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Integrated GNSS and seismotectonic study of the slow lithospheric deformation in NW Galati seismogenic area

Eduard Ilie Nastase (1,2), Victor Mocanu (2), Alexandra Muntean (1), Boudewijn Ambrosius (3), Corne Kreemer (4), William Hammond (4), Geoffrey Blewitt (4), Sorin Nistor (5), and Dragos Tataru (1)

(1) National Institute for Earth Physics, PO BOX MG2, 077125, Magurele, Romania (eduard_nastase@infp.ro), (2) University of Bucharest, Department of Geophysics, 6 Traian Vuia St, 020956 Bucharest 2, Romania, (3) Delft University of Technology, Faculty Aerospace Engineering, Netherlands, (4) Nevada Geodetic Laboratory, University of Nevada, Reno, United States, (5) Department of Cadastre-Architecture, University of Oradea,Oradea, Romania

In September 2013 a seismic swarm occurred in the NW Galati area of Romania. Geophysical measurements have been conducted in the epicentral area and in the nearby regions shortly after the swarm event. The swarm episode included hundreds of earthquakes with magnitudes ranging from 0.1 to 4.0, generally associated with the existing active fault system. Prior to the swarm episode, the seismic activity was too weak to be recorded by the existing monitoring network. The large number of shallow events (depths less than 10 km) occurred over a short time interval in an area with low and dispersed seismicity, but in the vicinity of a populated area, which created concern and drew high attention of mass-media.

It has been 6 years since different GNSS reference and campaign station networks have been set up in NW Galati area. Over the last decade, we developed new tools to improve the observations and analyze earthquakes, active tectonics, and seismic hazard in regions of slow lithospheric deformation, like this one. Improvements in Precise Point Positioning (PPP), clock-jumps and cycle-slip detection and other interruptions over all constellations, frequencies and signals, carrier-phase signal-to-noise ratio, filtering methods, have led us to achieve improved and more reliable positions from the homogeneous combination of all networks. Here we present an analysis of all available RINEX data processed using the GIPSY software, with 3D velocities derived by the algorithm "MIDAS" (Median Interannual Difference Adjusted for Skewness; [1]). We analyze plate motion and strain rates derived by the algorithm "MELD" (Median Estimation of Local Deformation), which works particularly well to retrieve the long-wavelength strain rate signal in areas of low deformation [2]. We analyze vertical land motion derived by the GPS Imaging technique, which uses a median spatial filter [3].

A variety of geophysical studies are made possible by a combined Double Difference and PPP analysis, which shows two distinct areas pertaining to Sf. Gheorghe fault. One area is related to the north-eastern tectonic block, which shows an uplift movement; the other is related to the south-western tectonic block, where all velocities had a negative trend.

Keywords:
GNSS, High-rate GPS data, seismic swarm, active tectonics, strain rates, GPS Imaging technique;

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