geodetic data (GNSS and InSAR).

Durres Data: 54 points (wrapped phase) for ascending track and 31 for descending track. We use the programme inverse6 (http://github.com/pbriole/inverse6).
The geodetic fault-model is in agreement with published moment tensor solutions showing a NNW-SSE fault plane (for example the USGS solution has attributes 337°/27°/91°; strike/dip-angle/rake angle).

The geodetic centroid is located about 15 km to the NE of the EMSC epicentre.
This geometry is compatible with a blind thrust fault that may root on the main basal thrust *i.e.* along the main Ionian thrust front that separates Adria-Apulia from Eurasia.
\[ M_{w_{PGD}} = \frac{\log(PGD) + 8.2849}{1.6810 - 0.2453 \log(R)} \]

\[ M_{w_{PGD-S}} = \frac{\log(PGD-S) + 8.0839}{1.6793 - 0.2447 \log(R)} \]

\[ M_{w(PGD)} = 6.44 \text{ and } M_{w(PGDS)} = 6.42 \]
1. We identify the main source of the M6.4 earthquake that rocked north-central Albania on November 26, 2019 to be located within the frontal area of the basal thrust of the Dinaric-Hellenic orogen.

2. The seismic structure is the low-angle thrust fault (22 by 11 km) that dips towards east (23°) and continues towards the south.

3. Geodetic data GNSS & InSAR show ground motion to the SW and UP in agreement with seismology.

4. Geodetic data helped locate the epicentre better as seismology failed because of network problems.
The January 24, 2020 Mw 6.8 Doğanyol-Sivrice, Turkey Earthquake on the East Anatolian Fault Zone Imaged by Space Geodesy
Earthquake 24/01/2020 Mw 6.8, Eastern Turkey

Wrapped Interferogram
Ascending Orbit
Pair: 15/01/2020-27/01/2020 Relative Orbit: 116

Phase ifg_VV_15Jan2020_27Jan2020 [phase]

Produced by SNAP ESA Software

@ Contains modified Copernicus Data 2020
Slip inversion results. The preferred slip model is outcome from the joint inversion of InSAR and HR-GNSS with equal weights to each data set.

Melgar et al. in preparation
Elazig Talk Summary

1. We identify the main source of the M6.8 earthquake on January 24, 2020 to be located within the Puturge segment of the East Anatolia Fault Zone.
2. The seismic structure is the high-angle left-lateral fault (40 by 15 km) that ruptured towards the southwest.
3. Geodetic data GNSS & InSAR show ground motion in agreement with seismology.
4. Geodetic data helped determine the slip distribution of the rupture (3 slip patches surrounding one asperity).
Ευχαριστώ!