



Characteristics of Regional Crustal Deformation before 2016 Menyuan Ms6.4 Earthquake

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On January 21, 2016 [U+FF0C] a strong earthquake with a magnitude of Ms 6.4 happened at Menyuan, Qinghai Province of China. In almost the same place, there was another strong earthquake happened in 1986, with similar magnitude and focal mechanism. In this paper, we analyze the characteristics of regional crustal deformation before the 2016 Menyuan Ms6.4 earthquake by using the data from 10 continuous GPS stations and 74 campaign-mode GPS stations within 200 km of this event: (a) Based on the velocity field from over ten years GPS observations, a regional strain rate field is calculated. The results indicate that the crustal strain rate and seismic moment accumulation rate of the Qilian-Haiyuan active fault, which is the seismogenic tectonics of the event, are significantly higher than the surrounding regions. In a 20km×20km area around the seismogenic region, the maximum and minimum principal strain rates are 21.5 nanostrain/a (NW-SE extension) and -46.6 nanostrain/a (NE-SW compression), respectively, and the seismic moment accumulation rates is 17.4E15 N·m/a. The direction of principal compression is consistent with the focal mechanism of this event. (b) Based on the position timeseries of the continuous GPS stations for a time-span of about 6 years before the event, we calculate the strain time series. The results show that the dilatation of the seismogenic region is continuously reduced with a “non-linear” trend since 2010, which means the seismogenic region has been in a state of compression. However, about 2-3 months before the event, both the dilatation and maximum shear strain shown significant inverse trends. These abnormal changes of crustal deformation may reflect the non-linear adjustment of the stress-strain accumulation of the seismogenic region, when the accumulation is approaching the critical value of rupture.