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Recent crustal deformation in the Northern Tien Shan based on GPS and seismic data

A. Kostuk

Research Station of Russian Academy of Science in Bishkek city, Kyrgyzstan (a_d_kostuk@mail.ru, +996-312-611459)

The Tien Shan is one of the most active parts of Central Asian intracontinental mountain belt. This system was formed mainly in Pliocene-Quaternary period due to large-scale warping of the Caledonian and Hercinian basement and overlaying Paleogene-Neogene deposits. It is composted of a series of roughly east-west trending parallel ranges with elevations up to 7000 m, with about 2500 km east-west extension and more then 500 km maximum width. The Tien Shan is delimited by the stable Kazakh shield on the north, and the Tarim basin on the south. This region is prone to a high seismicity. Thrust and strike slip faults accommodate a significant shortening through this intracontinental mountain belt. Most earthquakes are concentrated near the northern and southern boundaries of this mountain system. Broadband seismic network and high density segment of the Central Asia GPS network in the northern part of Tien Shan allow us to collect considerable dataset. Faulting geometry, seismic moment and depth of 70 moderate-sized earthquakes in the Northen Tien Shan were estimated by matching 3-component observed and synthetic seismogram records. Digital seismograms were used for the period since 1994 till 2006. The distribution and mechanism of earthquakes suggests a significant consistent with the orientation of India-Eurasia convergence north-north-west directions shortening. Dominance of reverse faulting in the Northern Tien Shan is clear, yet some events have significant strike-slip components. The P-axes of the fault plane solution of earthquakes are sub-horizontal with most plunges < 30°. At the same time long-term GPS observations allow us to construct a velocity vector field of crust movement and thereby to estimate strain rate. Results show north-north-west direction of strain rate axes and heterogeneity of the strain rate field with high compression zones. We have also found out few small tension zones. Average azimuth of the maximum compression axes constrained by GPS observations and moment tensor solutions of earthquakes provide the almost same result: 356.36° and 352.51° respectively. Seismic and GPS data as well as relief most likely prove than Tien-Shan reduce continuing considerable pressure from the South to Kazakh shield.