2023年2月6日にトルコで発生した*M*7.8と*M*7.5の地震前後の地震活動について

Seismicity before and after the February 6, 2023 *M*7.8 and *M*7.5 earthquakes in Turkey

*楠城 一嘉[1,2,3,4]、熊澤 貴雄[3]、井筒 潤[5,1]、堀 高峰[4,1]、長尾 年恭[6,1]、尾池 和夫[1]
*Kazuyoshi Z. NANJO[1,2,3,4], Takao Kumazawa[3], Jun Izutsu[5,1], Takane Hori[4,1], Toshiyasu Nagao[6,1], Kazuo Oike[1]

1. 静岡県立大学、2. 静岡大学、3. 統計数研究所、4. 海洋研究開発機構、5. 中部大学、6. 東海大学
1. University of Shizuoka, 2. Shizuoka University, 3. Institute of Statistical Mathematics, 4. Japan Agency for Marine-Earth Science and Technology, 5. Chubu University, 6. Tokai University

On February 6, 2023 (UTC), a devastating *M*7.8 earthquake struck the East Anatolian Fault zone (EAFZ) bounding the Arabian and Anatolian tectonic plates. Nine hours later, a *M*7.5 earthquake occurred about 90 km NNW of the initial *M*7.8 earthquake. We provided a report on seismicity before and after the *M*7.8 and *M*7.5 earthquakes. To create it, we used three earthquake catalogs created by the Disaster and Emergency Management Authority (AFAD), Lomax (2023), and Kwiatek et al. (2023), to demonstrate that the result does not depend on the choice of catalog.

One feature of the seismicity before the *M*7.8 and *M*7.5 earthquakes is the 2020 *M*6.8 earthquake. Aftershocks since the *M*6.8 earthquake suggest that the south end of the *M*6.8 rupture was close to the north end of the *M*7.8 rupture. Another feature was the occurrence of two seismic swarms on and around the fault segment, from which the *M*7.8 rupture had initiated. On this segment, an area of a large slip (~1.3 m) overlapped with one of the swarms. The swarms began in mid-2022, and statistical analysis using the Epidemic-Type Aftershock Sequence model revealed that the occurrence rate after the start of the swarms (1.3 events of *M*1.5+ per day) was significantly larger than that before it (0.3 events of *M*1.5+ per day). We also observed a clear decrease in the Gutenberg-Richter *b*-value since the start of the swarms. This infers an increase in stress, assuming that the *b*-value is negatively correlated with differential stress.

We pointed out three features pertaining to seismicity after the *M*7.8 and *M*7.5 earthquakes. The first feature is the lack of post-*M*7.5-quake seismicity at the zone of increase in Coulomb stress imparted by the *M*7.8 and *M*7.5 earthquakes beyond the north end of the *M*7.8 rupture, noting that this area, which lacked seismicity, closely matched the area of the *M*6.8 rupture. The second feature is that due to stress transfer by the *M*7.8 and *M*7.5 quakes, future rupture was promoted around the south end of the *M*7.8 rupture, where the largest aftershock of *M*6.4 occurred on February 20, 2023. A map view that shows data of post-*M*7.5-quake seismicity until immediately before the *M*6.4 earthquake reveals a zone of low *b*-values around the future hypocenter. That zone coincided remarkably with the region where future rupture was promoted. The third feature is based on a comparison between the distribution of *b*-values based on seismicity after the *M*6.4 earthquake and the distribution of the faults of the *M*7.8 and *M*7.5 earthquakes. The spatial pattern in *b* generally shows high *b*-values around the causative faults (indicative of stress relieved by these earthquakes), except for two zones beyond the north end of the *M*7.8 rupture: one is the rupture area of the 2020 *M*6.8 earthquake and the other is a part of the EAFZ farther to the north, beyond the *M*6.8 rupture area. We will tackle the question of whether these two zones may show future activation.