Seismoprogn. Observ. Territ. Azerb. V.16, №1, 2019, pp.35-42

MODERN GEODYNAMICS OF AZERBAIJAN ON GPS STATION DATA FOR 2017-2018 YEARS

I.E.Kazimov[1], A.F.Kazimova[1]

Introduction

As is known, Azerbaijan is part of the Alpine-Himalayan mountain belt formed in Cenozoic on the southern edge of the East European Platform as a result of the collision of the Eurasian and Arabian plates, which over the past five million years has experienced a rapid uplift.

The study of the dynamics of the movement and interaction of the plates (i.e., the primary forces acting on the plates), as well as the rheology of the continental lithosphere, is one of the important fundamental problems of active geotectonics [9]. At present, the concept of lithospheric plate tectonics dominates in Earth sciences. According to this concept, the formation of the internal tectonic structure of the moving belts (of the Alpine-Himalayan belt type) and the mobile structures is determined by the approach of the lithospheric plates. It is assumed that as a result of these horizontal displacements, the Caucasian segment of the Alpine-Himalayan mobile belt shrinks, the layers of sedimentary and volcanic rocks collapse, the base blocks experience multidirectional displacements, and the upper crustal horizons are disturbed by upsets and thrusts. Some researchers believe that the impact of the northern drift of the Arabian Plate affects the distribution of horizontal stresses within the Eurasian Plate at a distance of one and a half to two thousand kilometers from the southern edge of the latter [4, 5, 7].

In recent years, the Azerbaijani part of the Greater Caucasus is characterized by active seismic activity, during which the stresses accumulated in the collision zone are unloaded. Over the past 10 years, the seismicity of the republic's territory has been uneven both in terms of the number of earthquakes and the total seismic energy released in their sources. The number of earthquakes reached an anomalous value in 2015 due to an increase in weak seismicity. The greatest energy during this period was allocated in 2012. ($E=122.8 \bullet 10^{11}$J). This indicates that seismic-tectonic events are activating, there are shifts in individual tectonic structures, which are realized in the form of tangible 5-6 magnitude earthquakes that occurred in Zaqatala-Balaken, Sheki, Oguz-Gabala and Ismayilli regions.

Calculation Technique

One of the methods currently widely used in the world is the method based on the technologies of global navigation satellite systems (GNSS). With the advent of GPS technology, which is the first of the technologies implemented by GNSS, it has become possible to carry out high-precision (3-10 mm in all dimensions) geodesic monitoring on large areas with relatively small expenditures and time. For monitoring the changes in the earth's surface caused by geodynamic processes, over the course of a number of years, GPS devices have been used successfully, as indicated above. High-precision GPS measurements of almost any lines are carried out on the basis of the differential method using the so-called basic GPS stations (this method is also called the method of relative kinematics).

The first studies of modern geodynamics of Azerbaijan using GPS receivers were conducted in the early 1998s of 20th century. In 1991, within the framework of Azerbaijan (SGI) - American (MIT) agreement on joint research in the field of calculating the velocity field of modern horizontal displacements of the earth's crust in Azerbaijan.

Starting from 2012-2017 a network of permanent GPS/GLONASS observation stations has been established on the territory of Azerbaijan RSSC. Regular observations have been conducted since 2013. The stations are equipped with Choke Ring (10), Zephyr geodetic2 (14) antennas and TrimbleNetR9 (24) L1/L2 GPS/GLONASS/Galileo receivers (Fig. 1, Table 1). The current work of the stations is serviced by employees of the Geodynamics of the RSSC, in whose territory they are

[1] *Republican Seismic Survey Center of Azerbaijan National Academy of Sciences*

installed. Data from GPS receivers are transmitted via the Internet to the HP Proliant DL308P Gen8 server storage and processing complex with a total volume of 7 TB.

Thus, the formed geodetic network makes it possible to solve regional problems of studying the basic laws of modern movements of the earth's crust in the territory of Azerbaijan.

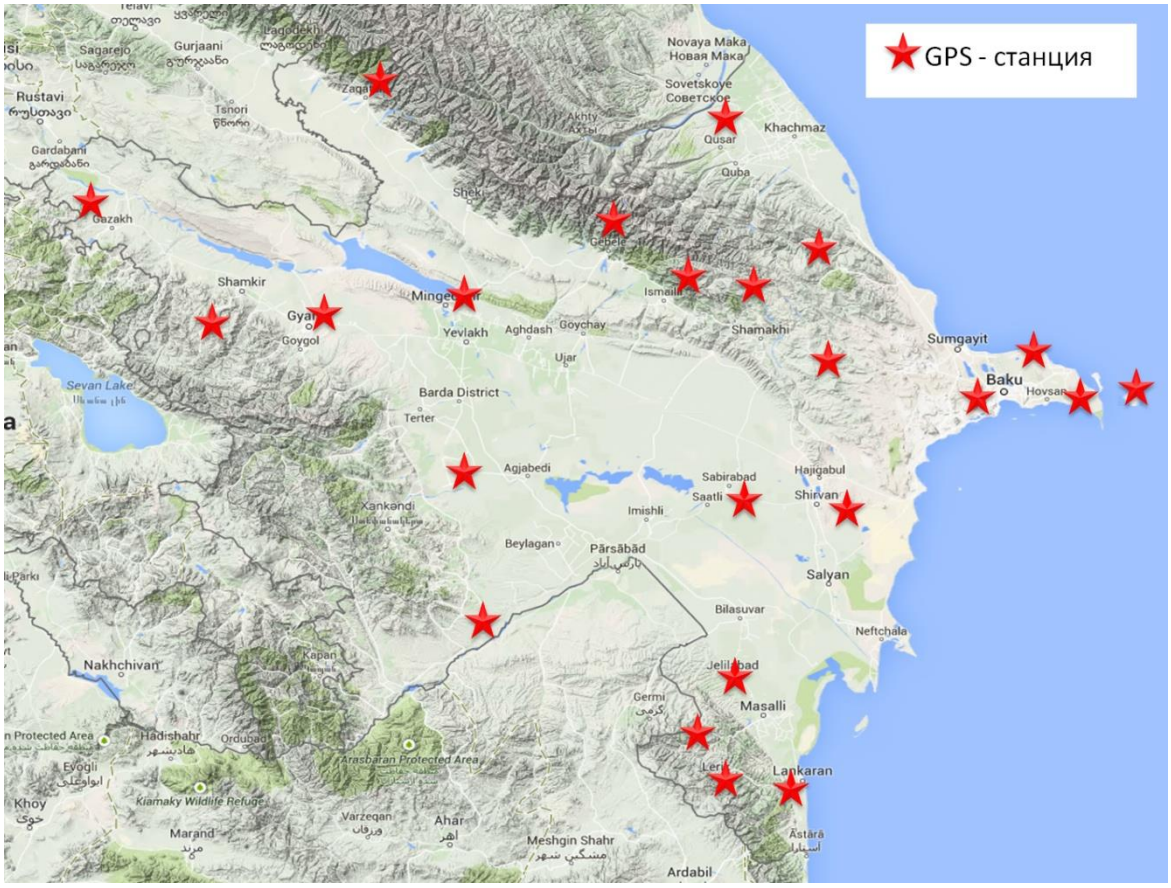

Figure 1. Location map of 24 stationary GPS stations of the RSSC geodetic network

The speed estimates are based on the analysis of the time series of the coordinates of GPS stations, calculated from primary data, which are sets of phase and code measurements at two frequencies lasting 24 hours with a recording interval of 15 s. To estimate the speeds of the designated stations, it is necessary to have at least one reference point in the network, and preferably several. In the case of several strong points, it is necessary to take into account their mutual displacement. Therefore, in this study, data from 11 closely located IGS reference stations were added to the measurement set at 24 GPS stations: ARTU (Arti, Russia), CRAQ (Simeiz, Ukraine), TEHN (Tehran, Iran), POLV (Poltava, Ukraine), MDVJ (Mendeleevo, Russia), ANKR (Ankara, Turkey), NICO (Nicosia, Cyprus) DRAG), POL2 (Bishkek, Kyrgyzstan), YIBL (Ibal, Oman), BZGN (Bazergan, Iran). The selected reference stations with the specified coding are included in the implementation of the International Terrestrial Reference Frame ITRF2008. The geographical position of the reference and observed stations is shown in Fig.2. and in Table 2.

The GPS data processing was performed using the GAMIT / GLOBK software package (Kalman filter) 10.6 and TRACK. The software was developed by the Massachusetts Institute of Technology (MIT), the Scripps Institute of Oceanography and Harvard University.