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Contemporary crustal deformation in Georgia (Caucasus)

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The Republic of Georgia is located in the Caucasus, between the Black and Caspian seas from the west and the east, and the Greater and Lesser Caucasus mountains from the north and the south. Tectonically, the region belongs to the Alpine-Himalayan collisional zone, formed during the late Cenozoic period as a result of a collision between the Arabian and Eurasian plates. The deformation zone due to this collision is broad and extends from Zagros mountains in southern Iran to the Greater Caucasus in the north. The GPS studies conducted during the last decade suggest a convergence rate of up to 20 mm/yr between the Arabia and Eurasia plates. Although majority of this convergence occurs in the southern part of the deformation zone, important part of this convergence takes place in Georgia, implying an elevated seismic risk in the region. This is corroborated by a presence of significant historical and instrumental earthquakes in the country.

As part of the project dealing with the detection of possible low frequency electromagnetic emissions proceeding earthquakes, in summer of 2016 we have installed a continuous GNSS station MTSK between Mtskheta and Tbilisi. The station consists of Leica GRX1200 GNSS receiver with an AS10 antenna. It is mounted on top of the building, anchored to the existing brick wall. In contrast, principal convergence between the Lesser and Greater Caucasus across the Tbilisi segment, occurs along the northern boundary of the Lesser Caucasus. To constrain the velocity gradient to the northern boundary of the lesser Caucasus, in 2019 an additional continuous GNSS station MKRN was installed in this deformation zone by the GTDI near the settlement of Mukhrani. It consists of Trimble 5700 receiver with a Zephyr Geodetic antenna.

The analysis of the data is performed using the Gamit/Globk software package from MIT and it is processed in conjunction with 26 continuous GNSS stations of the GEO-CORS network operated by National Agency of Public Registry of Georgia (geocors.napr.gov.ge). In addition, we analyze data from the stations located on Eurasia, Arabia and Africa plates. The main objective of the given work is to monitor a millimeter level deformation of the crust due to the collision of Arabia and Eurasia tectonic plates and identify the regions of higher deformation and relate them to individual faults.

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