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Active deformation processes of the Northern Caucasus deduced from the GPS observations

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The Northern Caucasus, as a part of the Alpine-Himalayan mobile belt, is a zone of complex tectonics associated with the interaction of the two major tectonic plates, Arabian and Eurasian. The first GPS study of the contemporary geodynamics of the Caucasus mountain system were launched in the early 1990s in the framework of the Russia-US joint project. Since 2005 observations of the modern tectonic motion of the Northern Caucasus are carried out using the continuous GPS network. This network encompasses the territory of three Northern Caucasian Republics of the Russian Federation: Karachay-Cherkessia, Kabardino–Balkaria, and North Ossetia. In the Ossetian part of the Northern Caucasus the network of GPS survey-mode sites has been deployed as well.
The GPS velocities confirm weak general compression of the Northern Caucasus with at the rate of about 1-2 mm/year. This horizontal motion at the boundary of the Northern Caucasus with respect to the Eurasian plate causes the higher seismic and tectonic activity of this transition zone. This result confirms that the source of deformation of the Northern Caucasus is the sub-meridional drift of the Arabian plate towards the adjacent boundary of the Eastern European part of the Eurasian lithospheric plate. The concept of such convergence implies that the Caucasian segment of the Alpine-Himalayan mobile belt is under compression, the layers of sedimentary and volcanic rocks are folded, the basement blocks are subject to shifts in various directions, and the upper crust layers are ruptured by reverse faults and thrusts.
Weak deviation of observed velocities from the pattern corresponding to homogeneous compression can also be revealed, and numerical modeling of deformations of major regional tectonic structures, such as the Main Caucasus Ridge, can explain this. The deformation tensor deduced from the velocity field also exhibits the sub-meridional direction of the major compressional axes which coincides with the direction of the relative Arabian-Eurasian plate motion.
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